Curriculum Proposals
August 19, 2019 Curriculum Committee
September 10, 2019 Faculty Senate

College of Arts and Humanities – Department of Behavioral Sciences

1. Add the Undergraduate Certificate of Proficiency in Psychology.

College of Arts and Humanities – Department of Music

1. Add the Undergraduate Certificate of Proficiency in Performance.

College of Natural and Health Sciences – Department of Mathematics

1. Add the following courses to the course descriptions:
    a. MATH 1001: Orientation to Mathematics;
    b. STAT 2000: Statistical Packages Lab;
    c. STAT 2303: Statistical Methods;
    d. STAT 3113: Regression Analysis;
    e. STAT 3183: Statistical Process Control;
    f. STAT 3203: Actuarial Probability I;
    g. STAT 3213: Actuarial Probability II:
    h. STAT 4113: Categorical Data Analysis;
    i. STAT 4283: Financial Mathematics I;
    j. STAT 4293: Financial Mathematics II; and
    k. STAT 4393: Statistical Learning;
2. Change the title for STAT 3153: Applied Statistics I, TO: Applied Statistics;
3. Change the title for STAT 4153: Applied Statistics II, TO: Experimental Design and Analysis, modify the prerequisite FROM: Prerequisite: STAT 3153: Applied Statistics I, TO: Prerequisite: STAT 2303: Statistical Methods; and modify the course description;
4. Change the course number for STAT 4263: Mathematical Statistics, TO: 4163;
5. Modify the Curriculum in Mathematics, as follows: delete TECH 1001: Orientation to the University; and add MATH 1001: Orientation to Mathematics;
6. Add the Bachelor of Science in Applied Statistics with the Actuarial Science Option and Computer Science Option.

ARKANSAS TECH UNIVERSITY

UNDERGRADUATE CERTIFICATE OF PROFICIENCY
(6-21 SEMESTER CREDIT HOURS)

Department Initiating Proposal	Date
Behavioral Sciences	6/25/2019

Title	Signature	Date
Department Head David Ward		June 26, 2019
Dean Jeff Woods		6/27/19
Assessment Christine Austin		7/17/19
Registrar Tammy Weaver		7/23/19
Graduate Dean (Graduate Proposals Only) N/A		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Program Title:
Undergraduate Certificate of Proficiency in Psychology

Answer the following Assessment questions: (See table below)

1. Detail the student learning outcomes.
2. Provide tool or measure directly linked to each learning outcome. (How will student learning in this outcome be measured?)
3. What is the rationale for adding this course? What evidence demonstrates this need? N/A. No courses added

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. N/A

Course	LO1	LO2	LO4	LO5
Basic Core	Specialized Knowledge	Research Design, Ethics/Critical Thinking	Written Expression	Broad Integrative Learning
PSY 2003	I – Psy topics/areas	I - Corr from other designs, research designs I – Training in Ethics		I –Levels of explanation of behavior
PSY 2053		R – Perform basic types of statistical analysis	I/R - Write Results Section/ Interpretation	
PSY 2063		I/R – Explain discipline standards. R - Training in Ethics R – Identify basic research designs APA Style Proposal	R - Write a Intro and Method Section APA Style Proposal	
PSY 3003	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 3063 or PSY 3813	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 3053	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior
PSY 3073	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 3093	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior
PSY 3153	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 4013	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior
PSY 4033	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior
PSY 4043	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 4073	R – Knowledge of Content Area	R – Basics of stats/design	R – Write APA style paper	R – Mult Causes of Area's Behavior
PSY 4053	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior
PSY 4133	R – Knowledge of Content Area	R – Basics of stats/design		R – Mult Causes of Area's Behavior

ADHE LETTER OF NOTIFICATION FOR

UNDERGRADUATE CERTIFICATE OF PROFICIENCY

(6-21 SEMESTER CREDIT HOURS)

1. Institution submitting request:

   Arkansas Tech University

2. Contact person/title:

   David Ward, Head of Dept of Behavioral Sciences

3. Phone number/e-mail address:

   dward@atu.edu; (479) 968-0305

4. Proposed effective date:

   Fall 2020

5. Name of proposed Undergraduate Certificate of Proficiency (Program must consist of 6-21 semester credit hours):

   Undergraduate Certificate of Proficiency in Psychology

6. Proposed CIP Code: 420101

7. Reason for proposed program implementation:

   The Certificate of Proficiency in Psychology will provide students outside the psychology major with the opportunity to earn a certificate acknowledging their instruction in psychology. This certification enhances students' employment opportunity in a wide-range of areas from nursing to social work to criminal justice to human resources and integrates well with many majors and employment fields.

8. Provide the following:

   a. Curriculum outline - List of courses in new program – Underline required courses; asterisked are provided online.

      Required:

      PSY 2003 General Psychology*
      PSY 2053 or PSY 2063 or, with approval, Research/Stats substitutes from other majors.

      Choose 12 Hours from:

      PSY 3003 – Abnormal Psychology
      PSY 3063 or PSY 3813 – Developmental* or Lifespan Developmental*
      PSY 3053 – Physiological Psychology
      PSY 3073 – Psychology of Learning
      PSY 3093 – Industrial Psychology*
      PSY 3153 – Theories of Personality*
      PSY 4013 – History of Psychology
      PSY 4033 – Psychological Tests and Measurements
      PSY 4043 – Social Psychology*
      PSY 4073 – Cognitive Psychology*
      PSY 4053 – Psychology of Perception
      PSY 4133 – Psychopharmacology*

b. Total semester credit hours required for proposed program

18 hours

c. New courses and new course descriptions

None

d. Program goals and objectives

Employers in many occupational areas search for applicants with "soft" skills, and psychology helps students understand people and the causes of their behavior. This certificate will appeal to students and employers in a broad array of occupations including business, political science, pre-law, health care and pre-med, counseling, criminal justice and engineers working in areas like cybersecurity and artificial intelligence. This certificate will allow students to present to potential employees a credential which shows education in the basics of psychology while still earning a major in other areas.

e. Expected student learning outcomes

Course	LO1	LO2	LO4	LO5
Basic Core	Specialized Knowledge of the Contents of Psychology	Research and Ethics in Psychology	Written Expression; including APA Style	Broad and Integrative Learning of Causes of Behavior
PSY 2003	I			I
PSY 2053		I/R	I/R	
PSY 2063		I/R	I/R	
Upper Division Choices				
PSY 3003	R	R	R	R
PSY 3063 or PSY 3813	R	R	R	R
PSY 3053	R	R		R
PSY 3073	R	R	R	R
PSY 3093	R	R		R
PSY 3153	R	R	R	R
PSY 4013	R	R		R
PSY 4033	R	R		R
PSY 4043	R	R	R	R
PSY 4073	R	R	R	R
PSY 4053	R	R		R
PSY 4133	R	R		R

f. Student demand (projected enrollment) for proposed program

Currently (Feb 2019) there are 91 students with psychology minors enrolled at ATU. We estimate 60 to 80 of these would choose to pursue the certificate; this should translate into 10 to 20 students graduating with the certificate each year. Given the current enrollment in the minor, no additional marketing plan should be necessary

g. Program approval letter from licensure/certification entity, if required

N/A

h. Name of institutions offering similar programs and the institution(s) used as model to develop proposed program

N/A

i. Scheduled program review date (within 10 years of program implementation)

2029 – 2030 academic year

9. Institutional curriculum committee review/approval date:

10. Will this program be offered on-campus, off-campus, or via distance delivery? If yes, indicate mode of distance delivery. Mark *distance technology courses.

Yes. Distance courses are online courses; see question 8 for "*" courses

11. Identify off-campus location. Provide a copy of email notification to other institutions in the area of the proposed off-campus program offering and their responses; include your reply to the institutional responses.

12. Provide additional program information if requested by ADHE staff.

ARKANSAS TECH UNIVERSITY

UNDERGRADUATE CERTIFICATE OF PROFICIENCY
(6-21 SEMESTER CREDIT HOURS)

Department Initiating Proposal	Date
Music	June 25, 2019

Title	Signature	Date
Department Head		6-28-19
Dean		6/28/19
Assessment		7/17/19
Registrar		7/23/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Program Title: Certificate of Proficiency in Performance

Answer the following Assessment questions: 1. Detail the student learning outcomes. 2. Provide tool or measure directly linked to each learning outcome. (How will student learning in this outcome be measured?) 3. What is the rationale for adding this course? What evidence demonstrates this need?
If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

1. Students will be able to:

- Demonstrate knowledge of appropriate performance practices for the discipline in each of the courses the student elects to take in this certificate program.
- Employ communication strategies necessary for authentic performance(s) for the discipline in each of the courses the student elects to take in this certificate program.
- Develop collaboration and social skills by working with other members enrolled in the course to prepare and produce representative performances for that particular courses discipline.
- Evaluate and analyze the quality and effectiveness of a particular performance.
- Design an original performance representative of the discipline of the course.

2. Tool or measure for each outcome

While the tool or measure for each outcome will of course vary dependent on the course, discipline and instructor, it is understood that rubrics will be employed to evaluate students on their knowledge of performance practice, communication strategies, collaboration skills, evaluation and analyzation techniques as well as the development of original performances.

3. A search of recent job postings reveals a desire for applicants to have "strong communication skills" and an "ability to communicate with coworkers." In his book, "Grown Up Digital," Dan Tapscott highlights a concern about millennials from the Net-Generation. He argues that many are "poor communicators...net addicted" and are 'losing their social skills." Completion of this degree sequence will help enhance the communication and social skills desired by current employers.

ADHE LETTER OF NOTIFICATION FOR

UNDERGRADUATE CERTIFICATE OF PROFICIENCY

(6-21 SEMESTER CREDIT HOURS)

1. Institution submitting request: Arkansas Tech University

2. Contact person/title: Dr. Jeff Bright / Head, ATU Department of Music

3. Phone number/e-mail address: 479-968-0369 / jbright6@atu.edu

4. Proposed effective date: Fall 2020

5. Name of proposed Undergraduate Certificate of Proficiency (Program must consist of 6-21 semester credit hours): Certificate of Proficiency in Performance

6. Proposed CIP Code: 50.9999

7. Reason for proposed program implementation:
The Certificate of Proficiency in Performance provides students with the opportunity to earn within the first four semesters of study, a certificate acknowledging their instruction in the art of performance. This stackable education sequence enhances a student's employment opportunity and augments any degree program with which it is paired.

8. Provide the following:
   a. Curriculum outline - List of courses in new program – Underline required courses

Students need to complete 12 hours of credit from the following electives:

COMM 1111 – Individual Events Practicum
COMM 1121 – Individual Events Practicum
COMM 2003 – Public Speaking
COMM 2011 – Debate Practicum
COMM 2021 – Debate Practicum
COMM 2111 – Debate Practicum
COMM 2121 – Debate Practicum
COMM 2013 – Voice & Diction
COMM 2173 – Business & Professional Speaking

ENGL 2043 – Intro to Creative Writing

JOUR 1811 – Broadcast Practicum
JOUR 1821 – Broadcast Practicum
JOUR 2811 – Broadcast Practicum
JOUR 2821 – Broadcast Practicum

MUS 1XXX – Applied lessons (Maximum of 4 credits)

MUS 1301 – Opera Workshop
MUS 1311 – Jazz Ensemble
MUS 1501 – Band
MUS 1511 – Brass Choir
MUS 1521 – Woodwind Ensemble
MUS 1531 – Brass Ensemble
MUS 1541 – Percussion Ensemble
MUS 1551 – String Ensemble
MUS 1571 – University Choir
MUS 1581 – Chamber Choir (Choral Artists)
MUS 1611 – Music Theater Workshop
MUS 1631 – Symphonic Wind Ensemble
MUS 1681 – Concert Chorale

POLS 3433 – United Nations

SEED 2002 – Education as a Profession

TH 2273 – Intro to Theater
TH 2301 – Intro to Theatrical Dance
TH 2331 – Advanced Theatrical Dance
TH 2703 – Acting Theories and Techniques
TH 2711 – Acting Practicum
TH 2713 – Intermediate Acting
TH 2721 – Acting Practicum

b. Total semester credit hours required for proposed program (Program range: 6-21 semester credit hours) - 12 hours

c. New courses and new course descriptions – no new courses proposed for this certificate

d. Program goals and objectives-
Completion of this degree sequence will help enhance the communication and social skills desired by current employers.

e. Expected student learning outcomes
Students will be able to:

- Demonstrate knowledge of appropriate performance practices for the discipline in each of the courses the student elects to take in this certificate program.
- Employ communication strategies necessary for authentic performance(s) for the discipline in each of the courses the student elects to take in this certificate program.
- Develop collaboration and social skills by working with other members enrolled in the course to prepare and produce representative performances for that particular courses discipline.
- Evaluate and analyze the quality and effectiveness of a particular performance.
- Design an original performance representative of the discipline of the course.

f. Documentation that program meets employer needs
A search of recent job postings reveals a desire for applicants to have "strong communication skills" and an "ability to communicate with coworkers." In his book, "Grown Up Digital," Dan Tapscott highlights a concern about millennials from the Net-Generation. He argues that many are "poor communicators...net addicted" and are 'losing their social skills."

g. Student demand (projected enrollment) for proposed program
Several sophomore music majors, actively participating non-majors in music, sophomore communication majors, speech education majors, and theater minors are already required take many of the classes needed for the certificate. Extrapolating

from enrollments in these areas, we estimate that at least 20 and as many as 60 current students will pursue the certificate each year.

h. Program approval letter from licensure/certification entity, if required – not required. Review will take place at next accreditation comprehensive review in 2022-2023.

i. Name of institutions offering similar programs and the institution(s) used as model to develop proposed program – no institutions with similar programs at this time

j. Scheduled program review date (within 10 years of program implementation) 2022-2023 Academic Year - Reviewed by the National Association of the Schools of Music

9. Institutional curriculum committee review/approval date:

10. Will this program be offered on-campus, off-campus, or via distance delivery? If yes, indicate mode of distance delivery. Mark *distance technology courses. – On Campus

11. Identify off-campus location. Provide a copy of email notification to other institutions in the area of the proposed off-campus program offering and their responses; include your reply to the institutional responses. – Not offered off campus

12. Provide additional program information if requested by ADHE staff. – No knowledge of additional information requested at this time.

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Mathematics	**06/28/2019**

Title	Signature	Date
Department Head	[signature]	6/26/19
Dean	[signature]	2019 Jun 27
Assessment	[signature]	6/28/19
Registrar	[signature]	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
MATH	**1001**	○ Spring ◉ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Orientation to Mathematics

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

ORIENTATION TO MATHEMATICS

Will this course be cross-listed with another existing course? If so, list course subject and number.

○ Yes ◉ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?

If so, list course subject and number. ○ Yes ◉ No

Is this course repeatable for additional earned hours? ○ Yes ◉ No How many total hours?

Grading: ◉ Standard Letter ○ P/F ○ Other

Mode of Instruction (check appropriate box):

◉ 01 Lecture	○ 02 Lecture/Laboratory	○ 03 Laboratory only
○ 05 Practice Teaching	○ 06 Internship/Practicum	○ 07 Apprenticeship/Externship
○ 08 Independent Study	○ 09 Readings	○ 10 Special Topics
○ 12 Individual Lessons	○ 13 Applied Instruction	○ 16 Studio Course
○ 17 Dissertation	○ 18 Activity Course	○ 19 Seminar ○ 98 Other

Does this course require a fee? ○ Yes ◉ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Every semester.

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?

- **No special resources required.**

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?

- **A classroom with SMART technologies will be required.**

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   NA

b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.
      PLO 6 – Professional Knowledge and Skills
   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Students in MATH 1001 will complete a group project in which they will give a 5 - 10 minute PowerPoint presentation on a prospective career path in the field of mathematics.

c. What is the rationale for adding this course? What evidence demonstrates this need?
   This course will provide students a place to develop scholarly interests in the field of mathematics and/or the field of mathematics education while they explore aspects of becoming a professional.

The course will also allow for greater and timelier interactions between our faculty and our prospective preservice teacher candidates with the dual aims of 1) improving retention and 2) increasing the 4-year graduation rate in our Mathematics for Teacher Licensure program.

Our department used the Sankey Diagram generator to track the movement of freshman entering the Mathematics for Teacher Licensure program over the course of 8 terms.

Semester Entered	Freshman Enrolled in Program	Candidates graduating the Program in 8 terms	Number of candidates lost in the 1st semester	Number of candidates lost in the 2nd semester
Fall 2012	16	1	4	5
Fall 2013	5	0	3	2
Fall 2014	12	3	7	2
Fall 2015	4	1	0	0

MATH 1001 Orientation to Mathematics will be structured so as to foster early and meaningful interactions between mathematics education faculty and preservice teacher candidates – providing detailed program guidelines, expectations, and resources. It is our expectation that the early access to our preservice teacher candidates provided by the proposed course will 1) improve retention for the program (the table illustrates that the majority of our program losses are occurring within the candidates' first two terms) and 2) increase our program's 4-year graduation rate (since the Fall of 2012 our program's 4-year graduation rate for has averaged about 14%).

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

a. Course subject: MATH

b. Course number: 1001

c. Catalog course title: Orientation to Mathematics

d. Catalog description:
MATH 1001: Orientation to Mathematics

This course is designed to provide information and enhance skills that will enable students to make a successful transition to college. The course will expose students to college resources, requirements, and promote the development of practical skills for college success. Learning experiences also include exploration of career paths available in the field of mathematics.

e. Instructor information:
Instructor:
Office:
Office hours:
Telephone:
Email:

f. Text(s) required: None.

g. Bibliography (supplemental reading list): None.

h. Justification/rationale for the course:
This course serves as an introduction to the university and to the career paths available in the field of mathematics. An aim of this course is to facilitate meaningful interactions between departmental faculty and students enrolled in programs in the field of mathematics.

i. Course objectives:

After the successful completion of this course students will have gained:

- Strategies to set and accomplish goals,
- Skills for successfully interacting with collegiate faculty, staff and others,
- Knowledge of information/resources on campus,
- Strategies for time and life management,
- Effective collegiate learning skills (note taking, textbook use, memory tools and test taking),
- Knowledge of campus technology (OneTech, Blackboard, College Scheduler and others),
- Knowledge of the career paths available in the field of mathematics,
- Insight into the career path(s) in the field of mathematics that align with their specific interests and strengths.

j. Description of how course meets general education objectives:

The general education curriculum is designed to provide a foundation for knowledge common to educated people and to develop the capacity for an individual to expand that knowledge over his or her lifetime. Students who have completed the course will be able to:

- Communicate effectively,
- Think critically,
- Understand wellness concepts.

k. Assessment methods:

- Attendance and Participation (10%)
- Homework Assignments (40%): Practical assignments will be given throughout the semester. Many assignments will be given and completed in class, making attendance critical to success in this course. Other assignments will be done outside of class and then used in group or individual work when students return to class. Late work will not be accepted unless prior arrangements have been made with the instructor. Most assignments will be in short answer format, discussion boards, and reflection papers.
- Group Project (20%): There will be one group project assigned at the beginning of the term. Groups will give a 5 - 10 minute PowerPoint presentation on a prospective career path in the field of mathematics. All students must attend presentation day(s). Further assignment details and a grading rubric will be distributed in class.
- Campus Networking Form (20%): Students who build a support network on campus are more likely to feel comfortable on campus, to have a higher GPA, and are more likely to graduate. There are many offices and clubs/organizations on campus focused solely on supporting student efforts to graduate and be successful in their future careers. To help students achieve this, they will be required to attend two appointments, meetings, or events with a support office, or club/organization at ATU during the current semester.
    - Go to 2 campus support office appointments, events, meetings to receive help/support during the semester.
    - Fill out a Campus Networking Form about your experience
        - Networking events could include:
            - Appointments with campus Support Services: APEX (Tutoring), English Writing Lab, Reference Librarian, Career Services, Student Support Services, Veterans Services, Biofeedback Lab (Counseling Services) or other student support services on campus.
            - Attendance at Events: Career Fairs, Conferences, Athletic Events, Clubs/Organization meetings or events, SAB events, or other events sponsored by campus groups.
            - See your Instructor for more clarification on qualifying events.
- Final Exam (10%): The final examination will consist of a cumulative assessment of the college resources, requirements and practical skills essential for college success presented throughout the semester.

Grading Scale: A 100-90%, B 89-80%, C 79-70%, D 69-60%, F < 60%

I. Policies:

Attendance and Participation
Class attendance is mandatory. If you must miss a class, contact your professor/instructor to explain the problem or situation before the absence occurs, if possible. You may call, e-mail, or leave a message in the office for your professor/instructor. Students will earn points for each class in which they attend and contribute in the class discussions and activities. Excessive absences (more than 2) can result in you being dropped from the class with an FE for non-attendance.

Class Expectations
Students are expected to attend class, be on time to class, actively participate, and to submit their own work unless assigned as a group project. Classroom misconduct, including inappropriate or disrespectful class behavior, cheating, or plagiarism will be addressed by the professor/instructor following the policies set forth in the student handbook. Students may be asked to leave class if their behavior is disruptive to the learning environment.

Other Services:

Arkansas Tech University does not discriminate on the basis of color, sex, sexual orientation, gender identity, race, age, national origin, religion, veteran status, genetic information, or disability in any of our practices, policies, or procedures. If you have experienced any form of discrimination or harassment, including sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the institution. If you report such an incident of misconduct to a faculty or staff member, they are required by law to notify Arkansas Tech University's Title IX Coordinator and share the basic fact of your experience with them. The Title IX Coordinator will then be available to assist you in understanding all of your options and connecting you with all possible resources on and off campus. For more information, please visit: http://www.atu.edu/titleix/index.php.

Arkansas Tech University adheres to the requirements of the Americans with Disabilities Act in order to prevent barriers to academic accessibility. If you need an accommodation due to a disability, please contact the ATU Office of Disability Services, located in Doc Bryan Student Center, Suite 171, or visit: http://www.atu.edu/disabilities/index.php.

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to notify the instructor, if they are comfortable in doing so. Community resources are available for students and can be found at the following webpage: https://www.atu.edu/localresources/
If a student finds they need more support, they are encouraged to contact the Office of the Vice President for Student Services (479-968-0238).

Students are responsible for information announced in class and conveyed by email. Any assignments announced in class or conveyed by email become the responsibility of the student.

m. Course content:

Week 1: Introduction to Department of Mathematics and Technology Overview

Week 2: Traditions and Expectations

Week 3: Campus Resources & Communication

Week 4: Success Strategies (additional focus on strategies for success in a math class)

Week 5: Managing Time & Stress

Weeks 6 & 7: Academic Planning: Catalog & College Scheduler

Weeks 8 – 10: Career development in the field of Mathematics (with special guest lecturers)

Week 11: Library Resources & Practicing Integrity

Week 12: Money Management

Weeks 13 & 14: Communication & Inclusion

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeffrey W. Robertson	2019Jun28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**2000**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Statistical Packages Lab

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☐ Standard Letter ☐ P/F ☒ Other No grade

Mode of Instruction (check appropriate box):

☐ 01 Lecture	☒ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?
Twice a Year - Fall & Spring

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?

Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
Computer Lab for the Lab Days

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.
      Implement professional statistical software packages for statistical computing and demonstrate competence in with database management
   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework and quizzes
c. What is the rationale for adding this course? What evidence demonstrates this need?
   This lab is the co-requisites of STAT 2303 Statistical Methods. This lab is an introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical

complement to the statistical methodology covered in STAT 2303.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics
STAT 2000 Statistical Packages Lab

Section: 001

Offered: Fall & Spring

Pre-Requisite: None

Co-Requisites: STAT 2303 Statistical Methods

Course Description: This lab is an introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: None

Bibliography:
For SAS:
Online document https://support.sas.com/en/documentation.html
Delwiche, L.D. and Slaughter, S.J., The Little SAS Book: A Primer, Fifth Edition, The SAS Institute, 2012

For R:
Grolemund, G. and Wickham H., R for Data Science, available for free at http://r4ds.had.co.nz/

Justification/rationale for the course: As the demands for professionals with quantitative analytical skills grows, especially in industry, application of statistical software becomes a more crucial part of data analysis. Among the advanced analytics software, SAS and R are the most popular languages used in statistical analysis in both academia and industry.

Objectives: The main point of this lab is to give the student a working start with the covered software SAS and R for the basic statistical analyses from STAT 2303. The student can learn the use of these software in more depth in the subsequent statistical courses. Student can spend a lifetime using and mastering them.

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The grade in this lab is incorporated into STAT 2303.

Attendance: Students are required to attend the lab regularly to learn and practice with SAS and R -- how they are implemented for the statistical analyses covered in STAT 2303.

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Rob	2019 Jun 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**2303**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Statistical Methods

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.

☉ Yes ☐ No Statistical Packages

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?

If so, list course subject and number. ☉ Yes ☐ No STAT 2300

Is this course repeatable for additional earned hours? ☐ Yes ☉ No How many total hours?

Grading: ☉ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☐ 01 Lecture	☉ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☉ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Twice a Year - Fall & Spring

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.? Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
Computer Lab for the Lab Days

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.

Not applicable

b. If this course is required for the major or minor, complete the following.

1. Provide the program level learning outcome(s) it addresses.

Students will be able to (1) have good understanding of exploratory data analysis, basic statistical inference, and limitations of the procedures, (2) implement professional statistical software packages for statistical computing and demonstrate competence in with database management, (3) explain statistical ideas, methods, and results effectively to statistical and non-statistical audiences.

2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)

In-class participation/projects, homework, quizzes, and tests

c. What is the rationale for adding this course? What evidence demonstrates this need?

The goal of this course is to introduce students to statistical methods for analyzing data. We will emphasize the basic principles and criteria for selecting the appropriate statistical technique. Students will get hands-on experience applying the topics covered to real datasets using R or SAS. From medical studies, research experiments, business information, from polling organizations, and insurance, data are being collected everywhere, and all the time. Knowledge in statistics provides you with the necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics
STAT 2303 Statistical Methods

Section: 001

Offered: Fall & Spring

Pre-Requisite: Math 2914 Calculus I

Co-Requisites: STAT 2000. **Statistical Packages** Laboratory. Introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303.

Course Description: The goal of this course is to introduce students to statistical methods for analyzing data. Some of the topics included are: Describing Data, Basic Probability, Random variables, Normal and Binomial Distributions, Sampling Distributions, Confidence Intervals, Hypothesis testing, Correlation and Regression, Contingency table, Comparing two populations, ANOVA.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: Moore, David S., McCabe, George P., and Craig, Bruce A. Introduction to the Practice of Statistics, 7th ed., W.H. Freeman and Company, New York.

Bibliography: There is NO required supplemental reading list for this course.

Justification/rationale for the course: The goal of this course is to introduce students to statistical methods for analyzing data. We will emphasize the basic principles and criteria for selecting the appropriate statistical technique. Students will get hands-on experience applying the topics covered to real datasets using R or SAS. From medical studies, research experiments, business information, from polling organizations, and insurance, data are being collected everywhere, and all the time. Knowledge in statistics provides you with the necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

Course objectives - By completing this course the student will learn to perform the following:

1) How to calculate and apply measures of location and measures of dispersion.
2) How to apply discrete and continuous probability distributions to various business problems.
3) Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
5) Compute and interpret the results of Simple Linear Regression and Correlation Analysis, ANOVA and F-test.

Course Content:

- Descriptive statistics & data visualization
- Probability
- Point and interval estimation
- Hypothesis testing
- Inference for a single population
- Comparisons between two populations
- One- way analysis of variance
- Analysis of categorical data
- Simple linear regression

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The final grade will consist of 100 percentage points, with the following breakdown:

In-Class Participation/Projects	15%	
Homework/Quizzes		15%
3 Exams (20% each)	70	%
	100%	

The following percentages will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

Attendance: The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled. *In the event that you must miss, it is your responsibility to find out what material you missed and if any assignments are due.* I DO NOT take doctor's notes for absences.

No Make-Up exams will be given.

Expectations:

- Students must adhere to the rules set forth in the handbook.
- Students must do their own work.
- Consider your actions carefully: There will be no tolerance for conduct that even gives the appearance of cheating.
- Students are expected to respect the rights of others
- Students should not hesitate to clarify any questions regarding the policies of this course with the instructor.

Cheating/Plagiarism : Cheating or copying someone else's work may result in anything from a zero on the assignment (or test) to expulsion from the course with a course grade of F. Talking to others or using notes are NOT allowed during exams, either. *Please note that while I strongly encourage working together on assignments, copying someone else's work is cheating, and will not be tolerated.* Using apps, unapproved websites, etc are also considered cheating.

ARKANSAS TECH UNIVERSITY

RECEIVED

JUN 27 2019

Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**3113**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Regression Analysis

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a Year - Spring semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
Computer lab

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

      Students will be able to apply appropriate statistical modeling tools to analyze data, interpret the results with proper scope of conclusions.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework assignments and tests
c. What is the rationale for adding this course? What evidence demonstrates this need?

   STAT 3113 Regression Analysis is a required course for BS in Applied Statistics program. Regression analysis is the most popularly used statistical technique with application in

	almost every imaginable field. Linear regression model, which relates an outcome to a set of predictors of interest using linear assumptions, is the most important statistical analysis tool in a data scientist's toolkit.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 3113	**Regression Analysis**
Section #	**001**
OFFEREDSpring	
PRE-REQUISITE	An introductory statistics course or permission of instructor
CO-REQUISITES	None
DESCRIPTION	This course introduces the methods for fitting and interpreting regression models. Topics include simple linear regression (SLR), multiple linear regression (MLR), model checking, variable selection methods, dummy variables, diagnostic measures, logistic regression, and time series analysis. Instruction will include the use of a statistical programming language.
NOTES	None
COURSE INSTRUCTOR	**Office** **Phone:** **Email:** To be completed by the faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Mendenhall, W., Sincich, T., A Second Course in Statistics Regression Analysis, 8th edition, Pearson.
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Regression analysis is the most popularly used statistical technique with application in almost every imaginable field. Linear regression model, which relates an outcome to a set of predictors of interest using linear assumptions, is the most important statistical analysis tool in a data scientist's toolkit. This course focus on regression models and associated methods of statistical inference, data analysis, interpretation of results, statistical computation and model building.
OBJECTIVES	After completing this course, the learner will be able to:

- understand regression model and model assumptions in SLR and MLR;
- Use SAS and/or R to get least square estimate, confidence interval, and do hypothesis for the parameters;
- do the estimation and prediction by using the linear regression model;
- do regression for the data with quantitative, qualitative predictors and both;
- do model selection by using SAS and/or R;
- check the model assumptions by residual plots and use some basic measures to remedy the model;
- apply logistic regression for the dependent variable with two discrete values.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**15%**
3 Exams (20% each)	**60%**
Final Exam	**25%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. Students missing more than 2 classes are to be dropped from the class with a grade of F. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Course overview, Review some basic concepts, Introduction to regression analysis		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Simple linear regression (SLR) definition, Least square method (LSE)		
3	SLR model assumptions, Estimation of , Interpretation & inference of the slope parameter		
4	Coefficient of correlation, Coefficient of determination, SLR estimation and prediction, Multiple linear regression (MLR) definition		

5	MLR: LSE, Model assumption, Estimation of ,		
6	MLR: Inference about the parameters, Multiple coefficients of determination, Estimation and prediction		
7	MLR: Interaction model, Curvilinear model, model with qualitative independent variable		
8	Model selection, Problems (misusing) with regressions		
9	Residual analysis		
10	Transformations and weighting to correct model inadequacies, Introduction to weighted least squares		
11	Introduction to piecewise linear regression, Introduction to logistic regression		
12	Introduction to ridge regression, Time series component		
13	Moving average method, Exponential smoothing		
14	Measures of forecast accuracy, Forecasting by regression approach		
15	Autocorrelation and autoregressive error models		

ARKANSAS TECH UNIVERSITY

RECEIVED

JUN 27 2019

Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Roth	2019 July 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	3183	Summer 2020 ☐ Spring ☒ **Summer I**
Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below) Statistical Process Control		
Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)		

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a Year - Spring Semesters

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?

Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
No

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.
      The students will be able to implement various statistical tools for quality monitoring commonly used in industry.
   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Tests, quizzes, homework assignments, and group projects.
c. What is the rationale for adding this course? What evidence demonstrates this need?

   This course is the foundation course in quality control for the BS in Applied Statistics degree. This

course will give a foundation in statistical quality control which is important to any student wanting to find employment in industry.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 3183	**Statistical Process Control**
Section #	**001**
OFFEREDSpring	
PRE-REQUISITE	STAT 3153 Applied Statistics
CO-REQUISITES	None
DESCRIPTION	This course is an introduction to statistical process control using Deming's philosophy for the improvement of quality, productivity, and competitive position.
NOTES	None
COURSE INSTRUCTOR	**Office** **Phone:** **Email:** To be completed by the faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Introduction to Statistical Quality Control, 7th edition, by D. Montgomery, Wiley, ISBN: 978-1118146811
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Regression analysis is an important topic for anyone interested in applying statistics in industry. This course focus on theory and methods of quality monitoring including process capability, control charts, acceptance sampling, quality engineering, and quality design.
OBJECTIVES	After completing this course, the learner will be able to: • Collect and analyze data with emphasis on basic concepts of quality control. • Understand the importance of variability in statistical quality control. • Understand the role of statistics in engineering and quality improvement.

- To learn various statistical tools of quality monitoring.
- To learn the statistical and economical design issues associated with quality control.
- To understand and implement various process capability analysis techniques.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. Students missing more than 5 classes are to be dropped from the class with a grade of F. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student

who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Course overview, Review some basic concepts, Introduction to Quality Management and Philosophy regression analysis		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2 & 3	Modeling Process Quality: Reviewing probability distributions associated with Quality Control		
4	Inferences about process quality		
5	Statistical Process Control: Methods and Philosophy of Statistical Process Control		
6 & 7	Control Charts for Variables		
8 & 9	Control Charts for Attributes		
10	Control Charts for Short Run Productions, Multiple-Stream Processes		
11&12	Process Capability Analysis		
13	Process Design and Improvement with Designed Experiments		
14&15	Acceptance Sampling		

ARKANSAS TECH UNIVERSITY

RECEIVED

JUN 27 2019

Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**3203**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Actuarial ~~Probabity~~ I Probability

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a year - Fall semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
None

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
None

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

      Students will demonstrate knowledge of fundamental probability tools for quantitatively assessing risk and basic financial mathematics.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework and tests
c. What is the rationale for adding this course? What evidence demonstrates this need?
   STAT 3203 & STAT 3213 are required courses for BS in Applied Statistics with Actuarial Science option. This course is designed to develop knowledge of the fundamental probability tools for

quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 3203	**Actuarial Probability I**
Section #	001
OFFERED	Fall
PRE-REQUISITE	MATH 2934 Calculus III
CO-REQUISITES	None
DESCRIPTION	In this course we develop knowledge of the fundamental probability tools for quantitatively assessing risk. The application of these tools to problems encountered in actuarial science is emphasized. A thorough command of the supporting calculus is assumed. A very basic knowledge of insurance and risk management is assumed.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Probability Course for the Actuaries: A Preparation for Exam P/1, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop knowledge of the fundamental probability tools for quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to use and apply the following Concepts : • Set functions including set notation and basic elements of probability • Mutually exclusive events

- Addition and multiplication rules
- Independence of events
- Combinatorial probability
- Conditional probability
- Bayes Theorem / Law of total probability
- Commonly used discrete random variables

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction.

If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Set theory		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Counting and combinatorics		
3	Probability: Definitions and properties		
4	Conditional Probability		
5	Bayes' formula		
6	Independent events, Odds and conditional probability		

7	Random variables		
8	Probability mass function and cumulative distribution function		
9	Expected value of a discrete random variable, Expected value of a function of a discrete random variable		
10	Variance and standard deviation of a discrete random variable		
11	Uniform discrete random variable, Bernoulli trails and binomial distribution		
12	The expected value and variance of the binomial distribution		
13	Poisson random variable Geometric random variable		
14	Negative binomial random Variable		
15	Hyper-geometric random variable		

ARKANSAS TECH UNIVERSITY

RECEIVED

JUN 27 2019

Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	3213	Summer 2020 ☐ Spring ☒ Summer I

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Actuarial ~~Probabity~~ Probability II

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a year - Spring semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
None

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
None

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

      Students will demonstrate knowledge of fundamental probability tools for quantitatively assessing risk and basic financial mathematics.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework and tests
c. What is the rationale for adding this course? What evidence demonstrates this need?
   STAT 3203 & STAT 3213 are required courses for BS in Applied Statistics with Actuarial Science option. This course is designed to develop knowledge of the fundamental probability tools for

quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 3213	**Actuarial Probability II**
Section #	001
OFFERED	Spring
PRE-REQUISITE	STAT 3203 Actuarial Probability I
CO-REQUISITES	None
DESCRIPTION	This course is a continuation to STAT 3203. At the end of this course, a student is prepared to take Exam P of the Society of Actuaries.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Probability Course for the Actuaries: A Preparation for Exam P/1, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop knowledge of the fundamental probability tools for quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to use and apply the following Concepts : • Probability functions and probability density functions Mutually exclusive events • Cumulative distribution functions • Mode, median, percentiles, and moments • Variance and measures of dispersion • Moment generating functions

- Transformations
- Joint probability functions and joint probability density functions
- Joint cumulative distribution functions
- Central Limit Theorem
- Conditional and marginal probability distributions
- Moments for joint, conditional, and marginal probability distributions
- Joint moment generating functions
- Variance and measures of dispersion for conditional and marginal probability distributions
- Covariance and correlation coefficients
- Transformations and order statistics
- Probabilities and moments for linear combinations of independent random variables

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE

Respect your peers. Students are expected to respect the rights of others.

CONDUCT

Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Cumulative and survival distribution function		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Review improper integrals from Calculus prerequisite I, Distribution functions		

3	Expectation and variance, Median, mode, and percentiles		
4	The continuous uniform distribution function, Normal random variables		
5	The normal approximation to the binomial distribution, Exponential random variable		
6	Gamma distribution, the distribution of a function of a continuous random variable		
7	Review graphing systems of inequalities in two variables and iterated double integrals from Calculus II		
8	Jointly distributed random variables, Independent random variables		
9	Sum of two independent random variables		
10	Conditional distribution		
11	Joint Probability distribution of functions of random variables, Expected value of a function of two random variables		
12	Covariance and variance of sums, The coefficient of correlation		
13	Conditional Expectation, Double Expectation		
14	Conditional variance, Moment generating functions		
15	Moment generating functions		

	of sums of independent RVs, The central limit theorem		

ARKANSAS TECH UNIVERSITY

RECEIV
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**4113**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Categorical Data Analysis

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a Year - Fall Semesters

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?

Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
No

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable
b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.
      The students will be able to apply appropriate statistical modeling tools to analyze data, interpret the results with proper scope of conclusions
   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework, quizzes, projects, and tests
c. What is the rationale for adding this course? What evidence demonstrates this need?
   The goal of this course is to introduce students to statistical methods for analyzing data in which the response variables are categorical: either qualitative or quantitative and the

explanatory variables can be categorical or continuous. In the real world, often times we have data that require knowledge of how to handle categorical response variables as well as the mixed inputs. By learning categorical analysis, it further deepens knowledge in statistics that will provide necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus
Department of Mathematics and Statistics
STAT 4113 Categorical Analysis

Section: 001

Offered: Fall

Pre-Requisite: STAT 3113 Regression Analysis

Course Description: Statistical tools to analyze univariate and multivariate categorical responses. Emphasis is given to Generalized Linear Models, including logistic regression and loglinear models.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: An Introduction to Categorical Analysis. 2nd edition. Author: Alan Agresti. Publisher: John Wiley & Sons, Inc. ISBN: 9780471226185.

Bibliography: There is NO required supplemental reading list for this course.

Justification/rationale for the course: The goal of this course is to introduce students to statistical methods for analyzing data in which the response variables are categorical: either qualitative or quantitative and the explanatory variables can be categorical or continuous. In the real world, often times we have data that require knowledge of how to handle categorical response variables as well as the mixed inputs. By learning categorical analysis, it further deepens knowledge in statistics that will provide necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

Course objectives - By completing this course the student will be able to perform the following:

- Students will be able to select the appropriate statistical methodology for the analysis of categorical data.
- Justify the basic theoretical models for categorical data.
- Conduct and/or actively participate in the modeling and analyzing of categorical data.
- Interpret results from contingency tables or generalized linear models that evaluate relationships between categorical variables
- Communicate, both verbally and in writing, results with non-statisticians
- Analyze categorical data using statistical software

Course Content:

1	Overview & Intro.	1.1-1.2
2	Sampling models & Inference	1.3-1.5
3	2-way tables: structure and proportions	2.1
4	2-way tables: odds ratios	2.2, 2.4
5	Inference: Chi-square tests	3.1-3.3
6	Inference: ordinal data, exact tests	3.4-3.6
7	3-way tables: partial association	2.3, 3.7

•	8	Generalized linear models (GLM)	4.1
•	9	GLMs for binary data	4.2
•	10	Poisson regression	4.3
		Inference and model checking	4.5-4.6
•	11	Logistic regression	5.1
•	12	Logistic regression: model checking	5.2
•	13	Logit models (categorical predictors)	5.3
•	15	Multiple logistic regression	5.4-5.5

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The final grade will consist of 100 percentage points, with the following breakdown:

Homework/Quizzes	35%
Projects/Exams (20% each)	65%
	100%

The following percentages will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

Attendance: The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled. *In the event that you must miss, it is your responsibility to find out what material you missed and if any assignments are due.* I DO NOT take doctor's notes for absences.

No Make-Up exams will be given.

Expectations:

- Students must adhere to the rules set forth in the handbook.
- Students must do their own work.
- Consider your actions carefully: There will be no tolerance for conduct that even gives the appearance of cheating.
- Students are expected to respect the rights of others
- Students should not hesitate to clarify any questions regarding the policies of this course with the instructor.

Cheating/Plagiarism : Cheating or copying someone else's work may result in anything from a zero on the assignment (or test) to expulsion from the course with a course grade of F. Talking to others or using notes are NOT allowed during exams, either. *Please note that while I strongly encourage working together on assignments, copying someone else's work is cheating, and will not be tolerated.* Using apps, unapproved websites, etc are also considered cheating.

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine Y. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Roth	2019 Jun 28
Assessment Dr. Christine Austin	Chr Aut	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**4283**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Financial Mathematics I

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a year - Fall semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
None

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
None

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
Not applicable

b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

Students will demonstrate knowledge of fundamental probability tools for quantitatively assessing risk and basic financial mathematics.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
Homework and tests

c. What is the rationale for adding this course? What evidence demonstrates this need?

STAT 4283 & STAT 4293 are required courses for BS in Applied Statistics with Actuarial

Science option. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 4283	**Financial Mathematics I**
Section #	001
OFFERED	Fall
PRE-REQUISITE	MATH 2914 Calculus I
CO-REQUISITES	None
DESCRIPTION	This is an introductory course in Financial Mathematics. The student will learn about the different types of interest (simple interest, discount interest, compound interest), annuities, debt retirement methods, investing in stocks and bonds.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Basic Course in the Theory of Interest: A Preparation for Exam FM/2, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course will be able to understand:

- and to perform calculations relating to present value, current value, and accumulated value
- and to calculate present value, current value, and accumulated value for sequences of non-contingent payments (annuities)
- key concepts concerning loans and how to perform related calculations
- key concepts concerning bonds, and how to perform related calculations

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a

distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, interest, Accumulation and amount functions, EIR, Simple Interest, Date conventions under simple interest		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Compound interest, Present value and discount functions, Effective rate of discount, Nominal rate of interest and discount		
3	Continuous compounding,		

	Time varying interest rates, Equations of value and time diagrams, Solving for the unknown interest rate/time		
4	Present and accumulated values of an annuity-immediate, Annuity due, Deferred annuity		
5	Perpetuities, Solving for the unknown number of payments/rate of interest of an annuity, Varying interest of an annuity		
6	Annuities payable at a different/less/more frequency than interest is convertible, Continuous annuities		
7	Varying annuity (immediate/due/with payments at a different frequency than interest is convertible), Continuous varying annuities		
8	Discounted cash flow technique, Uniqueness of IRR, Interest reinvested at a different rate		
9	Dollar-weighted/time-weighted interest rate, Portfolio and investment year methods		
10	Yield rate in capital budgeting, Finding the loan balance with prospective and retrospective methods		
11	Amortization schedules, Sinking fund method		

12	Loans payable at a different frequency than interest is convertible, Amortization with varying series of payments		
13	Type of bounds, the various pricing formulas of a bound		
14	Amortization of premium or discount, Valuation of bonds between coupons payment dates		
15	Approximation methods of bonds' yield rates, Callable bonds and serial bonds		

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeffrey W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**4293**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Financial Mathematics II

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a year - Spring semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
None

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
None

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
Not applicable

b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

Students will demonstrate knowledge of fundamental probability tools for quantitatively assessing risk and basic financial mathematics.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
Homework and tests

c. What is the rationale for adding this course? What evidence demonstrates this need?

STAT 4283 & STAT 4293 are required courses for BS in Applied Statistics with Actuarial

Science option. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 4293	**Financial Mathematics II**
Section #	001
OFFERED	Spring
PRE-REQUISITE	MATH 4283 Financial Mathematics I
CO-REQUISITES	None
DESCRIPTION	This is a continuation of STAT 4283. Topics include Loans, bonds, cash flow and portfolios, immunization, derivatives and options. At the end of this course, a student is prepared to take Exam FM of the Society of Actuaries.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Basic Course in the Theory of Interest: A Preparation for Exam FM/2, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to understand: • key concepts concerning yield curves, rates of return, and measures of duration and convexity, and how to perform related calculations

- key concepts concerning cash flow matching and immunization, and how to perform related calculations
- key concepts concerning interest rate swaps, and how to perform related calculations
- key concepts concerning the determinants of interest rates, the components of interest, and how to perform related calculations.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary,

you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Review the key concepts of loans and the related calculation		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Review the key concepts of bonds and the related calculation, Preferred and common stocks		
3	Buying stocks, Short sales, Money market instruments		
4	The effect of inflation on interest rates, The term structure of interest rate and yield curves		

5	Macaulay and modified durations, Redington immunization and convexity		
6	Full immunization and dedication, Financial derivatives and related issues		
7	Derivatives markets and risk sharing, Payoff and profit diagrams		
8	Call options/put options: payoff and profit diagrams, stock options		
9	Floors and caps, Covered calls and covered puts		
10	Synthetic forward and put-call parity, Spread strategies		
11	Collars, Straddles, Strangles, and Butterfly spreads		
12	Equity linked CDs, Prepaid forward contracts on stock		
13	Forward contracts on stock		
14	Future contracts, A simple commodity swap		
15	Interest rate swaps, risk management		

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE ADDITION

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine Z. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)	Effective Term:
STAT	**4393**	Summer 2020 ☐ Spring ☒ **Summer I**

Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Statistical Learning

Banner Title: (limited to 30 characters, including spaces, capitalize all letters — this will display on the transcript)

Will this course be cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Will this course be cross-listed with a course currently not in the undergraduate or graduate catalog?
If so, list course subject and number. ☐ Yes ☒ No

Is this course repeatable for additional earned hours? ☐ Yes ☒ No How many total hours?

Grading: ☒ Standard Letter ☐ P/F ☐ Other

Mode of Instruction (check appropriate box):

☒ 01 Lecture	☐ 02 Lecture/Laboratory	☐ 03 Laboratory only	
☐ 05 Practice Teaching	☐ 06 Internship/Practicum	☐ 07 Apprenticeship/Externship	
☐ 08 Independent Study	☐ 09 Readings	☐ 10 Special Topics	
☐ 12 Individual Lessons	☐ 13 Applied Instruction	☐ 16 Studio Course	
☐ 17 Dissertation Research	☐ 18 Activity Course	☐ 19 Seminar	☐ 98 Other

Does this course require a fee? ☐ Yes ☒ No How Much? Select Fee Type

If selected other list fee type:

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

If course is required by major/minor, how frequently will course be offered?

Once a Year - Spring semester

Will this course require any special resources such as unusual maintenance costs, library resources, special software, distance learning equipment, etc.?
Software – University already has the options licensed.

Will this course require a special classroom (computer lab, smart classroom, or laboratory)?
Computer lab

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
   Not applicable

b. If this course is required for the major or minor, complete the following.
   1. Provide the program level learning outcome(s) it addresses.

      Students will be able to (1) apply appropriate statistical modeling tools to analyze data, interpret the results with proper scope of conclusions, (2) implement professional statistical software packages for statistical computing and demonstrate competence in with database management.

   2. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)
      Homework, group course project, and tests

c. What is the rationale for adding this course? What evidence demonstrates this need?

STAT 4393 Statistical Learning is a required course for BS in Applied Statistics Degree. With the explosion of "Big Data" problems, statistical learning has become a very hot field in many scientific areas as well as marketing, finance, and other business disciplines. People with statistical learning skills are in high demand! This course provides hands-on opportunities for students to apply the methods learned in real-world situations.

For the proposed course, attach a syllabus in Word format that includes: **(Items a. through d. should be entered as they should appear in the catalog)**

a. Course subject
b. Course number
c. Catalog course title
d. Catalog description
    1. Arkansas Course Transfer System (ACTS) course number, if applicable
    2. Cross-listing
    3. Offered (e.g., Fall only, Spring only. Do not enter if offer course fall and spring)
    4. Prerequisites
    5. Co-requisites
    6. Description
    7. Notes (e.g., information not in description such as course may be repeated for credit)
    8. Contact Hours if different than lecture (e.g., Lecture three hours, laboratory three hours)
    9. Fees (e.g., $36 art fee)
e. Section for Name of instructor, office hours, contact information (telephone, email)
f. Text required for course
g. Bibliography (supplemental reading list)
h. Justification/rationale for the course
i. Course objectives
j. Description of how course meets general education objectives (courses included in the general education component should show how the course meets one or more of the objectives contained in General Education Objectives listed in undergraduate catalog)
k. Assessment methods (include grading policy with specific equivalents for A, B, C)
l. Policy on absences, cheating, plagiarism, etc.
m. Course content (outline of material to be covered in course).

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 4393	**Introduction to Statistical Learning**
Section #	**001**
OFFERED	Spring
PRE-REQUISITE	STAT 3113 Regression Analysis
CO-REQUISITES	None
DESCRIPTION	This course is directed towards advanced undergraduates or master's students in statistics or related quantitative fields. The focus of the course is an accessible overview of the field of statistical learning and provide the students with valuable hands-on experience by illustrating how to implement each of the statistical learning methods using R. Topics covered include: Linear Regression, Logistic Regression, Linear Discriminant Analysis, K-Nearest Neighbors, Cross-Validation, Bootstrap, Variable Selection, Shrinkage Methods, Dimension Reduction, Considerations in High Dimensions, Polynomial Regression, Generalized Additive Models, Decision Trees, Bagging, Random Forests, Boosting, Support Vector Machines, Principal Components Analysis, Clustering, and more.
NOTES	None
COURSE INSTRUCTOR: TBD	**Office: Corley** **Phone:** **Email:**
OFFICE HOURS	
TEXTBOOK	James, G., Witten, D., Hastie, T., and Tibshirani, R. An Introduction to Statistical Learning with Applications in R. New York: Springer. The book webpage is http://www-bcf.usc.edu/~gareth/ISL/.
BIBLIOGRAPHY	Applied Data Mining and Statistical Learning: Very good online lecture notes on Statistical Learning.
JUSTIFICATION	With the explosion of "Big Data" problems, statistical learning has become a very hot field in many scientific areas as well as marketing, finance, and

other business disciplines. People with statistical learning skills are in high demand! This course provides hands-on opportunities for students to apply the methods learned in real-world situations.

OBJECTIVES

After completing this course, the learner will be able to:

- Identify supervised (regression, classification) and unsupervised (clustering) learning problems.
- Understand the fundamental idea behind statistical learning methods, know the pros and cons of each method.
- Understand the limitations of linear models and understand the nonlinear alternatives.
- Explain the challenges with high dimensional data and have a basic understanding of linear model selection and regularization.
- Formulate a mathematical solution to the real-world problems and implement the statistical learning methods by using statistical computing package.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**15%**
Group Course Project	**25%**
3 Exams (including Final Exam, 20% each)	**60%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. After 2 absences, a student's name may be reported to the advising center's Early Warning staff. After 4 absences, a student may be dropped from the course with an FE* if the grade is below 60%. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Introduction to Statistical Learning and statistical software package R		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Linear Regression		
3	Logistic Regression		
4	Linear Discriminant Analysis (LDA), K-Nearest Neighbors (KNN)		
5	A Comparison of		

	Classification Methods, Cross-Validation		
6	Cross-Validation, Bootstrap		
7	Variable Selection, Shrinkage Methods		
8	Dimension Reduction, Considerations in High Dimensions		
9	Polynomial Regression, Generalized Additive Models		
10	Decision Trees, Bagging		
11	Random Forests, Boosting		
12	Support Vector Classifiers		
13	Support Vector Machines		
14	Principal Components Analysis (PCA)		
15	PCA, Clustering		

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE CHANGE

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Roberts	2019 Jun 28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)
STAT	**3153**

Official Catalog Title:
Applied Statistics I

Is this course cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Request to change: (check appropriate box):

☐ Course Number	☑ Title	☐ Course Description
☐ Cross-Listing	☐ Prerequisite	☐ Co-requisite
☐ Grading	☐ Fee	
☐ Other		

NOTES: These changes will become effective in the Summer I Term of the new catalog year. If this course is cross-listed, a prerequisite/co-requisite, or included in the course description of other courses, a Course Change must be submitted to address all changes in related courses.

New Course Number: (e.g., 1003)

3153

New Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Applied Statistics

Banner Title: (limited to 30 characters, including spaces, capitalize all letters - this will display on the transcript)

New Course Description:

Collection and analysis of data, probability models, random variables, confidence intervals, and hypothesis testing.

New Cross List:

☐ Adding Cross-Listing ☐ Changing Cross-Listing ☐ Deleting Cross-Listing

If adding or changing cross-listing, indicate course subject and number

New Prerequisite (list all, as you want them to appear in the catalog):

MATH 2924 Calculus II

New Co-requisite (list all, as you want them to appear in the catalog):

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.

Not applicable

b. If this course is required for the major or minor, complete the following.

a. Provide the program level learning outcome(s) it addresses.

The students will be able to understand the fundamentals of probability and statistical theory.

b. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)

Homework and tests

c. What is the rationale for adding this course? What evidence supports this action?

STAT 3153 Applied Statistics is a core course of the Applied Statistics program. The purposes of this course are to facilitate student learning of basic probability concepts, statistical methods, and data analysis.

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

ARKANSAS TECH UNIVERSITY™

RECEIVED
JUN 27
Registrar's Office

REQUEST FOR COURSE CHANGE

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Rath	2019 Jun 28
Assessment Dr. Christine Austin		6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)
STAT	**4153**

Official Catalog Title:
Applied Statistics II

Is this course cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Request to change: (check appropriate box):

☐ Course Number	☑ Title	☑ Course Description
☐ Cross-Listing	☑ Prerequisite	☐ Co-requisite
☐ Grading	☐ Fee	
☐ Other		

NOTES: These changes will become effective in the Summer I Term of the new catalog year. If this course is cross-listed, a prerequisite/co-requisite, or included in the course description of other courses, a Course Change must be submitted to address all changes in related courses.

New Course Number: (e.g., 1003)

STAT 4153

New Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Experimental Design and Analysis

Banner Title: (limited to 30 characters, including spaces, capitalize all letters - this will display on the transcript)

Exper. Design Anal.

New Course Description:

This course introduces students to both design and analysis of experiments as well as statistical computing. SAS and JMP will be the primary software for this course. Topics will include basic principles of experimental design, randomization, replication, completely randomized design, randomized blocks, Latin squares, complete and incomplete block designs, factorial design, blocking in factorial design, 2k factorial design, blocking and confounding in 2k factorials, fractional factorial designs, blocking in fractional factorials, experiments with random factors, nested and split-plot designs, analysis of covariance, repeated measures, regression, ANOVA, and follow-up analysis, sample size determination. Other topics may be discussed if time permits.

New Cross List:

☐ Adding Cross-Listing ☐ Changing Cross-Listing ☐ Deleting Cross-Listing

If adding or changing cross-listing, indicate course subject and number

New Prerequisite (list all, as you want them to appear in the catalog):
STAT 2303 Statistical Methods

New Co-requisite (list all, as you want them to appear in the catalog):

☐ Elective ☑ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
Not applicable

b. If this course is required for the major or minor, complete the following.
   a. Provide the program level learning outcome(s) it addresses.

Demonstrate knowledge of efficient design and analysis of experiments for standard situations

b. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)

Homework, Course projects, and tests

c. What is the rationale for adding this course? What evidence supports this action?

STAT 4153 Experimental Design and Analysis is a core course of the Applied Statistics program. Designing experiments to effectively address research questions, performing data analysis by using appropriate software and drawing statistical conclusions are the essential skills for statisticians. Experimental design is also an important tool for engineers and scientists to use for product design and development as well as process development and improvement.

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

Syllabus

Department of Mathematics and Statistics

STAT 4153	**Experimental Design and Analysis**
Section #	**001**
OFFERED	Spring
PRE-REQUISITE	An introductory statistics course or permission of instructor
CO-REQUISITES	None
DESCRIPTION	This course introduces students to both design and analysis of experiments as well as statistical computing. SAS and JMP will be the primary software for this course. Topics will include basic principles of experimental design, randomization, replication, completely randomized design, randomized blocks, Latin squares, complete and incomplete block designs, factorial design, blocking in factorial design, 2k factorial design, blocking and confounding in 2k factorials, fractional factorial designs, blocking in fractional factorials, experiments with random factors, nested and split-plot designs, analysis of covariance, repeated measures, regression, ANOVA, and follow-up analysis, sample size determination. Other topics may be discussed if time permits.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley** **Phone:** **Email:** To be determined by faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Montgomery, D. C., Design and Analysis of Experiments, 9th edition, Wiley.
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Designing experiments to effectively address research questions, performing data analysis by using appropriate software and drawing statistical conclusions are the essential skills for statisticians. Experimental design is also an important tool for engineers and scientists to use for

product design and development as well as process development and improvement. Experimental design should be introduced early in the product cycle to substantially reduce development lead time and cost, leading to processes and products that perform better in the field and have higher reliability than those developed using other approaches.

OBJECTIVES

After completing this course, the learner will be able to:

- understand the principles, models and strategies commonly used for experimental design;
- construct appropriate experiments to effectively address research questions;
- use statistical software to correctly analyze data collected from designed experiments and draw appropriate statistical conclusions.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
Course Project	**15%**
2 Exams (20% each)	**40%**
Final Exam	**25%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. After 2 absences, a student's name may be reported to the advising center's Early Warning staff. After 4 absences, a student may be dropped from the course with an FE* if the grade is below 60%. Students who arrive to class

late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Basic principles and guidelines for designing experiments		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Completely randomized experiment (CRD), Perform single-factor ANOVA for CRD		
3	Perform single-factor ANOVA for CRD, ANOVA model adequacy checking		
4	Practical interpretation of results, Interpret computer output from SAS/JMP,		

	Determining sample size		
5	The regression approach to the ANOVA, Nonparametric methods in the ANOVA		
6	Randomized blocks, Latin squares, Complete and incomplete block designs		
7	Factorial design, Blocking in factorial design		
8	2k series of factorial designs, ANOVA for 2k factorial design		
9	Regression model for 2k factorial design, unreplicated 2k factorial design		
10	Blocking and confounding in 2k factorials		
11	Fractional factorial designs		
12	Blocking in fractional factorials		
13	Experiments with random factors		
14	Nested and split-plot designs		
15	Brief introduction of ANCOVA and repeated measures		

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR COURSE CHANGE

Department Initiating Proposal	Date
Department of Mathematics and Statistics	6/30/2019

Title	Signature	Date
Department Head Dr. Jeanine Myers	Jeanine L. Myers	6/27/19
Dean Dr. Jeff Robertson	Jeff W. Robertson	2019 Jun 28
Assessment Dr. Christine Austin	Christine Austin	6/28/19
Registrar Ms. Tammy Weaver	Tammy Weaver	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Course Subject: (e.g., ACCT, ENGL)	Course Number: (e.g., 1003)
STAT	**4263**

Official Catalog Title:
Mathematical Statistics

Is this course cross-listed with another existing course? If so, list course subject and number.
☐ Yes ☒ No

Request to change: (check appropriate box):

☑ Course Number ☐ Title ☐ Course Description

☐ Cross-Listing ☐ Prerequisite ☐ Co-requisite

☐ Grading ☐ Fee

☐ Other

NOTES: These changes will become effective in the Summer I Term of the new catalog year. If this course is cross-listed, a prerequisite/co-requisite, or included in the course description of other courses, a Course Change must be submitted to address all changes in related courses.

New Course Number: (e.g., 1003)

4163

New Official Catalog Title: (If official title exceeds 30 characters, indicate Banner Title below)

Banner Title: (limited to 30 characters, including spaces, capitalize all letters - this will display on the transcript)

New Course Description:

New Cross List:

☐ Adding Cross-Listing ☐ Changing Cross-Listing ☐ Deleting Cross-Listing

If adding or changing cross-listing, indicate course subject and number

New Prerequisite (list all, as you want them to appear in the catalog):

New Co-requisite (list all, as you want them to appear in the catalog):

☐ Elective ☐ Major ☐ Minor

(If major or minor course, you must complete the Request for Program Change form to add course to program.)

Answer the following Assessment questions:

a. If this course is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.

Not applicable

b. If this course is required for the major or minor, complete the following.

a. Provide the program level learning outcome(s) it addresses.

Demonstrate understanding of the fundamentals of probability and statistical theory

b. Provide tool or measure directly linked to each program learning outcome. (How will student learning in this outcome be measured?)

Homework assignments, tests

c. What is the rationale for adding this course? What evidence supports this action?

The course number is changed from STAT 4263 to STAT 4163. STAT 4163 Mathematical Statistics is a core course of the Applied Statistics program. The course is an introductory

course in mathematical statistics. This course is needed to provide the students background knowledge in probability and statistical theory.

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

ARKANSAS TECH UNIVERSITY

RECEIVED
JUN 27 2019
Registrar's Office

REQUEST FOR PROGRAM CHANGE

Department Initiating Proposal	Date
Mathematics	**06/28/2019**

Title	Signature	Date
Department Head	Jeffrey L. Myers	6/26/19
Dean	Jeffrey W. Roth	2019 Jun 26
Assessment		6/28/19
Registrar	Tammy Williams	7/2/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Program Title:
Mathematics

Outline change in program: (e.g., list changes in program such as (1) delete three hours of elective and (2) add three hours of approved major electives)

Delete TECH 1001; add MATH 1001 Orientation to Mathematics

What impact will the change have on staffing, on other programs and space allocation?

No expected changes to staffing, other programs or space allocation.

Answer the following Assessment questions:

a. How does the program change align with the university mission?

The mission statement for Arkansas Tech states that the university is dedicated to student success, access, and excellence as a responsive campus community providing opportunities for progressive intellectual development and civic engagement. Embracing and expanding upon its technological traditions, Tech inspires and empowers members of the community to achieve their goals while striving for the betterment of Arkansas, the nation, and the world. As part of the "responsive campus community" of the university our mathematics department takes seriously the retention and success rates of our mathematics students. We believe that the program changes outlined in this form are reflective of our department's dedication to "student success, access and excellence" and will provide further opportunities for "progressive intellectual development" for our program's majors.

b. If this change in the program is mandated by an accrediting or certifying agency, include the directive. If not, state not applicable.
NA

c. What is the rationale for this program change?

1. How will the program change impact learning for students enrolled in this program?

The replacement of TECH 1001 with MATH 1001 will allow for greater and timelier interactions between our faculty and our mathematics majors with the dual aims of 1) improving retention and 2) increasing the 4-year graduation rate in mathematics program.

2. Provide an example or examples of student learning assessment evidence which supports the changes in the program.

Our department used the Sankey Diagram generator to track the movement of freshman entering the mathematics program over the course of 8 terms.

Semester Entered	Freshman Enrolled in Program	Candidates graduating the Program in 8 terms	Number of candidates lost in the 1st semester	Number of candidates lost in the 2nd semester
Fall 2012	2	1	0	0
Fall 2013	3	1	0	2

Fall 2014	3	1	0	0
Fall 2015	4	1	0	2

MATH 1001 Orientation to Mathematics will be structured so as to foster early and meaningful interactions between mathematics faculty and mathematics students – providing detailed program guidelines, expectations, and resources. It is our expectation that the early access to our mathematics majors provided by the proposed course will 1) improve retention for the program (see table) and 2) increase our program's 4-year graduation rate (since the Fall of 2012 our program's 4-year graduation rate has averaged about 33%).

b. How does this program fit in the current state of the discipline? Include Arkansas institutional comparisons. If Arkansas educational institutions do not have the course or program provide comparative examples from regional educational institutions.

Many departments on campus have their own departmental version of TECH 1001.

c. Attach a detailed assessment plan including three to five specific program student learning outcomes, means or instructional measures to assess each outcome, identify program courses where learning will be assessed, and performance standards or criteria for success which demonstrate student learning for each outcome. (Examples for assessment plans/curriculum mapping can be found at the Office of Assessment and Institutional Effectiveness web page.)

The PLO's are the same as the current mathematics program. Assessment/Curriculum mapping is attached.

If this course will affect other departments, a Departmental Support Form for each affected department must be attached. The form is located on the Curriculum forms web page at http://www.atu.edu/registrar/curriculum_forms.php.

In the attached matrix, include requested changes in the matrix and include course number and title.

Curriculum Matrix for Catalog Curriculum in Mathematics for Teacher Licensure (enter title for program changing)	
Freshman Fall Semester Add/Change: **MATH 1001 Orientation to Mathematics 1** Delete: **TECH 1001 Orientation to the University 1** Total Hours: **15**	Freshman Spring Semester Add/Change: Delete: Total Hours: **15**
Sophomore Fall Semester Add/Change: Delete:	Sophomore Spring Semester Add/Change: Delete:

Total Hours: **15**	Total Hours: **15**
Junior Fall Semester Add/Change: Delete: Total Hours: **15**	Junior Spring Semester Add/Change: Delete: Total Hours: **15**
Senior Fall Semester Add/Change: Delete: Total Hours: **15**	Senior Spring Semester Add/Change: Delete: Total Hours: **15**

B.S. in Mathematics Program Review Program Learning Outcomes/Assessment Mapping

2018-2020

Directions: Please indicate in each column which courses introduce the PLO (mark with "I", which reinforce it (needs 2 reinforcements mark with "R"), and which courses the mastery of the PLO is assessed "M".

PLOs/Assessment

PLOs	1. Students will have sufficient knowledge of mathematics and critical thinking/reasoning skills to be successful in the area below: a. Graduate degree in mathematics or related area	1. Students will have sufficient knowledge of mathematics and critical thinking/reasoning skills to be successful in the areas below: b.Working career in industry	2. Students will be able to effectively read, verbalize, understand and write mathematics and mathematical proofs.	3. Students will be able to identify and use appropriate technology and modeling methods to solve problems that arise in mathematics and other related disciplines.
COURSES				
Math 2914 Calculus I	**I** Test/Assignment/Problem: Grades			**I** Test/Assignment/Problem: Grades
Math 2924 Caculus II	**R** Test/Assignment/Problem: Grades			**R** Test/Assignment/Problem: Grades
Math 2703 Discrete Mathematics	**R** Test/Assignment/Problem: Grades	**I** Test/Assignment/Problem: Grades	**I** Test/Assignment/Problem: Grades	
Math 2934 Calculus III	**R** Test/Assignment/Problem:	**R** Test/Assignment/Problem:		**R** Test/Assignment/Problem:

	Grades	Grades		Grades
Math 3003 Foundations of Number Systems	**R** Test/Assignment/Problem: Grades		**R** Test/Assignment/Problem: Grades	
Math 3243 Differential Equations	**R** Test/Assignment/Problem: Grades	**R** Test/Assignment/Problem: Grades		**R** Test/Assignment/Problem: Grades
Math 3153 Applied Statistics I	**R** Test/Assignment/Problem: Grades	**R** Test/Assignment/Problem: Grades		**R** Test/Assignment/Problem: Grades
Math 4003 Linear Algebra	**R** Test/Assignment/Problem: Grades	**R** Test/Assignment/Problem: Grades		**R** Test/Assignment/Problem: Grades
Math 3203 Introduction to Analysis	**M** Test/Assignment/Problem: Grades		**M** Test/Assignment/Problem: Grades	
Math 4123 Mathematical Modeling	**R** Test/Assignment/Problem: Grades	**M** Test/Assignment/Problem: Grades		**M** Test/Assignment/Problem: Grades
Math 4033 Abstract Algebra	**M** Test/Assignment/Problem: Grades		**M** Test/Assignment/Problem: Grades	
Math 4971 Senior Seminar	**M** Scores	**M** Scores		

Arkansas Tech University
DEPARTMENTAL SUPPORT FORM

This form must be completed for every department affected by the course change.

Department Affected:	This department ☒ supports ☐ does not support the change.
College Student Personnel	

Comments:

The mathematics department is deleting TECH 1001 Orientation to the University and replacing it with MATH 1001 Orientation to Mathematics in both our Mathematics and Mathematics for Teacher Licensure programs. This is a similar change to other departments who have moved orientation to their departments for retention purposes.

Department Head Signature: _____

Date: 6/26/19

ARKANSAS TECH UNIVERSITY

PROPOSAL FOR NEW PROGRAM
(Associate, Bachelor, Master's, or Doctoral Degrees)

Department Initiating Proposal	Date
Department of Mathematics	7/1/19

Title	Signature	Date
Department Head	Jeanie L. Myers	7/1/19
Dean	Jeff W. Rath	2019 July 1
Assessment	[illegible]	7/1/19
Registrar	Tammy Weaver	7/24/19
Graduate Dean (Graduate Proposals Only)		
Vice President for Academic Affairs		

Committee	Approval Date
General Education Committee (Undergraduate Proposals Only)	
Teacher Education Committee (Graduate or Undergraduate Proposals)	
Curriculum Committee (Undergraduate Proposals Only)	
Faculty Senate (Undergraduate Proposals Only)	
Graduate Council (Graduate Proposals Only)	

Program Title:
Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

RECEIVED

JUN 27 2019

Registrar's Office

LETTER OF INTENT – 1
(New Certificate or Degree Program)

1. Institution submitting request:
   Arkansas Tech University

2. Education Program Contact person/title:

   Dr. Jeanine Myers
   Head, Department of Mathematics & Statistics
   Arkansas Tech University

3. Telephone number/e-mail address:
   jmyers32@atu.edu
   479.968.0659

4. Proposed Name of Certificate or Degree Program:
   Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

5. Proposed Effective Date:
   Summer 2020

6. Requested CIP Code:
   27.0599

7. Program Description:

Demand for professionals with strong quantitative analytical skills is not new, but recent changes in the economy and the growing reliance of our businesses and governments on data have created an even greater need for workers who can manage data, produce informative visualizations of data, and are guided by fundamental statistical principles. The curriculum in Applied Statistics is tailored to professionals who may be working with data and statistics in any industry including natural resources, environmental agencies, non-profit organizations, healthcare, insurance, business and finance, or any industry where the analysis of data research results is required. The Applied Statistics degree includes courses in mathematical theory, statistical modeling, computer programing, economics, and business analytics.

8. Mode of Delivery (mark all that apply):

___x__**On-Campus**

_____**Off-Campus Location**
Provide address of off-campus location_____
_____

Provide a copy of the e-mail notification to other institutions in the state notifying them of the proposed program. Please inform institutions not to send the response to **"Reply All"**. If you receive an objection/concern(s) from an institution, reply to the institution and copy ADHE on the email. That institution should respond and copy ADHE. If the objection/concern(s) cannot be resolved, ADHE may intervene.

Submit copy of written notification to Higher Learning Commission (HLC) if notification required by HLC for a program offered at an off-campus location.

_____Indicate distance of proposed site from main campus.

_____**Distance Technology** (50% of program offered by distance technology)

Submit copy of written notification to HLC if notification is required by HLC for a program offered by distance technology.

9. List existing certificate or degree programs that support the proposed program:

Mathematics
Business Administration
Business Data Analytics
Economics
Accounting
General Education
Computer Science

10. President/Chancellor Approval Date:

11. Academic Affairs Officer: Date:

Jeff Robertson

From: Jeff Robertson
Sent: Tuesday, June 18, 2019 2:28 PM
To: caos4-year@adhe.edu
Cc: Jeff Robertson
Subject: Proposed program

Notifications and Responses

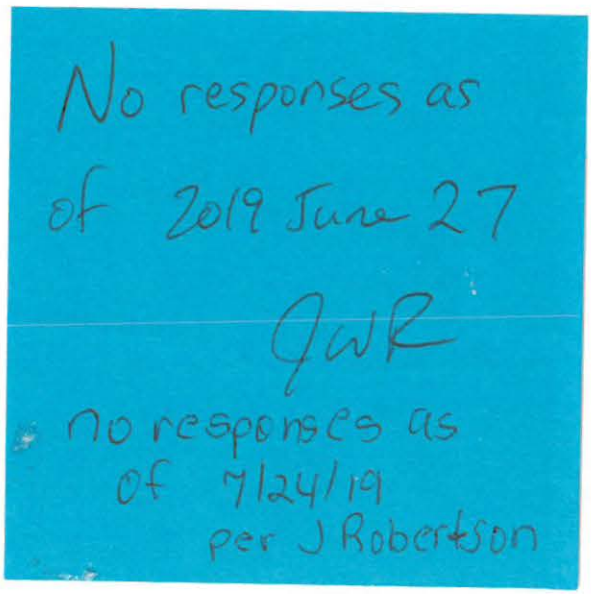
Notification

This email is notification that Arkansas Tech University will propose offering a Bachelor of Science in Applied Statistics with Actuary Science Option or Computer Science Option effective Summer 2020 and is interested in receiving comments or feedback about the program. This program will be offered in a campus-based format and is oriented toward preparing students to be data analysts. ***The Applied Statistics degree with actuarial science option includes courses in mathematics, data analysis, statistical software, business data analytics, economics, accounting, actuarial probability, financial mathematics, upper level electives in both statistics and mathematics, and an internship/capstone project. The Applied Statistics degree with computer science option includes courses in mathematics, data analysis, statistical software, experimental and modeling design, categorical analysis, computer programming, data structures, upper level electives in both statistics and computer science, and an internship/capstone project.*** *The program, orientation and format are in response to student and employer demand.* ***We respectfully request your support for this proposal.***

Please email any responses to Dr. Jeff Robertson at jrobertson@atu.edu
Thank you for your time and consideration.

Sincerely,

Jeff Robertson, Ph.D.
Dean, College of Natural & Health Sciences
Interim Dean of the Graduate College
Arkansas Tech University
1701 N. Boulder Ave.
Russellville, AR 72801
479.964.0548



Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

ADHE New Program Proposal

Table of Contents

Proposed Program Title 4
CIP Code Requested 4
Proposed Starting Date 4
Contact Persons 4
Program Summary 4
Support Programs 5
Need for the Program 6
Employer Needs Survey and Support Letter 6
Employer Tuition Assistance 14
Need the Proposed Program Addresses 14
Employer Contact 14
Composition of Advisory Committee 14
Student Feedback Survey 15
Projected Graduates 16
Curriculum 16
Newly Added Courses Information 19
General Education, Core and Major Courses 31
New Course Delivery Method 32
Number of Contact Hours for Internship/Clinical courses 32
Admission Requirements 32
Specified Learning Outcomes/Course Examination Procedures 33
Blank Student Evaluation Form for Faculty 37
Course Content Comments from Employers 44
Institutional Curriculum Committee Review/Approval Date 44
Faculty 44
Lead Faculty Member 45
Number of Faculty Required for Implementation 45
Proposed Graduate Program 45
Description of Resources 46
New Program Costs/Expenditures for first 3 years 47

Source of Program Funding 47
Projected Enrollment 48
State General Revenue 48
Tuition and Fees 2018-2019 48
Expense to Student (for 3 Hours) 51
Faculty Expense to Deliver 3 Hours of Instruction 51
University Revenue for 3 Hours 51
Organizational Chart 52
Specialized Requirements 52
Licensure/Certification Requirements 52
Documentation Review/Approvals 52
Board of Trustees Approval 52
Similar Programs 53
Current Undergraduate Programs in the US 53
Current Master's Programs in the US 53
Similar Programs Offered in Arkansas 54
Similar Programs that Proposed Degree Models 54
Email Notifications Sent to 4 year Universities 54
Desegregation 56
MOU (Memorandum of Understanding) 56
Academic Program Review 56
Instruction by Distance Education 57
Institutional Policies 57
Occupational Employment Evidence 58
Departmental Support 73
Marketing Plan ..... ~~78~~ 79

PROPOSAL – 1
NEW DEGREE PROGRAM
BS Applied Statistics

PROPOSED PROGRAM TITLE
Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

CIP CODE REQUESTED
27.0599

PROPOSED STARTING DATE
Summer 2020

CONTACT PERSONS
Dr. Barbara J. Johnson
VP of Academic Affairs
Arkansas Tech University
bjohnson@atu.edu
479.968.0319

Dr. Jeanine Myers
Head, Department of Mathematics & Statistics
Arkansas Tech University
jmyers32@atu.edu
479.968.0659

PROGRAM SUMMARY
Program Summary: (Include general description of program with overview of any curriculum additions or modifications, proposed cost, faculty resources, library resources, facilities and equipment, purpose, and any other important information)

Demand for professionals with strong quantitative analytical skills is not new, but recent changes in the economy and the growing reliance of our businesses and governments on data have created an even greater need for workers who can manage data, produce informative visualizations of data, and are guided by fundamental statistical principles.

The curriculum in Applied Statistics is tailored to professionals who may be working with data and statistics in any industry including natural resources, environmental agencies, non-profit organizations, healthcare, insurance, business and finance, or

any industry where the analysis of data research results is required. The Applied Statistics degree includes courses in mathematical theory, statistical modeling, computer programing, economics, and business analytics.

Applied statistics with actuarial science option graduates will be able to:
** use mathematics, statistics, and financial theory to study the uncertainty of events.*
** analyze the financial consequences of risk.*
** evaluate the likelihood of future events & reduce the likelihood of undesirable events.*
** decrease the impact of undesirable events that do occur.*
** manage financial risk for an organization.*
** communicate concisely with other team members or the clients.*

Applied statistics with computer science option graduates will be able to:
** gather, view and analyze information to meet an organization's needs.*
** create visualizations and dashboards to help the team interpret the data collected.*
** measure and statistically analyze data.*
** translate data into digestible and accessible information.*
** communicate the findings to help make business decisions.*

The proposed major will require ten new courses:
STAT 2303 Statistical Methods
STAT 3113 Regression Analysis
STAT 3183 Statistical Process Control
STAT 3203 Actuarial Probability I
STAT 3213 Actuarial Probability II
STAT 4113 Categorical Data Analysis
STAT 4153 Experimental Design and Analysis
STAT 4283 Financial Mathematics I
STAT 4293 Financial Mathematics II
STAT 4393 Statistical Learning

The only cost that is associated with this new program is in creating designated statistics faculty. We already have an assistant professor of statistics, an associate professor of statistics without any extra salary cost, and will need an instructor of statistics position which can result from converting an instructor of mathematics position with an increase in salary cost of at most $7,750 according to CUPA numbers. There is no additional library resources or facilities and equipment required for this degree.

List degree programs or emphasis areas currently offered at the institution that support the proposed program.

Mathematics

Business Administration
Business Data Analytics
Economics
Accounting
General Education
Computer Science

NEED FOR THE PROGRAM

Demand for professionals with data analyzing skills are rapidly increasing. According to the well-known job site, Indeed.com, since December 2013, data science postings have rocketed 256%. Nearly all data scientists have some training in statistical modelling and machine learning, as well as programming.

https://www.hiringlab.org/2019/01/17/data-scientist-job-outlook/

The U. S. Bureau of Labor Statistics includes information that the applied statistics related occupations, e.g. Actuaries, Applied Statisticians, Operations Research Analysts, are all rapidly increasing in employment, much faster than the average.

https://www.bls.gov/ooh/math/home.htm

Bureau of Labor Statistics May 2018 State Occupational Employment and Wage Estimates for Arkansas also shows the same trends.

http://www.bls.gov/oes/current/oes_ar.htm

(See Occupational Employment Evidence in Appendix A)

Employer Needs Survey / Letter of Support

Letters of support should address the following when relevant: the number of current/anticipated job vacancies, whether the degree is desired or required for advancement, the increase in wages projected based on additional education, etc.

Employer Needs Survey Form

Date May 10, 2019 Institution_Arkansas Tech University__

Return this survey by email to contact Dr. Jeanine Myers (jmyers32@atu.edu) by date June 1, 2019
(Institution provide email address above)

Proposed Degree Program BS in Applied Statistics with Actuarial Science Option or Computer Science Option

Brief description of the program The Bachelor's level applied statistics program will be offered to meet the growing demand for professionals with data analytics skills statewide and nationwide. The program will be committed to providing training on mathematical theory, statistical modeling, and offering hands-on experience in analyzing data through popular statistical analysis software. The interdisciplinary nature of the program could prepare students to diversify their data analytics skill sets and to work across industries. Graduates could work as data analysts, corporate statisticians, or SPC specialists in the industry. The actuarial science related courses can prepare the potential actuaries the critical things for an actuarial career.

Employer Arkansas Economic Development Commission Type of company State Government
Contact Person Phil Plyler Position Title Manager of Client Services
Email pplyler@arkansasedc.com Telephone number 501-683-4410

1. List job titles with your company that require employees to have the knowledge and skills obtained from the proposed degree program___Research Analyst, Director of Research
2. List the degree required for each job title listed in #1_BS/BA_____
3. Indicate the certification/licensure required for each job title listed in #1___none_____
4. How many positions do you currently have for each job title listed in #1? ____four_____
5. How many position openings do you currently have for each job title listed in #1? __two_____
6. How many position openings will you have the next 2-5 years for each job title listed in #1?___two-four
7. What is the annual salary for each position listed in #4 & #5? ____$56,547 to $64,311_____
8. If no opening now, when do you anticipate having openings for the positions listed in #1?_____
9. Would you give hiring preference to applicants with the proposed degree? _probably_____
10. Indicate the number of employees who would benefit from enrolling in selected coursework in the proposed degree program? _____six_____ If yes, would you provide tuition assistance?___no_____
11. Would it be helpful for your employees if the courses were offered online/distance technology, evenings or weekends? _____yes_____ Indicate your preference_____online/distance_____
12. Indicate the type of support your company will provide for the proposed degree program, such as, program start-up funds, provide an internship site, part-time faculty, tuition reimbursement, employee release time, or equipment? _____none (maybe internship in future)_____
13. Will you or a co-worker serve on the institution's program advisory committee? _____yes_____
(provide name of employee & email)
14. Indicate the skills individuals would need for employment in the positions listed in #1.

X Interpersonal communications	___Supervision/Management	___Budgeting
X Written/oral communications	___Leadership/initiative	X Data analysis
X Team work	X Planning/Organizing	___Public Speaking
X Independent worker	___Conflict resolution	___Marketing
X Analytical reasoning	X Problem solver	___Teacher/Trainer
___Computer programming	X Computer applications	X PowerPoint presentations

X Foreign language (specify) not required but helpful (Spanish, German, Japanese, Chinese, French
___Other skills not listed (identify) _____

15. How will this proposed degree program benefit your local community, the state, region or nation? Economic Development at the state level is becoming more competitive, and analytical research is critical to our mission. Having staff with a background including this degree would strengthen our position in recruiting and retaining industry. Also, many of the manufacturers in the state that my group interacts with daily are seeking candidates with strong analytical skills. Some of these companies would be well served by candidates with this type of degree.

16. Provide any additional comments about the proposed degree program. Appears to be a rigorous program. The inclusion of economics and accounting makes sense. From personal experience, many graduates of traditional engineering programs would have benefited at all levels of their careers from more undergraduate exposure to statistics and accounting than from their 3000-4000 level engineering electives. This degree program could prepare candidates for some of the many positions in industry that are currently filled or attempting to be filled by engineering grads.

Employer Needs Survey Form

Date_____ Institution_____

Return this survey by email to_____by date _____
(Institution provide email address above)

Proposed Degree Program BS in Applied Statistics with Actuarial Science Option or Computer Science Option

Brief description of the program The Bachelor's level applied statistics program will be offered to meet the growing demand for professionals with data analytics skills statewide and nationwide. The program will be committed to providing training on mathematical theory, statistical modeling, and offering hands-on experience in analyzing data through popular statistical analysis software. The interdisciplinary nature of the program could prepare students to diversify their data analytics skill sets and to work across industries. Graduates could work as data analysts, corporate statisticians, or SPC specialists in the industry. The actuarial science related courses can prepare the potential actuaries the critical things for an actuarial career.

Employer Arkansas Electric Coop Type of company Utility
Contact Person Melissa Dunn Position Title Mgr - Employee Relations
Email Melissa.Dunn@aecc.com Telephone number 501-570-2283

1. List job titles with your company that require employees to have the knowledge and skills obtained from the proposed degree program Various Engineer Analyst level I-SR
2. List the degree required for each job title listed in #1 math, physics or related
3. Indicate the certification/licensure required for each job title listed in #1 N/A
4. How many positions do you currently have for each job title listed in #1? 1
5. How many position openings do you currently have for each job title listed in #1? 1
6. How many position openings will you have the next 2-5 years for each job title listed in #1? 8-10
7. What is the annual salary for each position listed in #4 & #5? $51,000 - $87,000
8. If no opening now, when do you anticipate having openings for the positions listed in #1? 6-12 mos.
9. Would you give hiring preference to applicants with the proposed degree? yes, pending other min. quals.
10. Indicate the number of employees who would benefit from enrolling in selected coursework in the proposed degree program? N/A If yes, would you provide tuition assistance? yes, if required.
11. Would it be helpful for your employees if the courses were offered online/distance technology, evenings or weekends? yes Indicate your preference ——
12. Indicate the type of support your company will provide for the proposed degree program, such as, program start-up funds, provide an internship site, part-time faculty, tuition reimbursement, employee release time, or equipment? _____
13. Will you or a co-worker serve on the institution's program advisory committee? N/A
(provide name of employee & email)
14. Indicate the skills individuals would need for employment in the positions listed in #1.

✓ Interpersonal communications	___ Supervision/Management	___ Budgeting
✓ Written/oral communications	✓ Leadership/initiative	✓ Data analysis
✓ Team work	✓ Planning/Organizing	✓ Public Speaking
✓ Independent worker	___ Conflict resolution	___ Marketing
✓ Analytical reasoning	✓ Problem solver	___ Teacher/Trainer
___ Computer programming	✓ Computer applications	✓ PowerPoint presentations

___ Foreign language (specify) _____
✓ Other skills not listed (identify) Strong analytical skills

15. How will this proposed degree program benefit your local community, the state, region or nation?
Analyst positions are experiencing retirement bubble. Strong math or related skills are needed in power/utility industry.
16. Provide any additional comments about the proposed degree program.

From: **Tim Hicks <tim.hicks@ozk.com>**
Sent: **Thursday, May 30, 2019 11:33 AM**
To: **Jeanine Myers <jmyers32@atu.edu>**
Cc: **Rick Massengale <rmassengale@atu.edu>**
Subject: **RE: Your input on the new Arkansas Tech University - Applied Statistics Degree**

EXTERNAL SENDER. Only open links and attachments from known senders. DO NOT provide your username or password.

Dr. Myers,

I requested the head of our ERM – Analytics & Reporting team to provide his feedback on the program document. His comments are below. He would be happy to discuss those on the phone with you if you would like. I have not had time to complete the survey, but we have numerous positions that would benefit from an applied statistics degree. I am attaching a list of some of those job descriptions and the number of current employees. None of the Bank OZK job descriptions lists having a degree in statistics as a single requirement; it is usually combined with other education requirements or preferences. We would expect to continue to hire additional positions over the next several years. I hope this information is helpful, let me know if you need anything else.

Please see below my brief feedback for the program document:

Bachelor of Science in Applied Statistics with Actuarial Science Option

- **It would be better to have Linear Algebra before Discrete Math as Linear Algebra would be required for Statistics related courses**
- **R and/or Python is a must for all Applied Statistics courses**

Bachelor of Science in Applied Statistics with Computer Science Option

- **Instead of focusing on Computer Science (e.g. compilers etc.), the focus should be on learning basic concepts of programming and letting students use R/Python as a tool for all Statistics classes. This would enable the students to have a more experiential learning environment.**
- **Using industry data to create case studies for students (https://www.forbes.com/sites/bernardmarr/2016/02/12/big-data-35-brilliant-and-free-data-sources-for-2016/#87f3dacb54db)**

Overall the programs have been well designed and seem to meet industry standards. I'd also be happy to participate on a quick phone call if that is desired by our partners at ATU.

Best Regards,
Arindam

Arindam Majumdar
Director of Enterprise Risk Management, Analytics and Reporting
17901 Chenal Parkway, Little Rock, AR 72223
O: 501-906-7825 | M: 319-471-7432 | IP: 100-7825
arindam.majumdar@ozk.com
ozk.com

Tim Hicks
Chief Administrative Officer/Executive Director of IR
17901 Chenal Parkway, Little Rock, AR 72223
O: 501-978-2336
tim.hicks@ozk.com
ozk.com

The email attachment:

	A	B	C	D
1	Job Descriptions that Include Statistic	Current Employee Count	Division	Group
2	Deposit Analytics Manager	1	Corporate	Community Banking
3	Business IntelligenceOfcr	2	Corporate	Credit Review
4	Dep Dir DataAnlytcs&Innov	1	Corporate	Credit Review
5	Quantitative Risk Modeler	7	Corporate	Credit Risk Management
6	ERM Analyst	1	Corporate	CRMG Enterprise Risk Mgmt
7	Macro Risk Analyst	1	Corporate	CRMG Enterprise Risk Mgmt
8	Business Risk Officer	2	Corporate	Human Resources
9	HR Payroll & Ops Analyst	1	Corporate	Human Resources
10	SrQuantitativeRiskModeler	3	Corporate	Quantitative Risk Mgmt
11	Business Risk Ofcr - IT	1	IT/Operations	IT
12	Bus Risk OfcrII-LoanAdmin	1	IT/Operations	Loan Admin
13	Dir MachineLearnProdInnov	1	IT/Operations	IT
14	VP Business Risk Officer	1	IT/Operations	IT
15	CommConstrMonitoringOfcr	2	Lending	Central Credit Services
16	Loan MonitoringSpecialist	2	Lending	Central Credit Services
17	Portfolio Analytics Ofcr	1	Lending	Central Credit Services
18	Bus RiskOfcrII-CommBnkLnd	1	Lending	Community Banking
19	Bus RskOfcr II-CommBnkLnd	1	Lending	Community Banking
20	SrCreditDataAnalyticsOfcr	1	Lending	Portfolio Risk Mgmt
21	Data Analytics Analyst	2	Operations	Banking Systems
22	SVP Retail Opns Support	1	Operations	ROS Item Processing
23	Bus RiskOfcrII-Operations	1	Operations	ROS New Account Verificat
24	BusRskOfcrII-DigSvc&CaCtr	1	Operations	ROS New Account Verificat
25	Business Risk Ofcr II T&W	1	Trust and Wealth	Trust
26				
27	*No Bank OZK job description lists having a degree in statistics as a single requirement. It is usually combined with other education requirements or preferences.*			

From: Mike.Parker@FalconJet.com <Mike.Parker@FalconJet.com>
Sent: Wednesday, May 8, 2019 3:20 PM
To: Rick Massengale <rmassengale@atu.edu>
Subject: RE: Your input on the new Arkansas Tech University - Applied Statistics Degree

EXTERNAL SENDER. Only open links and attachments from known senders. DO NOT provide your username or password.

Hi Rick,
It's great to hear from you. It may be a coincidence (or higher-power), but I am in the process of filling two new positions where the applicants certainly would have benefited from this curriculum. I will forward this to our HR department so you have a company-level response. I can tell you first-hand these skills are critical. Good luck with this program!

Best regards,

Mike Parker
Sr. Manager – Materials Demand Planning
Dassault Falcon Jet

Office:.....+ 1 501 301 2858
Mobile:.....+ 1 501 837 2151

Little Rock National Airport
3801 East 10th Street
Little Rock, Arkansas 72202
USA

www.dassaultfalcon.com

From: Barry Crane <Barry.Crane@acxiom.com>
Sent: Tuesday, May 14, 2019 2:04 PM
To: Jeanine Myers <jmyers32@atu.edu>
Subject: RE: Help with ATU Stats Proposal.

EXTERNAL SENDER. Only open links and attachments from known senders. DO NOT provide your username or password.

Jeanine,

I have forwarded this email to one of recruiters who I think can help with the survey better than I could.

I looked over the curriculum plan and do have a couple of questions. Are you including any course work that would teach the students to use analytical or statistical tools? A lot of the companies that Acxiom works with use SAS or R. Without some introduction to these tools students will be less equipped to be employed by these types of companies. Based on my experience the ideal situation would be to include use of these tools in conjunction with a database. To really give the them a leg up I would suggest some experience with Hadoop. Right now this is a plus, but the days are coming very quickly where this will be the norm for larger companies. This would help prepare the students for Data Scientist roles.

I hope this helps.

Barry

From: Jami Paul <jpaul@misoenergy.org>
Sent: Wednesday, May 29, 2019 11:53 AM
To: Rick Massengale <rmassengale@atu.edu>; Jeanine Myers <jmyers32@atu.edu>
Subject: FW: [EXT] Your input on the new Arkansas Tech University - Applied Statistics Degree

EXTERNAL SENDER. Only open links and attachments from known senders. DO NOT provide your username or password.

Thank you for the opportunity to respond to this survey, however, we are not able to answer line by line, so instead, we have compiled a summary of how we might find this degree helpful.

MISO does not currently have any jobs that require a BS in applied statistics. That said, we have multiple positions in which this background and or degree may be helpful. We hire many individuals on an annual basis that have a computer science degree.
The following are just a few of the jobs that we have recently filled with computer science candidates;

- Software Developer
- Data Governance Analysts
- System Engineers
- Database Analysts
- Database Administrators
- Business Analysts

We have no way of predicting how many of these jobs will be open in the next two to five years but on average we probably hire 25+ individuals annually with degrees in computer science or Information technology with a starting salary of approximately $72,000.
Please note, none of these positions are currently located in our Little Rock facility.
Since we operate as a non-profit, we are not able to offer any financial support for this program.

All of our full time openings as well as our internships are posted on our website at MISOenergy.org.

Please feel free to reach out to clarify any information in this email and again, thank you for allowing us to participate.

Regards,

Jami C. Paul, SPHR
Human Resource Business Partner

From: **Smith, Linda K (HR) <Linda.Smith3@Mercy.Net>**
Sent: **Thursday, May 9, 2019 11:35 AM**
To: **Jeanine Myers <jmyers32@atu.edu>**
Subject: **Bachelor's Degree in Applied Statistics**
EXTERNAL SENDER. Only open links and attachments from known senders. DO NOT provide your username or password.

Dr. Myers,

Rick Massengale had sent the request to our Executive Director of HR, Bryan Brown for us to complete an Employer Needs Survey Form for your new upcoming degree program. This is a very exciting new degree that I think is a wonderful option for students in this area. I started to work on the survey form but the answers that I would have to give you as it relates to Mercy here in Fort Smith would not be helpful to what you are trying to do. Most of the positions that would utilize the skills gained through this particular degree program are not based out of Fort Smith but would likely be in the Shared Services area of the Mercy Ministry Office in St. Louis. The bulk of our openings are clinical openings such as nursing and other medical related type fields.

I do think there are many businesses and organizations that would utilize employees with this degree program maybe in banking, finance/accounting, manufacturing, insurance, transportation, etc.

Please do not hesitate to let me know if you have any questions or how I can assist you further.

Warmest regards,

Linda K. Smith, PHR
Senior HR Manager

Mercy
2901 South 74th Street| Fort Smith, AR 72903
Office: 479-314-4706 | Fax: 479-314-1122
linda.smith3@mercy.net

HR Purpose Statement
It is our deep abiding conviction to cultivate a mission culture which honors diversity, inclusion, dignity, and justice, while unleashing and enriching each person's God-given gifts and talents; providing all who serve in Mercy an environment to fully live out their individual calling.

This e-mail contains information which (a) may be PROPRIETARY IN NATURE OR OTHERWISE PROTECTED BY LAW FROM DISCLOSURE, and (b) is intended only for the use of the addressee (s) named above. If you are not the addressee, or the person responsible for delivering this to the addressee (s), you are hereby notified that reading, copying or distributing this e-mail is prohibited. If you have received this e-mail in error, please contact the sender immediately

Mercy is a three-time Watson Health Top 15 Health System (2016-2018)

Find us at:
Facebook | Mercy | theMercyChannel | mercy.net | Mercy Careers

This electronic mail and any attached documents are intended solely for the named addressee(s) and contain confidential information. If you are not an addressee, or responsible for delivering this email to an addressee, you have received this email in error and are notified that reading, copying, or disclosing this email is prohibited. If you received this email in error, immediately reply to the sender and delete the message completely from your computer system.

Indicate if employer tuition assistance is provided or if there are other enrollment incentives.
This varies by employer. However, because of the increasing demand for data analytics expertise, many employers indicate a large number of employees would benefit from enrolling in the program, tuition assistance could be further discussed.

Describe what need the proposed program will address and how the institution became aware of this need.
The Bachelor's Level Applied Statistics program will be offered to meet the growing demand for professionals with data analytics skills statewide. The program will be committed to providing training on mathematical theory, statistical modeling, and offering hands-on experience in analyzing data through popular statistical analysis software. The interdisciplinary nature of the program could prepare students to diversify their data analytics skill sets and to work across industries.

Dr. Jeanine Myers, Department Head of the Mathematics Department at Arkansas Tech University noticed the increased regional demand for bachelor's- and master's-level statistics professionals, which increased 35 percent from H2 2013 to H2 2017. It is expected that the growth for statistics-related occupations will continue. There are also many inquiries from high school students and ATU students about the courses or degree in statistics and actuarial science. Arkansas Tech's Applied Statistics Degree is proposed to meet these needs.

Indicate which employers contacted the institution about offering the proposed program. None

Indicate the composition of the program advisory committee, including the number of members, professional background of members, topics to be considered by the members, meeting schedule (annually, bi-annually, quarterly), institutional representative, etc.

Advisory support has come from the following individuals:
Barry Crane -- Acxiom Corporation, Conway, Arkansas
Arindam Majumdar -- Bank OZK, Little Rock, Arkansas
Phil Plyler -- Arkansas Economic Development Commission, Little Rock, Arkansas
Melissa Dunn -- Arkansas Electric Cooperative Corporation, Little Rock, Arkansas

Mr. Plyer, Mr. Tyler Tuskey from Acxion Corporation, Ms. Shelby Sparkman from Dillard's Inc, Ms. Charlie Chesney from Arkansas Blue Cross and Blue Shield, Mr. Silas Clark from Arkansas Tech University, Mr. Stevie Wells from Arkansas Electric Cooperative Corporation, Mr. Tanner Stewart from MedEvolve, along with Dr. Jeff Robertson, Dean of the College of Natural & Health Sciences at Arkansas Tech, and Dr. Jeanine Myers, Department Head of the Mathematics Department at Arkansas Tech make up the program's Advisory Committee. In preparation of this proposal, the committee provided crucial advice in determining curriculum designs, statistical software requirements, and industry needs. The Advisory Committee will meet at the end of each semester, for a total of two (2) meetings each year to discuss current trends in the marketplace, the essential skillset that the employers look for, as well as possible program modifications and new degrees.

Completed Student Feedback

Student Feedback for Proposed Bachelor of Science in Applied Statistics

- **Summary of feedback from 247 high school students**

Question	Yes	No	Maybe	Blank
1. Do you plan on enrolling at Arkansas Tech University in the future?	31	72	114	30
2. Would you be more likely to enroll at Arkansas Tech if an Applied Statistics major was available?	14	136	71	26
3. Would you be interested in taking some of the courses offered in the Applied Statistics degree?	31	121	95	0
	Actuarial Science Option	**Computer Science Option**	**None**	**Blank**
4. Would you declare Applied Statistics as your major? If yes, which option would you choose?	7	38	198	4

- **Summary of feedback from 299 entering ATU freshmen**

Question	Yes	No	Maybe	Blank
1. Have you declared a major?	250	43		6
2. Would you be interested in taking some of the courses offered in the Applied Statistics degree?	20	161	112	6
	Actuarial Science Option	**Computer Science Option**	**None**	**Blank**
3. Would you declare Applied Statistics as your major? If yes, which option would you choose?	6	38	236	19

Projected Program Enrollments and Graduates
Based on a very conservative estimate of our survey data, we would anticipate a minimum of 20 students entering the program each year for the first three years producing approximately 45 graduates within the next 3-5 years.

CURRICULUM
(New courses in italics)

Bachelor of Science in Applied Statistics with Actuarial Science Option:
Freshman Fall (15 hours)
ENGL 1013 Composition I
MATH 1001 Orientation to Mathematics
MATH 2914 Calculus I
BUAD 2003 Business Info Systems
ECON 2003 Principles of Econ I
Electives[1]

Freshman Spring (16 hours)
ENGL 1023 Composition II
Fine Arts/Humanities
MATH 2924 Calculus II
STAT 2303 Statistical Methods
ECON 2013 Principles of Econ II

Sophomore Fall (16 hours)
STAT 3153 Applied Statistics
MATH 2703 Discrete Math
MATH 2934 Calculus III
ACCT 2003 Accounting Principles I
BDA 2003 Business Problem Solving

Sophomore Spring (16 hours)
STAT 3113 Regression Analysis
MATH 3243 Differential Equations I
COMS 2104 Found. Comp. Prog. I
ACCT 2013 Accounting Principles II
Quantitative Elective[2]

Junior Fall (16 hours)
Fine Arts/Humanities
US History/Government
Science/Lab
STAT 3203 Actuarial Probability I
MATH 4003 Linear Algebra

Junior Spring (16 hours)
Social Science

Science/Lab
STAT 4153 Experimental Design and Analysis
STAT 3213 Actuarial Probability II
Quantitative Elective[2]

Senior Fall (12 hours)
COMM 2173 Business and Prof. Speaking
STAT 4283 Financial Math. I
MATH/STAT Elective[3]
Electives[1]

Senior Spring (13 hours)
Social Science
STAT 4293 Financial Math. II
MATH 4971 Senior Seminar in Math
MATH/STAT Elective[3]
Electives[1]

Note:
[1] A minimum of 40 credit hours of the 120 total hours required for the B.S. degree must be 3000-4000 level courses.
[2] The quantitative electives must be at the 2000-level or above and may include math, statistics, computer science, business administration, business data analytics, finance, or a course in another area with substantial quantitative content (ask for approval from advisor).
[3] See catalog to assure pre-requisites are met. See advisor to select courses from: *STAT 3183 Statistical Process Control, STAT 4113 Categorical Data Analysis, STAT 4393 Statistical Learning*, MATH 4123 Mathematical Modeling, or a MATH/STAT course at the 3000-4000 level approved by advisor.

Bachelor of Science in Applied Statistics with Computer Science Option:
Freshman Fall (15 hours)
ENGL1013 Composition I
US History/ Government
MATH 1001 Orientation to Mathematics
MATH 2914 Calculus I
BUAD 2003 Business Info Systems
Electives[1]

Freshman Spring (16 hours)
ENGL 1023 Composition II
Fine Arts/ Humanities
STAT 2303 Statistical Methods
MATH 2924 Calculus II
BDA 2003 Bus. Problem Solving

Sophomore Fall (16 hours)
Social Science

MATH 2703 Discrete Math
MATH 2934 Calculus III
STAT 3153 Applied Statistics
Electives[1]

Sophomore Spring (16 hours)
MATH 3243 Differential Equations I
COMS 2104 Found. Computer Prog. I
STAT 3113 Regression Analysis
BDA 3053 Bus. Data Analysis
Electives[1]

Junior Fall (16 hours)
Fine Arts/Humanities
Science/Lab
COMS 2203 Found. Computer Prog. II
MATH 4003 Linear Algebra
STAT 4163 Mathematical Statistics

Junior Spring (16 hours)
Science/Lab
STAT 4153 Experimental Design and Analysis
COMM 2173 Business and Prof. Speaking
COMS 2213 Data Structures
MATH/STAT Elective[2]

Senior Fall (12 hours)
Social Science
STAT 4113 Categorical Data Analysis
COMS Elective[3]
Electives[1]

Senior Spring (13 hours)
MATH 4971 Senior Seminar in Math
COMS Elective[3]
MATH/STAT Elective[2]
Electives[1]

Note:
[1]A minimum of 40 credit hours of the 120 total hours required for the B.S. degree must be 3000-4000 level courses.
[2]See catalog to assure pre-requisites are met. See advisor to select courses from: *STAT 3183 Statistical Process Control, STAT 4393 Statistical Learning,* MATH 4123 Mathematical Modeling, or a MATH/STAT course at the 3000-4000 level approved by advisor.
[3]See catalog to assure pre-requisites are met. See advisor to select courses from: COMS 3233 Database Design and Impl., COMS 3243 Data Mining, COMS 4353 Artificial Intelligence, or a COMS course at the 3000-4000 level approved by advisor.

Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

Newly Added Course Information

All new courses for this degree will initially be offered as a campus-based only.

Course Number	**STAT 2303**
Course Name	**Statistical Methods**
Section	001
Description	The goal of this course is to introduce students to statistical methods for analyzing data. Some of the topics included are: Describing Data, Basic Probability, Random variables, Normal and Binomial Distributions, Sampling Distributions, Confidence Intervals, Hypothesis testing, Correlation and Regression, Contingency table, Comparing two populations, ANOVA. By completing this course, the student will learn to perform the following: 1) How to calculate and apply measures of location and measures of dispersion. 2) How to apply discrete and continuous probability distributions to various business problems. 3) Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values. 5) Compute and interpret the results of Simple Linear Regression and Correlation Analysis, ANOVA and F-test.
Co-Requisite(s)	STAT 2000 Statistical Packages Lab: Introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303.
Prerequisite(s)	MATH 2914 Calculus I
Credit hours	3
Semester offered	Fall, Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics** • **Ms. Kristi Brown - M.S. Statistics**
Distance Ed class	No

Course Number	**STAT 2000**
Course Name	**Statistical Packages Lab**
Section	001
Description	This lab is an introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303. The main point of this lab is to give the student a working start with the covered software SAS and R for the basic statistical analyses from STAT 2303. The student can learn the use of these software in more depth in the subsequent statistical courses. Student can spend a lifetime using and mastering them.
Co-Requisite(s)	STAT 2303 Statistical Methods
Prerequisite(s)	None
Credit hours	0
Semester offered	Fall, Spring
General Education	This course does not satisfy the general education curriculum.
Core	
Major	
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics** • **Ms. Kristi Brown - M.S. Statistics**
Distance Ed class	No

Course Number	**STAT 3113**
Course Name	**Regression Analysis**
Section	001
Description	This course introduces the methods for fitting and interpreting regression models. Topics include simple linear regression (SLR), multiple linear regression (MLR), model checking, variable selection methods, dummy variables, diagnostic measures, logistic regression, and time series analysis. Instruction will include the use of a statistical programming language. After completing this course, the student will be able to: • understand regression model and model assumptions in SLR and MLR; • Use SAS and/or R to get least square estimate, confidence interval, and do hypothesis for the parameters; • do the estimation and prediction by using the linear regression model; • do regression for the data with quantitative, qualitative predictors and both; • do model selection by using SAS and/or R; • check the model assumptions by residual plots and use some basic measures to remedy the model; • apply logistic regression for the dependent variable with two discrete values.
Co-Requisite(s)	None
Prerequisite(s)	An introductory statistics course or permission of instructor
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics** • **Ms. Kristi Brown - M.S. Statistics**
Distance Ed class	No

Course Number	**STAT 3183**
Course Name	**Statistical Process Control**
Section	001
Description	This course is an introduction to statistical process control using Deming's philosophy for the improvement of quality, productivity, and competitive position. After completing this course, the student will be able to: • Collect and analyze data with emphasis on basic concepts of quality control. • Understand the importance of variability in statistical quality control. • Understand the role of statistics in engineering and quality improvement. • To learn various statistical tools of quality monitoring. • To learn the statistical and economical design issues associated with quality control. • To understand and implement various process capability analysis techniques.
Co-Requisite(s)	None
Prerequisite(s)	STAT 3153 Applied Statistics
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics**
Distance Ed class	No

Course Number	**STAT 3203**
Course Name	**Actuarial Probability I**
Section	001
Description	In this course we develop knowledge of the fundamental probability tools for quantitatively assessing risk. The application of these tools to problems encountered in actuarial science is emphasized. A thorough command of the supporting calculus is assumed. A very basic knowledge of insurance and risk management is assumed. Students successfully completing this course should be able to use and apply the following Concepts : • Set functions including set notation and basic elements of probability • Mutually exclusive events • Addition and multiplication rules • Independence of events • Combinatorial probability • Conditional probability • Bayes Theorem / Law of total probability • Commonly used discrete random variables
Co-Requisite(s)	None
Prerequisite(s)	MATH 2934 Calculus III
Credit hours	3
Semester offered	Fall
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Marcel Finan- Ph.D. Actuarial Mathematics**
Distance Ed class	No

Course Number	**STAT 3213**
Course Name	**Actuarial Probability II**
Section	001
Description	This course is a continuation to STAT 3203. At the end of this course, a student is prepared to take Exam P of the Society of Actuaries. Students successfully completing this course should be able to use and apply the following Concepts : • Probability functions and probability density functions Mutually exclusive events • Cumulative distribution functions • Mode, median, percentiles, and moments • Variance and measures of dispersion • Moment generating functions • Transformations • Joint probability functions and joint probability density functions • Joint cumulative distribution functions • Central Limit Theorem • Conditional and marginal probability distributions • Moments for joint, conditional, and marginal probability distributions • Joint moment generating functions • Variance and measures of dispersion for conditional and marginal probability distributions • Covariance and correlation coefficients • Transformations and order statistics • Probabilities and moments for linear combinations of independent random variables
Co-Requisite(s)	None
Prerequisite(s)	STAT 3203 Actuarial Probability I
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Marcel Finan- Ph.D. Actuarial Mathematics**
Distance Ed class	No

Course Number	STAT 4113
Course Name	Categorical Data Analysis
Section	001
Description	Statistical tools to analyze univariate and multivariate categorical responses. Emphasis is given to Generalized Linear Models, including logistic regression and loglinear models. By completing this course the student will be able to perform the following: • Students will be able to select the appropriate statistical methodology for the analysis of categorical data. • Justify the basic theoretical models for categorical data. • Conduct and/or actively participate in the modeling and analyzing of categorical data. • Interpret results from contingency tables or generalized linear models that evaluate relationships between categorical variables • Communicate, both verbally and in writing, results with non-statisticians • Analyze categorical data using statistical software
Co-Requisite(s)	None
Prerequisite(s)	STAT 3113 Regression Analysis
Credit hours	3
Semester offered	Fall
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics** • **Ms. Kristi Brown - M.S. Statistics**
Distance Ed class	No

Course Number	STAT 4153
Course Name	Experimental Design and Analysis
Section	001
Description	This course introduces students to both design and analysis of experiments as well as statistical computing. SAS and JMP will be the primary software for this course. Topics will include basic principles of experimental design, randomization, replication, completely randomized design, randomized blocks, Latin squares, complete and incomplete block designs, factorial design, blocking in factorial design, 2k factorial design, blocking and confounding in 2k factorials, fractional factorial designs, blocking in fractional factorials, experiments with random factors, nested and split-plot designs, analysis of covariance, repeated measures, regression, ANOVA, and follow-up analysis, sample size determination. Other topics may be discussed if time permits. After completing this course, the learner will be able to: • understand the principles, models and strategies commonly used for experimental design; • construct appropriate experiments to effectively address research questions; • use statistical software to correctly analyze data collected from designed experiments and draw appropriate statistical conclusions.
Co-Requisite(s)	None
Prerequisite(s)	An introductory statistics course or permission of instructor
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Scott Jordan – Ph.D. Statistics** • **Dr. Weijia Jia - Ph.D. Statistics** • **Ms. Kristi Brown - M.S. Statistics**
Distance Ed class	No

Course Number	**STAT 4283**
Course Name	**Financial Mathematics I**
Section	001
Description	This is an introductory course in Financial Mathematics. The student will learn about the different types of interest (simple interest, discount interest, compound interest), annuities, debt retirement methods, investing in stocks and bonds. Students successfully completing this course will be able to understand: • and to perform calculations relating to present value, current value, and accumulated value • and to calculate present value, current value, and accumulated value for sequences of non-contingent payments (annuities) • key concepts concerning loans and how to perform related calculations • key concepts concerning bonds, and how to perform related calculations
Co-Requisite(s)	None
Prerequisite(s)	MATH 2914 Calculus I
Credit hours	3
Semester offered	Fall
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Marcel Finan - Ph.D. Actuarial Mathematics**
Distance Ed class	No

Course Number	STAT 4293
Course Name	Financial Mathematics II
Section	001
Description	This is a continuation of STAT 4283. Topics include Loans, bonds, cash flow and portfolios, immunization, derivatives and options. At the end of this course, a student is prepared to take Exam FM of the Society of Actuaries. Students successfully completing this course should be able to understand: • key concepts concerning yield curves, rates of return, and measures of duration and convexity, and how to perform related calculations • key concepts concerning cash flow matching and immunization, and how to perform related calculations • key concepts concerning interest rate swaps, and how to perform related calculations • key concepts concerning the determinants of interest rates, the components of interest, and how to perform related calculations.
Co-Requisite(s)	None
Prerequisite(s)	MATH 4283 Financial Mathematics I
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Marcel Finan - Ph.D. Actuarial Mathematics**
Distance Ed class	No

Course Number	STAT 4393
Course Name	Statistical Learning
Section	001
Description	This course is directed towards advanced undergraduates or master's students in statistics or related quantitative fields. The focus of the course is an accessible overview of the field of

	statistical learning and provide the students with valuable hands-on experience by illustrating how to implement each of the statistical learning methods using R. Topics covered include: Linear Regression, Logistic Regression, Linear Discriminant Analysis, K-Nearest Neighbors, Cross-Validation, Bootstrap, Variable Selection, Shrinkage Methods, Dimension Reduction, Considerations in High Dimensions, Polynomial Regression, Generalized Additive Models, Decision Trees, Bagging, Random Forests, Boosting, Support Vector Machines, Principal Components Analysis, Clustering, and more. After completing this course, the learner will be able to: • Identify supervised (regression, classification) and unsupervised (clustering) learning problems. • Understand the fundamental idea behind statistical learning methods, know the pros and cons of each method. • Understand the limitations of linear models and understand the nonlinear alternatives. • Explain the challenges with high dimensional data and have a basic understanding of linear model selection and regularization. • Formulate a mathematical solution to the real-world problems and implement the statistical learning methods by using statistical computing package.
Co-Requisite(s)	None
Prerequisite(s)	STAT 3113 Regression Analysis
Credit hours	3
Semester offered	Spring
General Education	This course does not satisfy the general education curriculum.
Core	X
Major	X
Courses that satisfy Gen Ed requirements	None
Faculty who can teach this course	• **Dr. Weijia Jia - Ph.D. Statistics** • **Dr. Xinli Xiao - Ph.D. Mathematics**
Distance Ed class	No

Identify required general education courses, core courses and major courses.

General Education Courses

6 hours English
3 hours Mathematics
8 hours science with lab
3 hours US Hist/Gov.
6 hours Social Science
6 hours FAH
3 hours COMMS
---
35 hours total

Bachelor of Science in Applied Statistics with Actuarial Science Option: Core Courses (64hrs)

MATH 2924	Calculus II
MATH 2934	Calculus III
MATH 2703	Discrete Mathematics
MATH 3243	Differential Equations I
MATH 4003	Linear Algebra
MATH 4971	Senior Seminar
BUAD 2003	Business Info Systems
BDA 2003	Bus. Problem Solving
COMS 2104	Found. Computer Prog. I
ECON 2003	Principles of Economics I
ECON 2013	Principles of Economics II
ACCT 2003	Accounting Principles I
ACCT 2013	Accounting Principles II
STAT 2303	Statistical Methods
STAT 3153	Applied Statistics
STAT 3113	Regression Analysis
STAT 3203	Actuarial Probability I
STAT 3213	Actuarial Probability II
STAT 4283	Financial Mathematics I
STAT 4293	Financial Mathematics II
STAT 4153	Experimental Design and Analysis
64 hours	

TOTAL HOURS: 120
MAJOR HOURS: 64
UPPER DIVISION HOURS: 40

Bachelor of Science in Applied Statistics with Computer Science Option: Core Courses (55hrs)

MATH 2924	Calculus II
MATH 2934	Calculus III
MATH 2703	Discrete Mathematics
MATH 3243	Differential Equations I
MATH 4003	Linear Algebra
MATH 4971	Senior Seminar
STAT 2303	Statistical Methods
STAT 3153	Applied Statistics
STAT 3113	Regression Analysis
STAT 4113	Categorical Data Analysis
STAT 4153	Experimental Design and Analysis
STAT 4163	Mathematical Statistics
BUAD 2003	Business Info Systems
BDA 2003	Bus. Problem Solving
BDA 3053	Bus. Data Analysis
COMS 2104	Found. Computer Prog. I
COMS 2203	Found. Computer Prog. II
COMS 2213	Data Structures
55 hours	

TOTAL HOURS: 120
MAJOR HOURS: 55
UPPER DIVISION HOURS: 40

Identify courses currently offered by distance technology (with an asterisk*) and endnote at the end of the document.
All new courses are campus-based only.

Indicate the number of contact hours for internship/clinical courses.
The number of contact hours for the internship will vary according to placement with different employers.

State the program admission requirements.
Program Admission/Requirements (Arkansas Tech University's admission policy)

New students to Arkansas Tech University must submit an application for admission, college entrance exam scores, a record documenting completion of secondary requirements, and proof of immunization documenting 2 MMR. If you have concurrent college credit, an official transcript from that institution is required. For Advanced Placement (AP), College Level Examination Program (CLEP), or International Baccalaureate (IB) credit, original score reports or a certified copy from your high school will need to be submitted prior to credit being awarded. A minimum criterion for exam scores and grade point average is listed below:

1. Composite ACT score of 19 or above, composite SAT score of 990 or above on the RSAT scale of 1600 or a composite SAT score of 1330 on the former SAT exam with a scale of 2400, or a composite Next Generation ACCUPLACER score of 246. Note: The ACT Writing exam is not required for admission purposes.

2. Completion of graduation requirements from a public secondary school, private secondary school, or a home school program documenting a minimum 2.0/4.0 cumulative grade point average, and completion of the university's secondary school core curriculum, OR minimum GED score of 600.

Students who have scored accordingly on an Advanced Placement (AP), College Level Examination Program (CLEP), or International Baccalaureate (IB) can earn credit toward graduation at Arkansas Tech University by receiving a qualifying score on the examinations. These credits can satisfy general education requirements. AP, CLEP, and IB scores should be documented on your application for admission. Submit official score reports or readable copies embossed by your high school to the Office of Admissions. Students who have earned an International Baccalaureate (IB) should submit their IB transcript for evaluation. Students who successfully complete the International Baccalaureate Diploma Programme can earn credit toward graduation at Arkansas Tech University.

Freshmen who do not meet unconditional admission requirements will be conditionally admitted with a minimum composite ACT score of 15, composite SAT score of 830 or above on the RSAT scale of 1600 or a composite SAT score of 1060 on the former SAT exam with a scale of 2400, or a composite Next Generation ACCUPLACER score of 229, and by completing college core with a 2.0/4.0 grade point average or minimum GED score of 600.

Describe specified learning outcomes and course examination procedures.

Arkansas Tech University
Academic Cycle: New Program Proposal
Program: Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

Program Objectives/Standards (align with mission)	Learning Objectives/ Outcome Assessment (3-5 unless otherwise specified)	Courses (program core)	Means of Assessment (direct and indirect measures)	Criteria for Success (performance standard)
PO1: **Have solid background in mathematics, probability, and statistical theory**	LO1: Demonstrate competence with mathematical skills needed for statistics, including calculus foundations, linear algebra, symbolic and abstract thinking LO2: Demonstrate understanding of the fundamentals of probability and statistical theory	MATH 2914, 2924, 2934 – Calculus I-III MATH 4003 – Linear Algebra MATH 2703 – Discrete Math MATH 3243 – Differential Equation STAT 3153 – Applied Statistics STAT 4163 – Mathematical Statistics	Tests, quizzes, assignments	High Pass 90-100% Pass 70-89%
PO2: **Demonstrate good working knowledge of the most commonly used statistical methods and design of studies**	LO1: Have good understanding of exploratory data analysis, basic statistical inference, and limitations of the procedures	STAT 2303 – Statistical Methods	Tests, quizzes, assignments; hands-on projects	High Pass 90-100% Pass 70-89%

	LO2: Demonstrate knowledge of efficient design and analysis of experiments for standard situations LO3: Be able to apply appropriate statistical modeling tools to analyze data, interpret the results with proper scope of conclusions	STAT 4153 – Experimental Design and Analysis STAT 3113 – Regression Analysis STAT 4113 – Categorical Data Analysis STAT 4393 – Statistical Learning		
PO3: **Have good mastery of statistical computing skills and computer programming ability to manage and analyze data**	LO1: Understand the basic programming algorithms and logic LO2: Implement professional statistical software packages for statistical computing and demonstrate competence in with database management	COMS 2104 – Foundations of Computer Programming I STAT 2303 – Statistical Methods STAT 4393 – Statistical Learning BUAD 2003 – Business Information Systems	Tests, quizzes, hands-on assignments	High Pass 90-100% Pass 70-89%

PO4: **Communicate effectively (written and oral) with skills in collaboration (within and between disciplines) and teamwork**	LO1: Be able to explain statistical ideas, methods, and results effectively to statistical and non-statistical audiences	STAT 2303 – Statistical Methods COMM 2173 – Business and Professional Speaking MATH 4971 Senior Seminar in Mathematics (Internship / Capstone Project)	Tests, quizzes, assignments	High Pass 90-100% Pass 70-89%
PO5: **Demonstrate competence as an actuary/data analyst by mastering the career choice related skills**	LO1: Demonstrate knowledge of fundamental probability tools for quantitatively assessing risk and basic financial mathematics LO2: Be able to implement various statistical tools for quality monitoring commonly used in industry	STAT 3203 & 3213 – Actuarial Probability STAT 4283 & 4293 – Financial Mathematics STAT 3183 – Statistical Process Control	Tests, quizzes, assignments	High Pass 90-100% Pass 70-89%

Assessment Plan Implementation				
Assessment	**CPGE Form or Department Method**	**CPGE System or Department Method**	**Actual Results Obtained (CPGE Report or Department Method)**	**Use of Results for Improvement**
Course Embedded	Department of Mathematics and Statistics utilizes Faculty Course Assessment Report.	Department of Mathematics and Statistics utilizes Faculty Course Assessment Report. Assessment data will be submitted annually.	Review and analyze departmental assessment data.	Course, instructional or program changes.
Indirect and Direct Measures Alignment	Graduates will complete exit survey in the MATH 4971. A survey will be sent to those providing an internship.	Graduates will complete exit survey in the MATH 4971. A survey will be sent to those providing an internship.	Analyze survey results	Program and Curriculum changes

Continuous Improvement Plan **Summarize each category from assessment results and conclusions.**	
Categories of Improvement:	**Recommended Changes:**
A. Student Learning	Course Embedded Student Learning Outcome Assessment
B. Instruction and Curriculum	Course Embedded Student Learning Outcome Assessment
C. Assessment	Evaluate assessment from Student Learning Outcome results
D. Program Quality	Evaluate changes from Student and Employer Satisfaction Surveys
E. Budget	Budget requests supported by student learning and program assessment.

Blank Student Evaluation Form for Faculty

Arkansas Tech University
Eval_Base_201820

Question 1

Student Evaluation of Faculty Survey

Question 2

Please answer the following questions about your commitment to this course:

Question 3

How often did you attend this course?

(4) Always	(3) Frequently	(2) Rarely	(1) Never
○	○	○	○

• Reversed Options • Do Not Calculate Mean/Std.

Question 4

On average, how many hours per week did you spend on this course outside of class (Examples: homework, readings, reviewing notes, completing weekly assignments, etc.)?

(5) 0 hours	(4) 1-3 hours	(3) 4-6 hours	(2) 7-10 hours	(1) more than 10 hours
○	○	○	○	○

• Reversed Options • Do Not Calculate Mean/Std.

Question 5

How satisfied were you with your effort in this course?

(5) Very Satisfied	(4) Satisfied	(3) Unsure	(2) Dissatisfied	(1) Very Dissatisfied
○	○	○	○	○

• Reversed Options

Page 1 of 8

Question 6

What is your expected grade in this course?

(5) A	(4) B	(3) C	(2) D	(1) F	(0) Course Not Graded
O	O	O	O	O	O

• Include Non-Numeric Option • Reversed Options • Do Not Calculate Mean/Std.

Question 7

What could you have done to be a more effective learner in this course?

Question 8

Please answer the following questions about classroom materials and university resources:

Question 9

Did you utilize resources outside the classroom for this course (Examples: writing lab, advising center, tutoring, or other similar resources)?

(2) Yes	(1) No	(0) None Available
O	O	O

• Question has branched logic • Include Non-Numeric Option • Reversed Options • Do Not Calculate Mean/Std.

Question 10

If yes, which resources did you utilize? (Check all that apply)

- ☐ (4) Writing Lab
- ☐ (3) Advising Center
- ☐ (2) On-Campus Tutoring
- ☐ (1) Other

• Question is referenced by branched logic • Reversed Options

Question 11

Did you have access to (rent, purchase, or borrow) the required course materials (Examples: textbook, online access code, etc.)?

(3) Yes	(2) Some	(1) No	(0) None Required
○	○	○	○

• Question has branched logic • Include Non-Numeric Option • Reversed Options • Do Not Calculate Mean/Std.

Question 12

The required course materials were valuable to my success in this course.

(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
○	○	○	○	○

• Question is referenced by branched logic • Reversed Options

Question 13

Did the instructor(s) provide supplemental materials (Examples: handouts, visuals, online resources, etc.)?

(2) Yes	(1) No
○	○

• Reversed Options • Do Not Calculate Mean/Std.

Question 14

Did the physical space the course was held in (Examples: classroom, lecture hall, laboratory, etc.) negatively impact your learning?

(2) Yes	(1) No	(0) Online/Not Applicable
○	○	○

• Question has branched logic • Include Non-Numeric Option • Reversed Options • Do Not Calculate Mean/Std.

Question 15

If you answered 'YES' to the previous question, please explain how the physical space negatively impacted your learning.

• Question is referenced by branched logic

Question 16

Please answer the following questions about the instructor:

Question 17

I sought the instructor out for assistance (Examples: after class, office hours, email, phone, etc.)

(2) Yes	(1) No
○	○

• Question has branched logic • Reversed Options • Do Not Calculate Mean/Std.

Question 18

When I had questions or needed assistance, my instructor was available.

(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
O	O	O	O	O

• Question is referenced by branched logic • Reversed Options • Team Taught Question

Question 19

When I had questions or needed assistance, the instructor was willing to help.

(2) Yes	(1) No	(0) I did not seek out assistance
O	O	O

• Question has branched logic • Include Non-Numeric Option • Reversed Options • Do Not Calculate Mean/Std.

Question 20

If you answered no to the previous question please explain, citing specific examples if possible.

• Question is referenced by branched logic • Team Taught Question

Question 21

	(5) Strongly Agree	(4) Agree	(3) Neutral	(2) Disagree	(1) Strongly Disagree
The instructor incorporated examples that furthered my understanding of course topics.	O	O	O	O	O
The instructor communicated guidelines and expectations clearly, and evaluated work accordingly.	O	O	O	O	O
The instructor was well-organized and prepared for class.	O	O	O	O	O
The instructor demonstrated a clear understanding of course topics.	O	O	O	O	O
The instructor provided timely feedback on assignments, tests, or discussions.	O	O	O	O	O
The instructor acted in a professional manner and treated students with respect.	O	O	O	O	O
The instructor created an environment that was conducive to learning.	O	O	O	O	O
The instructor was proficient in English.	O	O	O	O	O

• Reversed Options • Team Taught Question

Question 22

Please rate your instructor's overall performance

(5) Excellent	(4) Very Good	(3) Good	(2) Poor	(1) Very Poor
O	O	O	O	O

• Reversed Options • Team Taught Question

Question 23

Please answer the following open response questions:

Question 24

What were the strengths of this course?

Question 25

Do you have any constructive suggestions on improving this course?

Arkansas Tech University
Eval_Base_201820

Question 26

Do you have any additional comments about the instructor?

* Team Taught Question

Include information received from potential employers about course content.
In the employer support letters, potential employers indicate that the new Applied Statistics program is well designed and meet industry standards. Most employers emphasize the importance of the mathematical skills, computer programming skills, database management skills, and the use of advanced analytics software (SAS, R and/or Python, etc.), which are all incorporated in the design of the proposed program.

Provide institutional curriculum committee review/approval date for proposed program.
TBA

FACULTY

List the names and credentials of all faculty teaching courses for the proposed program. Include college/university awarding degree; degree level; degree field; subject area of courses faculty currently teaching and/or will teach. (For associate degrees and above: A minimum of one full-time faculty member with appropriate academic credentials is required.)

Dr. Scott Jordan	Associate Professor of Mathematics	B.S. Mathematics, Southern Arkansas University, 1985 M.S. Statistics, University of Arkansas, 1988 Ph.D. Statistics, University of Louisiana at Lafayette, 1994

Dr. Marcel Finan	Professor of Mathematics	B.S. Mathematics, Haigazian University, 1984 M.S. Mathematics, American University of Beirut, 1987 M.S. Applied Mathematics, University of Tennessee, 1992 Ph.D. Actuarial Mathematics, University of North Texas, 1998
Dr. Weijia Jia	Assistant Professor of Statistics	B.S. Mathematics, Hunan University of Science and Technology, 2006 M.S. Mathematics, Nankai University, 2010 Ph.D. Statistics, Kansas State University, 2018
Dr. Xinli Xiao	Assistant Professor of Mathematics	B.S. Mathematics, Wuhan University, 2007 M.S. Mathematics, Nankai University, 2010 Ph.D. Statistics, Kansas State University, 2016
Mrs. Kristi Spittler Brown	Instructor of Mathematics	B.S. Mathematics, University of Arkansas, 1997 M.S. Statistics, University of Arkansas, 1999

Indicate lead faculty member or program coordinator for the proposed program.
Dr. Weijia Jia

Total number of faculty required for program implementation, including the number of existing faculty and number of new faculty. For new faculty, provide the expected credentials/experience and expected hire date.

Number of Faculty Required for Implementation
We already have an assistant professor of statistics, an associate professor of statistics, and will need an instructor of statistics position which can result from converting an instructor of mathematics currently in the Department of Mathematics and Statistics.

For proposed graduate programs: Provide the curriculum vita for faculty teaching in the program, and the expected credentials for new faculty and expected hire date. Also, provide the projected startup costs for faculty research laboratories, and the projected number of and costs for graduate teaching and research assistants.

N/A

DESCRIPTION OF RESOURCES

- **Current library resources in the field**

MathSciNet – database of reviews, abstracts and bibliographic information for comprehensive coverage of mathematics and statistics topics

Web of Science – a comprehensive full-text and review research database that would include content relevant to different aspects of statistics

Business Insights: Global -- offers a comprehensive and convenient way to find case studies, in-depth statistical data coupled with deep research

E-journals and publications to which ATU has full-text access:
Statistics
Annals of Applied Statistics (ISSN: 1941-7330)
Annals of Applied Probability (2168-8737)
Journal of the American Statistical Association (1537-274X)
Journal of the Royal Statistical Society. Series B, Statistical Methodology (1467-9868)
Annals of Statistics (2168-8966)
Biometrika (1464-3510)
Journal of Applied Statistics (1360-0532)
Journal of Business & Economic Statistics (1537-2707)
Computational Statistics (1613-9658)
Business Statistics (0083-2545)

Actuarial Science
Annals of Actuarial Science (1748-5002)
Benefits Quarterl (2168-3336)
North American Actuarial Journal (2325-0453)
European Actuarial Journal (2190-9741)
British Actuarial Journal (2044-0456)
Journal of Risk & Insurance (1539-6975)

Data Analysis
Advances in Data Analysis and Classification (1862-5355)
Intelligent data analysis (1571-4128)
Lifetime data analysis (1572-9249)
Statistical Analysis and Data Mining (1932-1872)
Machine Learning (1573-0565)
Journal of Data Science (1680-743X)
Data Science Journal (1683-1470)

ATU presently has 69 books in our collection dated 2008 or later that are listed with the subject "Statistics", "Actuarial Science", or "Data Analysis".

- **Current instructional facilities including classrooms, instructional equipment and technology, laboratories (if applicable)**

ATU has more than 40 computer labs across the campus, including 12 computer classrooms could be used for teaching or student use and 6 for restricted class use. Students can get access to computers in the library and technology center. The current resources (computer lab, software, etc.) are adequate for the proposed Applied Statistics program.

- **New instructional resources required, including costs and acquisition plan**
  None

NEW PROGRAM COSTS – Expenditures for the first 3 years

- **New administrative costs** – *none for the first year; this program will be housed in the Department of Mathematics & Statistics and the administrative structure that is currently in place is sufficient.*
- ***New faculty***
  - *None for the first 3 years.*
  - *Will need an instructor of statistics position which can result from converting an instructor of mathematics position currently in the Department of Mathematics and Statistics with an increase in salary cost of at most $7,750 according to CUPA numbers.*
- **New library resources and costs**
  - None; the existing resources are adequate.
- **New/renovated facilities and costs**
  - None; the existing facilities are adequate.
- **New instructional equipment and costs**
  - *None; the Department of Mathematics & Statistics currently provides specialized software and will continue to do so.*
- **Distance delivery costs**
  - None
- **Other new costs**
  - None

If no new costs required for program implementation, provide explanation.
N/A

SOURCE OF PROGRAM FUNDING – Income for the first 3 years of program operation; If there will be a reallocation of funds, indicate from which department, program, etc. *Funds will be reallocated within the Department of Mathematics & Statistics. In addition, administration supports this new degree and will allocate funds for salary cost of converting an instructor of mathematics position to an instructor of statistics position.*

Projected enrollment: *Approximately 20 students for the first-year enrollment and may increase after the first year*

State general revenue per student: *$30,515,632 from State of Arkansas; this all goes into one general revenue fund; this is the amount that the VP of Administration and Finance distributes to the academic departments based on student semester credit hour production.*

Tuition and Fees 2018-19

Tuition and Fees are subject to change as necessary. Please Note: Students using the Nelnet Business Solutions (formerly FACTS Tuition Management) Budget Plan: The Student Accounts Office may adjust your tuition payment plan for any financial aid disbursed and any additional charges incurred. Tuition and Fees are due on or prior to the first day of class for each semester that the student is enrolled in.

All undergraduate students who are legal residents of states which are contiguous to Arkansas (specifically, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, or Texas) shall receive a waiver of out-of-state tuition charges.

However, if you qualify as a low income student, your financial aid package could result in a lower cost and in some instances may cover all costs.

Undergraduate Tuition Rates *(copied from 2018-2019 catalog)*

Hours	***Resident (In-State)***	***Non-Resident (Out-of-State)***	***Fees***
1	*226.00*	*452.00*	*76.25*
2	*452.00*	*904.00*	*152.50*
3	*678.00*	*1,356.00*	*228.75*
4	*904.00*	*1,808.00*	*305.00*
5	*1,130.00*	*2,260.00*	*381.25*
6	*1,356.00*	*2,712.00*	*457.50*
7	*1,582.00*	*3,164.00*	*533.75*
8	*1,808.00*	*3,616.00*	*610.00*
9	*2,034.00*	*4,068.00*	*686.25*
10	*2,260.00*	*4,520.00*	*762.50*
11	*2,486.00*	*4,972.00*	*838.75*
12	*2,712.00*	*5,424.00*	*915.00*
13	*2,938.00*	*5,876.00*	*991.25*
14	*3,164.00*	*6,328.00*	*1,067.50*
15	*3,390.00*	*6,780.00*	*1,143.75*
16	*3,616.00*	*7,232.00*	*1,220.00*

Hours	Resident (In-State)	Non-Resident (Out-of-State)	Fees
17	3,842.00	7,684.00	1,296.25
18	4,068.00	8,136.00	1,372.50
19	4,294.00	8,588.00	1,448.75
20	4,520.00	9,040.00	1,525.00
21	4,746.00	9,492.00	1,601.25
22	4,972.00	9,944.00	1,677.50

UNDERGRADUATE & GRADUATE FEES

Fee Title	Undergraduate	Graduate
Technology Operations Fee	16.50 per Credit Hour	16.50 per Credit Hour
Facilities Fee	16.00 per Credit Hour	16.00 per Credit Hour
Student Activity Fee	2.50 per Credit Hour	2.50 per Credit Hour
Instructional Support Fee	11.00 per Credit Hour	11.00 per Credit Hour
Public Safety Fee	2.25 per Credit Hour	2.25 per Credit Hour
Library Fee	1.00 per Credit Hour	1.00 per Credit Hour
Health & Wellness Fee	7.75 per Credit Hour	7.75 per Credit Hour
Athletic Student Fee	19.25 per Credit Hour	19.25 per Credit Hour
Online/ Mixed Technology Fee	10.00 per Credit Hour	10.00 per Credit Hour

OTHER FEES

Fee Title	Amount
International Student Service Fee	30.00
PO Box Fee (required on-campus students)	15.00/Fall/Spring; 15.00 Summer term
Auto Registration (each hangtag)	45.00
Late Registration Fee	25.00
Drop/Add Course Change Fee	10.00
Techfit	25.00 per term
Reinstatement Fee (if classes are canceled for Non-Payment of Account)	100.00
In addition to Reinstatement Fee (if classes are canceled for Non-Payment) a Late Registration Fee will also be assessed	25.00

ROOM CHARGES - PER SEMESTER

Residence Hall	Single (Private Room)	Double	Triple	Quad
Brown Hall	2,144.82	1,744.82	n/a	1,570.75
Critz Hall	2,144.82	1,744.82	n/a	1,570.75
Hughes Hall	2,144.82	1,744.82	n/a	1,570.75
Turner Hall	2,144.82	1,744.82	n/a	1,570.75
Wilson Hall	2,144.82	1,744.82	n/a	1,570.75
Jones Hall	2,374.51	1,974.51	n/a	n/a
Tucker Hall	2,374.51	1,974.51	n/a	n/a
Baswell Hall	2,771.06	2,371.06	2,134.16	n/a
M Street Hall	2,771.06	2,371.06	2,134.16	n/a
Nutt Hall	2,771.06	2,371.06	2,134.16	n/a
Paine Hall	2,771.06	2,371.06	2,134.16	n/a
South Hall	2,771.06	2,371.06	2,134.16	n/a
Stadium Suites	2,771.06	2,371.06	2,134.16	n/a
Caraway Hall - Sorority Housing	2,256.06	1,856.06	1,622.00	n/a

University Apartments	
University Commons - 4 Bedroom (Per Semester)	3,025.11
University Commons - 2 Bedroom (Per Semester)	3,758.47
Vista Place (Per Semester)	3,025.11

BOARD CHARGES - PER SEMESTER

Plan	Amount
Tech Platinum 1 - Unlimited Meals + $100 DCB	1,589.00
Tech Platinum 2 - Unlimited Meals + $175 DCB	1,664.00
Tech Gold 1 - 210 Meals per semester + $100 DCB	1,449.00
Tech Gold 2 - 210 Meals per semester + $175 DCB	1,524.00
Tech Silver 1 - 10 Meals per week + $100 DCB	1,358.00
Tech Silver 2 - 10 Meals per week + $175 DCB	1,433.00
Plan D - 65 Meals per semester plus $100 DCB - Commuter Plan	602.00
Plan E - 40 Meals per semester plus $100 DCB - Commuter Plan	431.00
Plan F - DCB Only Plan $500 DCB - Commuter Plan	500.00

Expense to student for 3 hours

In-State (3 hours)		*Out-of-State (3 hours)*	
Tuition	$696.00	*Tuition*	$1392
Technology Operations Fee	$49.50	*Technology Operations Fee*	$49.50
Student Activity Fee	$7.50	*Student Activity Fee*	$7.50
Instructional Support Fee	$36.75	*Instructional Support Fee*	$36.75
Facilities Fee	$54.00	*Facilities Fee*	$54.00
Health and Wellness Fee	$25.50	*Health and Wellness Fee*	$25.50
Athletic Student Fee	$60.00	*Athletic Student Fee*	$60.00
Public Safety Fee	$6.75	*Public Safety Fee*	$6.75
Library Fee	$3.75	*Library Fee*	$3.75
Student Union/Recreation Center Fee (on average)	$12.00	*Student Union/Recreation Center Fee (on average)*	$12.00
Books and supplies	$300.00	*Books and supplies*	$300.00
TOTAL Cost to Student	$1251.75		$1947.75

Program Revenue for 3 hours

A conservative estimate of enrollment is 20 students per year.

In-State (3 hours, 20 students)	*Out-State (3 hours, 20 students)*
Total: ***20 students x 1251.75 = 25,035***	***Total:*** ***20 students x 1947.75 = 38,955***

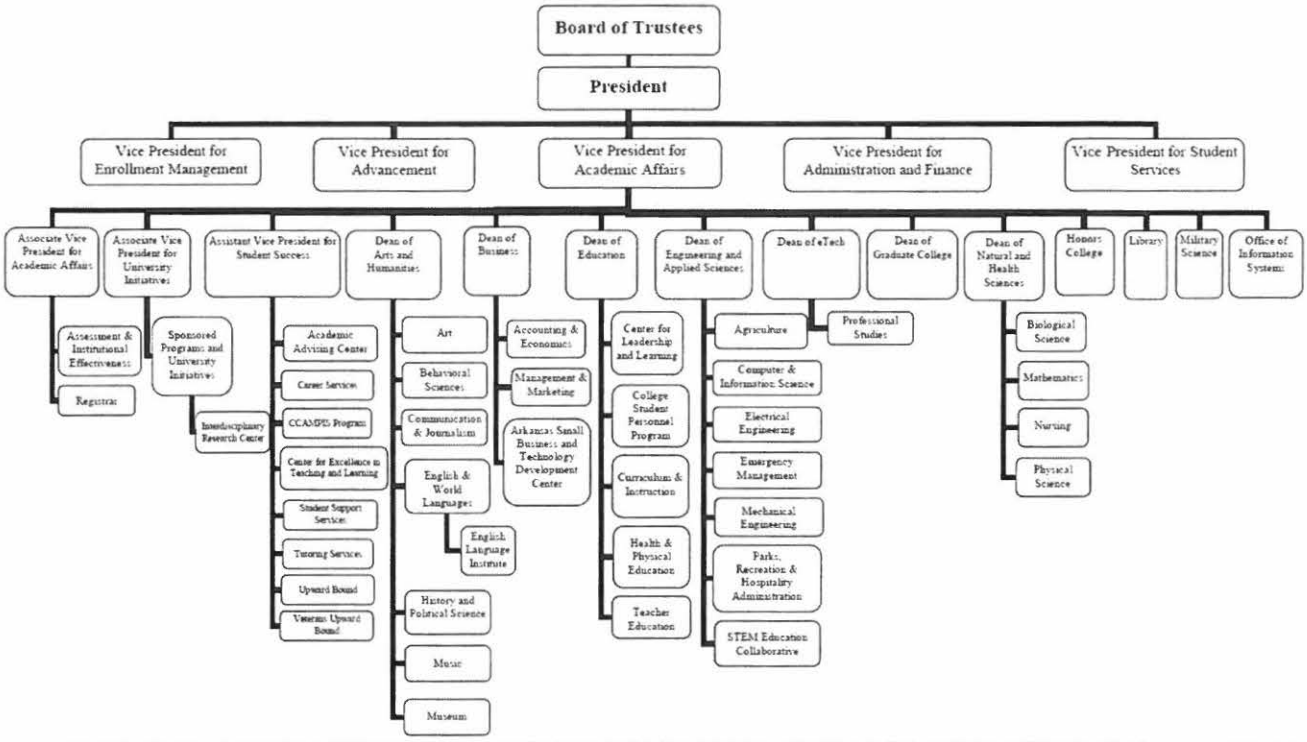
Faculty expense to deliver 3 hours:			
Faculty Expense (3 hours & 90% CUPA) ***Assistant Professor*** ***Associate Professor*** ***Professor***	 ***$ 7,489.13*** ***$ 7,969.50*** ***$ 9,221.13***	***Faculty Expense (3 hours & 90% CUPA)*** ***Assistant Professor*** ***Associate Professor*** ***Professor***	 ***$ 7,489.13*** ***$ 7,969.50*** ***$ 9,221.13***

University Revenue for 3 hours *(Difference between program revenue and faculty salary)*

	Assistant Professor	*Associate Professor*	*Professor*
In State	*$25,035 - $7,489.13 = $17,545.87*	*$25,035 - $7,969.50 = $17,065.50*	*$25,035 - $9,221.13= $15,813.87*
Out of State	*$38,955 - $7,489.13 = $31,465.87*	*$38,955 - $7,969.50 = $30,985.50*	*$38,955 - $9,221.13 = $29,733.87*

ORGANIZATIONAL CHART REFLECTING NEW PROGRAM

Proposed program will be housed in the Department of Mathematics and Statistics in the College of Natural & Health Science.



SPECIALIZED REQUIREMENTS

If specialized accreditation is required for program, list the name of accrediting agency.

None at this point.

Indicate the licensure/certification requirements for student entry into the field.

For students to enter the program, they must be a graduate from a public-school system.

Provide documentation of Agency/Board review/approvals (education, nursing— initial approval required, health-professions, counseling, etc.)

None

BOARD OF TRUSTEES APPROVAL

Provide the date that the Board approved (or will consider) the proposed program. **TBD**

Provide a copy of the Board meeting agenda that lists the proposed program, and written documentation of program/unit approval by the Board of Trustees prior to the Coordinating Board meeting that the proposal will be considered. **TBD**

SIMILAR PROGRAMS

List institutions offering program

With the recent rise of Big Data and Data Science, the demand for analytic skills has increased substantially. Programs in Applied Statistics with emphasis on Data Science or Actuarial Science are offered in a number of well-known universities in the US. Some of the current undergraduate and master's programs are listed below:

Undergraduate programs

- *The University of Iowa*
  B.S. in Actuarial Science
  B.S. in Statistics (Business, Industry, Government, and Research track)
  B.S. in Statistics (Statistical Computing and Data Science track)
- *University of California, Santa Barbara*
  B.S. in Actuarial Science
  B.S. in Statistical Science (Applied Statistics track)
- *University of California, Davis*
  B.S. in Statistics (Applied Statistics track)
  B.S. in Statistics (Computational Statistics track)
  B.S. in Statistics (Statistical Data Science track)
- *Rochester Institute of Technology*
  B.S. in Applied Statistics and Actuarial Science
- *University of Illinois at Chicago*
  B.S. in Statistics (Concentration in Applied Statistics)
- *Purdue University*
  B.S. in Statistics (Applied Statistics Option)

Master's programs

- *Purdue University*
  M.S. Statistics Degree in Applied Statistics
- *The Pennsylvania State University*
  Master of Applied Statistics
- *University of California, Los Angeles*
  Master of Applied Statistics
- *The Ohio State University*
  Master of Applied Statistics
- *Colorado State University*
  Master of Applied Statistics
- *Texas A&M University*
  Master of Science in Statistics (Applied Statistics Certificate)
- *Oklahoma State University*
  Master of Science in Applied Statistics

- *University of Kentucky*
  Data Analytic Master of Applied Statistics
- *University of Delaware*
  Master of Applied Statistics

There are just a few colleges and universities in Arkansas offer a similar program. Below is a list of the similar majors:

- *University of Arkansas*
  B.S. in Mathematics with Concentration (Statistics)
- *University of Central Arkansas*
  B.S. in Data Science
- *University of Arkansas at Little Rock*
  B.S. in Mathematics with Minor in Actuarial Science
  B.S. in Mathematics with Minor in Statistics

Arkansas Tech's Applied Statistics Degree provides the Actuarial Science Option and the Computer Science Option. This degree is going to provide the state and region with additional skilled employees in the rapidly growing industries emphasizing data analytics skills. It also provides a good preparation for those students intending to continue their education in statistics beyond the BS degree. There are no university degree programs identical to ATU's Applied Statistics Degree serving the state. The interdisciplinary nature of the program combines mathematical foundation, statistical modeling, software programming, and knowledge in economics and business management, which are essential skills that the employers are seeking.

List institution(s) offering a similar program that the institution used as a model to develop the proposed program.

Arkansas Tech University did not use any particular institution as an example/model for curriculum and degree development. The curriculum is developed by including essential mathematical and statistical courses, and the coursework to confer in-demand data analytics skills sought by the employers in the state and region.

Provide a copy of the e-mail notification to other institutions in the state notifying them of the proposed program. Please inform institutions not to send the response to **"Reply All"**. If you receive an objection/concern(s) from an institution, reply to the institution and copy ADHE on the email. That institution should respond and copy ADHE. If the objection/concern(s) cannot be resolved, ADHE may intervene.

Email notification sent to four (4) year universities in Arkansas for Bachelor of Science in Applied Statistics

DESEGREGATION

State the total number of students, number of black students, and number of other minority students enrolled in related degree programs, if applicable.

Program Title	2017-18			2018-19		
	Female	Male	Total	Female	Male	Total
Math & Math Education	5	15	20	10	13	23
Computer Science	11	126	137	12	126	138
Business Data Analytics	32	24	56	30	33	63

Program Title	2017-18				2018-19			
	Caucasian	African-American	Other Minorities	Total	Caucasian	African-American	Other Minorities	Total
Math & Math Education	18	1	1	20	18	1	4	23
Computer Science	98	3	36	137	95	4	39	138
Business Data Analytics	31	2	23	56	36	1	26	63

INSTITUTIONAL AGREEMENTS/MEMORANDUM OF UNDERSTANDING (MOU)

If the courses or academic support services will be provided by other institutions or organizations, include a copy of the signed MOU that outlines the responsibilities of each party and the effective dates of the agreement.

N/A

ACADEMIC PROGRAM REVIEW

The scheduled program review date is 2030-2031.

PROVIDE ADDITIONAL INFORMATION IF REQUESTED BY ADHE STAFF

INSTRUCTION BY DISTANCE TECHNOLOGY

If the proposed program will be offered by distance technology, provide the following information: *The new courses for this degree will be offered as a campus-based degree. General Education courses can be completed on campus or through distance education.*

Summarize institutional policies on the establishment, organization, funding and management of distance courses/degrees.
N/A; This degree will be offered as a campus-based degree.

Describe the internal organizational structure that coordinates (development, technical support, oversight) distances courses/degrees.
N/A; This degree will be offered as a campus-based degree.

Summarize the policies and procedures to keep the technology infrastructure current.
N/A; This degree will be offered as a campus-based degree.

Summarize the procedures that assure the security of personal information.
N/A; This degree will be offered as a campus-based degree.

Provide a list of services that will be outsourced to other organizations (course materials, course management and delivery, technical services, online payment, student privacy, etc.).
N/A; This degree will be offered as a campus-based degree.

Bachelor of Science in

Applied Statistics with Actuarial Science Option or Computer Science Option

Occupational Employment Evidence

U.S. National Job Outlook by Category - Bureau of Labor Statistics

https://www.bls.gov/ooh/math/home.htm

Job Type	Median Salary 2018	Number of Jobs 2018	Job Outlook 2016-2026	Comparative Job Growth	Employment Change 2016-2026
Actuaries	$102,880	23,600	22% increase	Much faster than average	5,300
Applied statisticians	$88,190	40,300	33% increase	Much faster than average	13,500
Operations Research Analysts	$83,390	114,000	27% increase	Much faster than average	31,300
Management Analysts	$83,610	806,400	14% increase	Faster than average	115,200
Market Research Analysts	$63,120	595,400	23% increase	Much faster than average	138,300

Bureau of Labor Statistics
May 2018 State Occupational Employment and Wage Estimates for Arkansas

http://www.bls.gov/oes/current/oes_ar.htm

Occupation Title	Employment	Employment per 1000 jobs	Annual Mean Wage
Actuaries	40	0.033	$87,730
Statistician	380	0.311	$76,630
Operations Research Analysts	600	0.493	$61,360
Management Analysts	5,380	4.448	$63,410
Market Research Analysts and Marketing Specialists	4,720	3.904	$68,050

Calculated with data collected from employers in all industry sectors in metropolitan and nonmetropolitan areas in Arkansas.

Job posting (Relevant to statistics & actuarial science)

Data Scientist, Group Services & Growth

Quantium ★★★★☆ 16 reviews - Bentonville, AR

Apply Now

Since 2002, Quantium have combined the best of human and artificial intelligence to power possibilities for individuals, organisations and society. Whether it be building forecasting engines that are driving down food wastage or creating tools to support campaigns that combat human trafficking, Quantium believes in better goods, services, experiences, and championing the benefits of data science and AI for a brighter future.

The opportunity

By leveraging Quantium's world-class capability built over 16 years in Australia, our Quantium U.S. team is growing rapidly – and with growth comes opportunity. Our data scientists solve a range of business problems by building applied analytics, data science and AI solutions including embedded innovative decision engines into the everyday business processes of our retail and banking clients including but not limited to, marketing optimisation, credit risk, forecasting and customer behaviour analysis. This is only the beginning of our expansion into the U.S. markets and our team is growing to meet the needs of our valued clients.

As a Data Scientist, you will be joining our friendly and talented team to provide technical analytical solutions for our clients. With Quantium's customer focus and innovative approach, you will have the opportunity to develop a range of technical skills on cutting edge projects with a true commercial edge.

Our data scientists and consultants are committed to making a positive impact on our clients each day, as such, you will be required to travel for up to 80% of your time to work onsite at client offices with our current opportunity requiring you to be based in Bentonville, Arkansas for a minimum of 1 year.

Key responsibilities

- Working in a team of data scientists and consultants to develop end-to-end data science solutions for client projects, from foundational data mining, analytical manipulation and presentation of results. This may include:
- Writing code for data exploration, cleansing, manipulation and analysis
- Developing clear presentation of insights via spreadsheets, PowerPoint presentations, self-service analytical visualisation tools and face-to-face client meetings
- Client interaction as appropriate
- Provide feedback to ensure continuous improvement with the team
- Providing informal coaching and guidance to junior team members
- Actively participating in learning forums and sharing knowledge with the wider team

About you

- A degree in a quantitative discipline e.g. actuarial studies, mathematics / statistics, engineering, computer science etc
- 2+ years' experience in a highly technical analytics environment, carrying out data analytics with large, complex datasets; retail industry experience strongly preferred
- Coding and modelling experience in SQL / R / Python and / or big data platforms
- Experience delivering against projects, tasks and activities in a dynamic deadline driven environment
- Commercial acumen to understand business needs and be able to suggest the commercial impacts of different analytics solutions or approaches
- Ability to clearly communicate technical concepts to a non-technical audience
- A natural flair for problem solving
- Easily adaptable in a fast-paced environment
- Innovative / outside the box thinking

28 days ago

Director-Actuary

USAble Life ★★★★☆ 46 reviews - Little Rock, AR 72223

Apply On Company Site

When it comes to making a meaningful difference in the lives of our customers and employees, USAble Life (a Life & Specialty Ventures Company) is always ready.

At USAble Life, we strive to have a positive impact in the lives of others, especially our employees. We are a diverse group of individuals working together to go the extra mile. Bring your talents and expertise to join our team, and you'll be rewarded with opportunities for personal and professional development. Our passion for delivering the best products is matched by our passion for our people.

For three consecutive years (2016, 2017, and 2018), Arkansas Business has acknowledged us as one of the best places to work. This coupled with our engaging culture and a comprehensive benefits package ensures we are committed to our employees.

Life Takes You Places! Are you ready to join us?

A **Director-Actuary** will:

- Provide actuarial knowledge and expertise within the organization.
- Play a key role in several areas of responsibility including pricing and cost analyses, the development and enhancing of our data repository and information distribution, participation in financial reviews, analyzing actuarial trends and issues, etc.
- Work with staff to monitor performance trends and is expected to provide actionable information from this analysis.
- Serve as an informal leader and coach to staff. All assignments and information are expected to be accurate and conform to applicable Actuarial Standards of Practice. Involvement and accountabilities will grow with time in position.

Essential Duties:

- Participate and lead, when capable, analysis and recommendations applicable to pricing, product development, financial reviews including various analysis to include reserves, reinsurance, competitiveness, regulations, etc.
- Lead efforts to enhance our data repository and the extraction of valuable data from it. Data repository needs to continue to provide decisionable insights into broker, product, and within product performance.
- Contribute to and lead, when applicable, the production of both recurring and ad-hoc reporting into actionable financial information to Senior Leaders.
- Provide guidance, training and coaching to a team with varied backgrounds.

Required Knowledge, Skills, and Abilities:

- Proficiency in Microsoft Office Suite, SQL, and Power BI
- Excellent communication, leadership and development skills. These communications include, but will not be limited to, C-Suite executives
- Sound actuarial judgment with the ability to solve complex problems
- Ability to effectively explain actuarial concepts to non-actuarial audiences
- Knowledge of Statutory and GAAP accounting
- Ability to easily learn new techniques and technologies
- Ability to juggle multiple conflicting priorities and challenges
- Demonstrated ability to develop colleagues

- The ability to influence without authority is necessary
- Successful experience in developing and implementing a data repository is preferred

Required Education and Experience:

- Bachelor's Degree in Actuarial Science, Mathematics, Statistics, Finance, Economics or related field
- Associate of the Society of Actuaries (ASA); Member of the Academy of Actuaries (MAAA)
- At least 5 years of post exams experience in broad based actuarial roles
- Demonstrated experience leading actuarial assignments in complex problems to successful results
- Proven success in influencing cross-functional teams

Preferred Education and Experience:

- Fellow of the Society of Actuaries (FSA)
- 7-10 years of post exams experience in actuarial leadership/management roles
- 3+ years of experience with ancillary products

Equal Opportunity Employer/Protected Veterans/Individuals with Disabilities

The contractor will not discharge or in any other manner discriminate against employees or applicants because they have inquired about, discussed, or disclosed their own pay or the pay of another employee or applicant. However, employees who have access to the compensation information of other employees or applicants as a part of their essential job functions cannot disclose the pay of other employees or applicants to individuals who do not otherwise have access to compensation information, unless the disclosure is (a) in response to a formal complaint or charge, (b) in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or (c) consistent with the contractor's legal duty to furnish information.

30+ days ago

Actuarial Analyst I

Arkansas Blue Cross and Blue Shield ★★★★☆ 197 reviews - Little Rock, AR

Apply On Company Site

Take the steps to start your career at Arkansas Blue Cross and Blue Shield.
01 USAble Mutual Insurance Company

Job Description Summary

This position is responsible for the evaluation of the financial impact of various health care financing schemes with emphasis on those involving real risk assumptions by our enterprise. Analyses completed by incumbents in this position will be used to support business decisions by many areas of the enterprise. Typical activities performed by this position include:

- Developing statistics and designing methodologies to be used to set unpaid claims liability estimates for the enterprise's financial statements.
- Developing and automating rating systems for group and individual medical, life, dental, and disability insurance products.
- Conducting experience studies to measure actual company experience versus current rating assumptions. Updating rating factors or algorithms to reflect current experience or changing conditions. Preparing reports to decision makers throughout the enterprise with information concerning current utilization trends or experience results.
- Recommending sufficient and competitive rates for all classes of business to ensure the financial soundness of the enterprise.
- Developing statistics and methodologies which will define, support, and/or forecast the financial position of the enterprise.
- Providing ratemaking input to corporate and regional underwriters. Providing ratemaking support to regional executives for use in the design of provider risk sharing models or for other purposes.
- Assisting in the completion of the Actuarial Division's exhibits to the Annual Statement.
- Assisting in the completion of JV and regional financial reports.
- Assisting in the setting of provider risk share targets and completion of provider settlements/reports on a quarterly basis.

Job Description

Education & Experience:

- A Bachelor's degree required with preference given to the following majors: Computer Science, Mathematics, Actuarial Science, Statistics, or other mathematics or financial related field from an accredited college or university. Successful completion of two or more actuarial exams may be considered for substitution for the degree, if the candidate's degree is not in one of the fields listed.
- One or more successfully completed SOA exams.

Specialized Knowledge & Skills

- Exhibit the mathematical skills and statistical analysis capabilities necessary to support and complete the workload assigned.
- Exhibit above average oral and written communication skills.

- Exhibit basic knowledge of personal computer hardware and software operation, and the ability to satisfactorily utilize the desktop computer work tools present within the Actuarial Division (i.e., Spreadsheet, Word Processing, Database, Application Development, etc.).
- Exhibit acceptable performance relative to the following dimensions, and the ability to apply them to interpersonal environments:

- Oral Communication Analysis
- Written Communication Decisiveness
- Job Motivation Judgment
- Initiative Organizational Vision
- Tolerance for Stress Technical/Professional Knowledge
- Sensitivity

- Possess basic knowledge of the health insurance industry, managed care, and computer programming. Possess good problem solving skills and good interpersonal skills.
- Have the ability to work with limited supervision.

Security Requirements

This position is identified as level three (3). This position must ensure the security and confidentiality of records and information to prevent substantial harm, embarrassment, inconvenience, or unfairness to any individual on whom information is maintained. The integrity of information must be maintained as outlined in the company Administrative Manual.

Segregation of Duties

Segregation of duties will be used to ensure that errors or irregularities are prevented or detected on a timely basis by employees in the normal course of business. This position must adhere to the segregation of duties guidelines in the Administrative Manual.

Employee Regular

Number Of Openings Available

1

Arkansas Blue Cross Blue Shield is an Equal Opportunity Affirmative Action employer and is subject to federal regulations pertaining to employment.Arkansas Blue Cross does not unlawfully discriminate on the basis of race, color, religion, sex, sexual orientation, gender identity or expression, national origin, age, disability, marital status, veteran status, or any other basis prohibited under federal, state or local laws governing non-discrimination in employment in every location in which the Company has facilities. Arkansas Blue Cross also provides reasonable accommodations for qualified individuals with disabilities in accordance with the Americans with Disabilities Act (ADA) and any other state or local laws.

You must apply using your Legal Name. Current Workers/Contingent Workers/Contractors: Apply with your existing worker account (Workday) from the enterprise network. (Do not apply from this site - apply internally only)

Posted 13 Days Ago Full time R0003675

Job posting (Relevant to statistics & computer science)

6/17/2019

Data Scientist

Walmart · Bentonville, AR, US

23 hours ago · 20 applicants

Apply on company website

Position Description

- Demonstrates up-to-date expertise and applies this to the development, execution, and improvement of action plans
- Develops analytical models to drive analytics insights
- Leads small and participates in large data analytics project teams
- Models compliance with company policies and procedures and supports company mission, values, and standards of ethics and integrity
- Participates in the continuous improvement of data science and analytics
- Presents data insights and recommendations to key stakeholders
- Provides and supports the implementation of business solutions

Minimum Qualifications

- Bachelor of Science and 2 years' data science experience OR Master of Science and 1 year's data science experience.

Additional Preferred Qualifications

- 4 years' experience with SQL and relational databases (for example, DB2, Oracle, SQL Server).
- 4 years' experience with statistical programming languages (for example, SAS, R).
- Bachelor's degree in Statistics, Economics, Analytics, Mathematics and 7 years' experience in an analytics related field.
- Certificate in business analytics, data mining, or statistical analysis.
- Doctoral degree in Statistics, Economics, Analytics, or Mathematics and 1 year's experience in an analytics related field.
- Master's degree in Statistics, Economics, Analytics, or Mathematics and 3 years' experience in an analytics related field.

Seniority level

Entry level

Employment type

Full-time

Job function

Analyst Information Technology Engineering

Industries

Marketing and Advertising Information Technology and Services Computer Software

6/17/2019

Staff Data Scientist

Walmart · Bentonville, AR, US

3 weeks ago · 18 applicants

Apply on company website

Position Description

- A Staff Data Scientist is responsible for analyzing large data sets to develop multiple custom models and algorithms to drive innovative business solutions. Staff Data Scientists work on large project teams in order to provide analytical support and guidance to an assigned area on for large projects (for example, email targeting, business optimization, consumer recommendations) within Walmart eCommerce. Staff Data Scientists are responsible for building large data sets from multiple sources in order to build algorithms for predicting future data characteristics. Those algorithms will be tested, validated, and applied to large data sets. Staff Data Scientists are responsible for training the algorithms so they can be applied to future data sets and provide the appropriate search results. Staff Data Scientists are responsible for researching new trends in the industry and utilizing up-to-date technology (for example, HBase, MapReduce, LAPack, Gurobi) and analytical skills to support their assigned project. Staff Data Scientists are the subject matter experts for statistical analysis and modeling for their project team.
- Build complex data sets from multiple data sources, both internally and externally.
- Build learning systems to analyze and filter continuous data flows and offline data analysis.
- Collaborate with cross-functional partners across the business.
- Collaborate with project teams to implement data modeling solutions.
- Combine data features to determine search models.
- Conduct advanced statistical analysis to determine trends and significant data relationships.
- Develop models of current state in order to determine improvements needed.
- Develop multiple custom data models to drive innovative business solutions.
- Drives the execution of multiple business plans and projects
- Ensures business needs are being met
- Interpret data to identify trends to go across future data sets.
- Promotes and supports company policies, procedures, mission, values, and standards of ethics and integrity
- Provides supervision and development opportunities for associates
- Research new techniques and best practices within the industry.

- Scale new algorithms to large data sets.
- Train algorithms to apply models to new data sets.
- Translate business needs into data requirements.
- Utilize system tools including (MySQL, Hadoop, Weka, R, Matlab,ILog).
- Validate models and algorithmic techniques.

Minimum Qualifications

- Bachelor of Science and 5 years' data science experience OR Master of Science and 3 years' data science experience.

Additional Preferred Qualifications

- 5 years' experience in predictive modeling and large data analysis
- 5 years' experience with statistical programming languages (for example, R, SAS)
- 5 years' experience with SQL and relational databases (for example, DB2, Oracle, SQL Server)
- Expert in any scripting language (Python, PHP, Perl, etc.)
- Experience with Big Data/Distributed computing (Hadoop, Hive, Cassandra, Spark, etc.)
- Experience communicating the results of analyses with product and leadership teams to influence the strategy of the product
- Experience analyzing data and a broad understanding of core statistical and ML techniques
- Computer science, applied mathematics or statistics background in addition to data science skills
- Capability to develop experimental and analytic plans for data modeling processes, use of baselines and KPIs, and ability to accurately determine cause and effect relationships
- Demonstrated experience mentoring and educating junior data scientists to help them become competent and confident problem solvers
- Certificate in business analytics, data mining, or statistical analysis

Seniority level

Entry level

Employment type

Full-time

Job function

ResearchAnalystEngineering

Industries

Marketing and AdvertisingInformation Technology and ServicesComputer Software

6/17/2019

Data Scientist

Krish Info Tech, inc · Bentonville, AR, US

5 days ago · 0 applicants

Apply on company website

5 - 7 yrs of total IT experience Must have skills Hadoop, Python (must know Python scripts writing), Cassandra. 4 years' experience with SQL and relational databases (for example, DB2, Oracle, SQL Server). 4 years' experience with statistical programming languages (for example, SAS, R). Bachelor's degree in Statistics, Economics, Analytics, Mathematics and 7 years' experience in an analytics related field. Certificate in business analytics, data mining, or statistical analysis. Candidate needs to work closely with Business teams in Data gathering, evaluation, Algorithm creation, and implementation Knowledge of quantitative analysis, machine learning, data mining Experience with big data technology (Hadoop, Hive, Spark, Hbase etc.) and data processing pipeline Experience in Real-Time stack and Streaming technologies (example Kafka) a plus Experience in AnomalyOutlier Detection techniques Experience with at least one compiled programming language (Java or another object oriented)

- Seniority level
  Entry level
- Employment type
  Full-time
- Job function
  EngineeringInformation Technology
- Industries
  Information Technology and ServicesComputer SoftwareInformation Services

6/17/2019

Associate Research Analyst

Acxiom · Conway, AR, US

2 weeks ago · 5 applicants

Apply on company website

The Associate Research Analyst will work with more senior analysts and product managers to perform a variety of analytical work. The work may include researching and describing the quality and value of a potential new data supplier, managing and updating data in a data repository, extracting and analyzing data to answer complex questions, auditing data to ensure quality, developing regression models to predict behaviors, researching and resolving data supplier issues, streamlining and improving processes for analyzing data, running comparisons of data across platforms to identify differences, and working with international data and data sources.

What You Will Need

- Experience writing and running SQL and generating reports; SAS experience is ideal.
- Experience using advanced statistical methods to analyze data and build models.
- Experience analyzing first or third party data in a marketing database.
- Knowledge and experience working with US Census data or International Census data is desired.
- Bachelors Degree in Statistics, Data Quality, Data & Analytics, Business, Math or related field with 2+ years experience; or a Masters degree in similar field.
- Experience with Microsoft Office Suite, especially Excel
- Experience in building datasets and analyzing data; experience working with unstructured data
- Experience with data manipulation, reporting and analytical tools such as SAS, R, Tableau, Altureyx.
- Experience working with machine learning algorithms and tools
- Ability to present detailed analysis using verbal descriptions, tables, graphs and charts
- Good communication skills; including flow charting, project planning and project documentation
- Quick learner with strong critical thinking skills
- Detail oriented

Primary Location City/State:
Conway, Arkansas

Business Data Analyst

Delta Dental of Arkansas ★★★★☆ 602 reviews - Sherwood, AR 72120

Apply On Company Site

A million smiles must know something! For more than a quarter of a century, Delta Dental of Arkansas has been providing innovative, high quality and affordable dental and vision benefits for employers and individuals in Arkansas. We have been voted one of Arkansas' Best Places to Work six years in a row and are now recruiting great people like you to start a career with us!

Some of the great benefits Delta Dental offers:

- Competitive pay with bonus opportunities
- Excellent insurance package including fully paid dental, short term disability, long term disability, and life insurance
- Education assistance
- 401(k) matching and profit sharing plan

Job **Summary:** Take responsibility for responding to business data analytics requests from across the organization by communicating with stakeholders, collaborating in defining requirements, and executing project tasks necessary to deliver information that is easy to understand and interpret, with a primary goal of providing insights that drive informed business decisions.

Primary Job Responsibilities:

- Communicates with stakeholders to understand analytics requirements, documents targeted outcomes, defines effort required to deliver those outcomes, and executes tasks necessary to deliver expected results. Provides regular status updates both within the department as well as to necessary stakeholders.
- Designs, implements, and maintains various levels of application programs necessary to complete job functions.
- Acquires, manages, and manipulates structured data from primary or secondary data sources, inspects, maintains, organizes, cleans, troubleshoots, and analyzes business data to facilitate identifying data driven patterns, trends, or insights. Prepares conclusions based on that information, and delivers those to organizational stakeholders in a method that is easy to understand and interpret.
- Evaluates data and associated risk, removing invalid information, while supporting initiatives for data governance and data integrity.
- Provides support in managing and designing the analytics environment, including data sources, storage structures, security, and metadata.
- Responsible for all the stages of the development of dynamic business intelligence reporting tools, from structuring data solutions to support the analytical outcome to training end users.
- Develops, monitors, implements, and improves upon existing and new standards and best practices for the Business Analysis function, upon approval from leadership.

Perform other related assigned duties as necessary to complete the Primary Job Responsibilities as described above.

Minimum Qualifications:

Position requires a bachelor's degree in Mathematics, Economics, Computer Science or related field and three years' of relevant experience. At least one year experience with a programming language such as SAS, SQL, or R. SAS programming experience preferred. Will accept any suitable combination of education, training or experience.

Position requires intermediate experience working with databases, advanced analytical skills, attention to detail, the ability to communicate both written and orally, and the ability to consistently process confidential data and information according to guidelines.

30+ days ago

Statistical Programmer - Boston, MA - BioPharma

i-Pharm Consulting - United States

$85,000 - $105,000 a year - Sponsored

Apply Now

SAS Programmer - Boston, MA - Competitive Pay - No Travel - Excellent Benefits!

i-Pharm Consulting have partnered with a rapidly growing Bio-Pharmaceutic organization who is seeking an experienced Statistical Programmer to join their team. This opportunity will allow you to step in as one of the first in-house statistical programmers where you'll be able to directly communicate across all levels of business leadership. As the SAS Programmer working alongside the Director, SAS Programming you will be in a position to lead programming efforts across numerous studies within various phases of trials. The client has gone through tremendous growth over the last few years and is now preparing to take the next step as they have several late phase studies with goals of going to market with a product soon!

Offering:

- Strong pipeline with numerous studies within early & late phases of trials
- Excellent opportunity for career progression
- Highly collaborative & close knit team culture
- Start-up "feel & excitement" with a strong foundation and proven successful business model
- Bonuses
- Stock options
- Comprehensive benefits package

Responsibilities:

- The SAS Programmer may also contribute to departmental initiatives such as infrastructure development, imaging and other large database access, real world data access, software/tool development and other efforts.
- Demonstrate excellent problem-solving skills, a proactive approach and a willingness to make decisions on a regular basis.
- Work on complex problems where analysis of situations or data requires an evaluation of intangible variables; development of technical solutions to abstract problems which require the use of ingenuity and creativity
- Demonstrate Good experience with CDISC standards
- Display a positive attitude at all times, promoting and contributing to good team spirit in a professional environment.

Education / Qualifications

- Bachelors Degree in Statistics, Math, Computer Science or related discipline.
- You should be able to demonstrate a robust and comprehensive expertise working as a SAS Programmer in the clinical research industry, preferably at a Pharma company.
- Must have a general understanding of regulatory guidelines and their application to data submissions.
- Must have the ability to work with limited supervision on multiple assignments.
- You must be fluent in English language (both verbal and written).

If you are interested in learning more about this opportunity, please apply for more information.

Job Type: Full-time

Salary: $85,000.00 to $105,000.00 /year

Experience:

6/17/2019

- CDISC, SDTM, ADaM: 3 years (Preferred)
- SAS Programming within Clinical Trials: 3 years (Preferred)
- Statistical Programming: 3 years (Preferred)
- working with a Biotech or Pharmaceutical company: 3 years (Preferred)

Education:

- Bachelor's (Preferred)

Location:

- United States (Required)

Work authorization:

- United States (Required)

Additional Compensation:

- Bonuses

Benefits offered:

- Paid time off
- Parental leave
- Dental insurance
- Health insurance
- Healthcare spending or reimbursement accounts such as HSAs or FSAs
- Retirement benefits or accounts

30+ days ago

Bachelor of Science in

Applied Statistics with Actuarial Science Option or Computer Science Option

Departmental Support

ADHE New Program Proposal

From: **Tracy Cole <tcole7@atu.edu>**
Sent: **Monday, June 17, 2019 3:14 PM**
To: **Jeanine Myers <jmyers32@atu.edu>**
Subject: **Re: Applied Stats Approval Form**

Hi Jeanine,

I've attached the signed form for you. Good luck with the new program.

Tracy

Tracy Cole, J.D.
Interim Department Head, Accounting & Economics
Associate Professor of Legal Studies

Arkansas Tech University
College of Business
Rothwell Hall 430
Russellville, AR 72801
479-968-0491

From: **Jeanine Myers**
Sent: **Monday, June 17, 2019 8:54:13 AM**
To: **Tracy Cole**
Subject: **Applied Stats Approval Form**

Dr. Cole,

I hope this email finds you well. The Mathematics Department is proposing a new bachelor's degree in Applied Statistics. The curriculum includes several courses in economics and accounting. More advanced courses, for example, FIN 3063, FIN 4043 will be possible electives for the students. Please look over the attached document. If you approve and support the changes, please sign the form and email it back to me within the next few days. If you have questions regarding the changes, please do not hesitate to let me know.

Thanks,
Jeanine

Jeanine L. Myers, Ph.D
Mathematics Department Head
Associate Professor of Mathematics
204 Corley Building
Email: jmyers32@atu.edu
Phone: (479)968-0659

Arkansas Tech University
DEPARTMENTAL SUPPORT FORM

This form must be completed for every department affected by the course change.

Department Affected: Department of Accounting, Finance & Economics	This department ☑ supports ☐ does not support the change.
Comments: The Department of Mathematics & Statistics is proposing a **Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option.** The **BS in Applied Stat with Actuarial Science Option** requires ECON 2003, ECON 2013, ACCT 2003, ACCT 2013. ECON 2003 is required during the fall of the Freshman year. ECON 2013 is required during the spring of the Freshman year. ACCT 2003 is required during the fall of the Sophomore year. ACCT 2013 is required during the spring of the Sophomore year. STAT 3153, as an alternative to BUAD 2053, in the prerequisites for FIN 3063.	

Department Head Signature: Tracy Cole

Date: 6-17-19

From: **Kim Troboy <ktroboy@atu.edu>**
Sent: **Monday, June 17, 2019 12:09 PM**
To: **Jeanine Myers <jmyers32@atu.edu>**
Subject: **Re: Stats Proposal Approval**

Jeanine,

I'd be happy to support this change. Please see the attached file with my signature.

I'll also put a note in the 'To my successor' file to be aware of this and to check with you on numbers before creating the spring schedule. Dr. David Pumphrey will be the new Department Head, starting in August.

Warm regards,

Kim

Dr. Kim Troboy,
Professor of MIS **Interim Head, Mgmt. & Mkt. Dept.**
College of Business **Rothwell 432**
Arkansas Tech University **479-968-0630 ofc**
106 West O Street **479-356-6211 fax**
Russellville, AR 72801 USA

From: **Jeanine Myers**
Sent: **Monday, June 17, 2019 8:58:33 AM**
To: **Kim Troboy**
Subject: **Stats Proposal Approval**

Dr. Troboy,
I hope this email finds you well. As you know, the Mathematics Department is proposing a new bachelor's degree in Applied Statistics. The curriculum includes several BDA and BUAD courses. The attached document lists the course changes needed, which we talked about before. If you approved and support the changes, please sign the document and email it back to me within the next few days. If you have questions regarding the changes, please do not hesitate to let me know.

Thanks,
Jeanine

Jeanine L. Myers, Ph.D
Mathematics Department Head
Associate Professor of Mathematics
204 Corley Building
Email: jmyers32@atu.edu
Phone: (479)968-0659

Arkansas Tech University
DEPARTMENTAL SUPPORT FORM

This form must be completed for every department affected by the course change.

Department Affected: Department of Management & Marketing	This department ☒ supports ☐ does not support the change.
Comments: The Department of Mathematics & Statistics is proposing **a Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option.** The **BS in Applied Stats with Actuarial Science Option** requires BUAD 2003, BDA 2003. BUAD 2003 is required during the fall of the Freshman year. BDA 2003 is required during the fall of the Sophomore year. The **BS in Applied Stats with Computer Science Option** requires BUAD 2003, BDA 2003, BDA 3053. BUAD 2003 is required during the fall of the Freshman year. BDA 2003 is required during the spring of the Freshman year. BDA 3053 is required during the Spring of the Sophomore year. STAT 3153, as an alternative to BUAD 2053, in the prerequisites for BDA 3053.	

Department Head Signature: Kim Inobeay

Date: 6-17-19

We are still waiting for the reply from the Departmental Support Form from the Computer Science Department.

Arkansas Tech University
DEPARTMENTAL SUPPORT FORM

This form must be completed for every department affected by the course change.

Department Affected: Department of Computer & Information Science	This department ☒ supports ☐ does not support the change.
Comments: The Department of Mathematics & Statistics is proposing **a Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option.** The **BS in Applied Stat with Actuarial Science Option** requires COMS 2104. This course is required during the spring of the Sophomore year. The **BS in Applied Stat with Computer Science Option** requires COMS 2104, COMS 2203, COMS 2213. COMS 2104 is required during the spring of the Sophomore year. COMS 2203 is required during the Fall of the Junior year. COMS 2213 is required during the Spring of the Junior year. Moreover, COMS 3233, COMS 3243, COMS 4353, or a COMS course at the 3000-4000 level will be elective for both Fall and Spring of the senior year. Allow STATS students to take COMS 2104 without taking COMS 1403 and COMS 1411. MATH 2703, as an alternative to COMS 2903, in the prerequisites for COMS 2213 and COMS 3233.	

Department Head Signature: Liang Mahoshek

Date: 6/27/2019

Bachelor of Science in

Applied Statistics with Actuarial Science Option or Computer Science Option

Marketing Plan

ADHE New Program Proposal

Arkansas Tech University engages in a variety of marketing initiatives to inform prospective students about the educational opportunities that it offers. These include advertisements on television, online, in print and through other channels as they become available and constructive in reaching stated objectives. All marketing messages and placements are tailored to reach specific audiences based upon regularly conducted research about the educational needs of prospective students and their awareness of Arkansas Tech.

These marketing efforts are supported by internal and external communication initiatives that leverage internal channels such as www.atu.edu, www.arkansastechnews.com and Arkansas Tech's social media presences as well as external channels such as newspapers, television stations, radio stations and press services. The external communication initiatives aid in constantly elevating the brand of Arkansas Tech, while internal communications represent an important retention tool by creating a better informed and more engaged student population.

As it relates to new academic programs such as the proposed Applied Statistics degree in the Arkansas Tech Department of Mathematics and Statistics, marketing and communication programs are designed to create awareness of the new degree, points of differentiation that make it a good option for prospective students and potential positive outcomes for graduates of the program. Specific tactics may include some or all of the following options: a presence on www.atu.edu, news releases announcing the new program, inclusion in marketing campaigns on behalf of the university and brochures and similar publications that include information about the program. These marketing and communication goals are established and pursued through collaboration between staff from the Office of University Relations and faculty members from the academic discipline.

MARKET RESEARCH BRIEF

Market Viability of Bachelor's- and Master's-Level Statistics Programs

Analysis of Employer Demand Trends, Program Design, and Student Trends

COE Forum

©2017 EAB Global, Inc. • All Rights Reserved.

COE Forum

Bridget Moran
Market Research Associate

Kacper Coulter
Market Research Manager

LEGAL CAVEAT

EAB Global, Inc. ("EAB") has made efforts to verify the accuracy of the information it provides to members. This report relies on data obtained from many sources, however, and EAB cannot guarantee the accuracy of the information provided or any analysis based thereon. In addition, neither EAB nor any of its affiliates (each, an "EAB Organization") is in the business of giving legal, accounting, or other professional advice, and its reports should not be construed as professional advice. In particular, members should not rely on any legal commentary in this report as a basis for action, or assume that any tactics described herein would be permitted by applicable law or appropriate for a given member's situation. Members are advised to consult with appropriate professionals concerning legal, tax, or accounting issues, before implementing any of these tactics. No EAB Organization or any of its respective officers, directors, employees, or agents shall be liable for any claims, liabilities, or expenses relating to (a) any errors or omissions in this report, whether caused by any EAB organization, or any of their respective employees or agents, or sources or other third parties, (b) any recommendation by any EAB Organization, or (c) failure of member and its employees and agents to abide by the terms set forth herein.

EAB is a registered trademark of EAB Global, Inc. in the United States and other countries. Members are not permitted to use these trademarks, or any other trademark, product name, service name, trade name, and logo of any EAB Organization without prior written consent of EAB. Other trademarks, product names, service names, trade names, and logos used within these pages are the property of their respective holders. Use of other company trademarks, product names, service names, trade names, and logos or images of the same does not necessarily constitute (a) an endorsement by such company of an EAB Organization and its products and services, or (b) an endorsement of the company or its products or services by an EAB Organization. No EAB Organization is affiliated with any such company.

IMPORTANT: Please read the following.

EAB has prepared this report for the exclusive use of its members. Each member acknowledges and agrees that this report and the information contained herein (collectively, the "Report") are confidential and proprietary to EAB. By accepting delivery of this Report, each member agrees to abide by the terms as stated herein, including the following:

1. All right, title, and interest in and to this Report is owned by an EAB Organization. Except as stated herein, no right, license, permission, or interest of any kind in this Report is intended to be given, transferred to, or acquired by a member. Each member is authorized to use this Report only to the extent expressly authorized herein.
2. Each member shall not sell, license, republish, distribute, or post online or otherwise this Report, in part or in whole. Each member shall not disseminate or permit the use of, and shall take reasonable precautions to prevent such dissemination or use of, this Report by (a) any of its employees and agents (except as stated below), or (b) any third party.
3. Each member may make this Report available solely to those of its employees and agents who (a) are registered for the workshop or membership program of which this Report is a part, (b) require access to this Report in order to learn from the information described herein, and (c) agree not to disclose this Report to other employees or agents or any third party. Each member shall use, and shall ensure that its employees and agents use, this Report for its internal use only. Each member may make a limited number of copies, solely as adequate for use by its employees and agents in accordance with the terms herein.
4. Each member shall not remove from this Report any confidential markings, copyright notices, and/or other similar indicia herein.
5. Each member is responsible for any breach of its obligations as stated herein by any of its employees or agents.
6. If a member is unwilling to abide by any of the foregoing obligations, then such member shall promptly return this Report and all copies thereof to EAB.

Table of Contents

1) Research Methodology 4

Project Challenge 4

Methodology and Definitions 4

Burning Glass Labor/Insight™ 4

Project Sources 5

Profiled Institutions 5

2) Executive Summary 6

3) Market Considerations 7

Employer Demand over Time 7

In-Demand Titles 8

Employers with High Demand 9

Advertised Salaries 10

4) Program Characteristics 11

Advertised Education 11

In-Demand Skills 12

Program Modality 13

5) Enrollment and Recruitment 14

Student Demographics 14

Top Locations 15

Enrollment Trends 16

Marketing Messages 17

Appendix: Top Locations 18

©2017 EAB Global, Inc. • All Rights Reserved.

1) Research Methodology

Project Challenge

Leadership at Arkansas Tech University approached the Forum as they considered launching a new bachelor's- and master's-level statistics program. Through a combination of qualitative interviews with administrators of similar programs, quantitative data analytics, and secondary research, the Forum sought to assess the market viability of a bachelor's- and master's-level statistics program.

EAB's market research function provides insights which guide strategic programmatic decisions at member institutions. The Forum combines qualitative and quantitative data to help administrators identify opportunities for new program development, assess job market trends, and align curriculum with employer and student demand.

EAB reports rely primarily on labor market data from the Burning Glass Labor/InsightTM tool (description below). Reports occasionally use data from the United States Census Bureau and United States Bureau of Labor Statistics data to explore occupation and job trends. Market research reports may also incorporate Integrated Postsecondary Education Data System (IPEDS) data to assess student enrollment, demographics, and completion rates across competitor programs.

Methodology and Definitions

Methodology: Unless stated otherwise, this report includes data from online job postings from April 1, 2017 to March 31, 2018. To best estimate the market demand for bachelor's- and master's-level statistics professionals, the Forum examined postings for professionals with a bachelor's- and master's-level degree and statistics-related skills (e.g., 'statistics,' 'statistical modeling,' 'variance analysis). The Forum identified the top titles, employers, and skills for bachelor's- and master's-level statistics professionals in Arkansas.

Annual growth in job postings is measured in the change between July 2013 and December 2017 by six-month halves (i.e., H2 2014 is July 2014 to December 2014).

Definitions: "Region" and "regionally" refer to the following states: Arkansas, Louisiana, Missouri, Mississippi, Oklahoma, Tennessee, and Texas.

"State" and "statewide" refer to Arkansas.

Burning Glass Labor/Insight™

EAB's Partner for Real-Time Labor Market Data

This report includes data made available through EAB's partnership with Burning Glass Technologies, a Boston-based leader in human capital data analytics. Burning Glass Technologies specializes in the use of web spidering technology to mine more than 80 million online job postings and analyze real-time employer demand. Under this partnership, EAB may use Burning Glass's proprietary Labor/Insight™ tool to answer member questions about employer demand for educational requirements, job titles, and competencies over time, as well as by geography. The tool considers job postings "unspecified" for a skill, industry, employer, geography, certification, or educational requirement when the job posting did not advertise for one of these particular job characteristics. Unspecified postings represent null values and should be excluded from the total number (n value) of job postings analyzed in the query. A

©2017 EAB Global, Inc. • All Rights Reserved.

more complete description of the tool is available at http://www.burning-glass.com/products/laborinsight-market-analysis/.

For more information about the Labor/Insight™ tool, please contact Betsy Denious, Director of Business Development Learning & Policy at bdenious@burning-glass.com or 301-525-6596.

Project Sources

The Forum consulted the following sources for this report:

- ACT (act.org)
- Data USA (datausa.io)
- The College Board (collegeboard.org)
- EAB's internal and online research libraries (eab.com)
- LinkedIn (linkedin.com)
- National Center for Education Statistics (NCES) (nces.ed.gov)
- SAT (https://collegereadiness.collegeboard.org/sat)
- Society for Human Resources Management (shrm.org)
- The United States Bureau of Labor Statistics (BLS) (bls.gov)
- Profiled program websites

Profiled Institutions

The Forum spoke to administrators or profiled programs via secondary research at the following institutions:

A Guide to Institutions Profiled in this Brief[1]

Institution	Location	Approximate Institutional Enrollment (Undergraduate/Total)	Classification
Institution A	Mid-Atlantic	7,500 / 18,500	Doctoral Universities: Highest Research Activity
Institution B	Midwest	9,000 / 22,000	Doctoral Universities: Highest Research Activity
Institution C	Midwest	6,000 / 16,000	Doctoral Universities: Highest Research Activity
Institution D	Mid-Atlantic	11,000 / 13,500	Doctoral Universities: Higher Research Activity
Institution E	South	14,000 / 16,000	Master's Colleges & Universities: Larger Programs
Institution F	South	25,500 / 34,000	Doctoral Universities: Highest Research Activity

1) National Center for Education Statistics and Maclean's.

©2017 EAB Global, Inc. • All Rights Reserved.

2) Executive Summary

Administrators at *Arkansas Tech University* should note increased regional demand for bachelor's- and master's-level statistics professionals. Regional employer demand for bachelor's- and master's-level statistics professionals increased from 14,702 postings in H2 2013 to 19,889 postings in H2 2017 (i.e., 35 percent). However, statewide employer demand for bachelor's- and master's-level statistics professionals decreased 13 percent during the same time period (i.e., from 640 to 558 postings); this represents a faster rate of decline than the six percent decrease for all bachelor's- and master's-level professionals in Arkansas during that time. Overall, the Bureau of Labor Statistics (BLS) projects employment of "statisticians" to grow 33 percent from 2016 to 2026.

Prioritize the development of a bachelor's-level statistics program to meet strong employer demand for statistics professionals with a bachelor's-level degree. Employers in Arkansas prefer statistics professionals to possess a bachelor's-level degree in 63 percent of specified postings in the past year (i.e., 1,231 of 1,409 specified postings). Furthermore, state employers express demand for statistics professionals with a minimum of a bachelor's-level degree in 83 percent of specified postings during that same time (i.e., 1,089 of 1,316 specified postings). According to Data USA, 50 percent of working professional in the "math and statistics" field hold a bachelor's degree.

Ensure prospective bachelor's- and master's-level statistics programs confer in-demand data analytics skills. Data analytics skills (e.g., 'data analysis,' 'SQL') represent eleven of the top 20 skills statewide employers seek from bachelor's- and master's-level statistics professionals in the past 12 months. Employers in Arkansas express demand for bachelor's- and master's-level statistics professionals with 'data analysis' skills in 66 percent of specified postings (i.e., 808 of 1,228 postings). Profiled institutions offer courses such as "analysis of qualitative data" and "longitudinal data analysis" to confer in-demand data and analysis skills.

Target recruitment efforts to metropolitan statistical areas (MSAs) in Texas to secure program enrollments. Texas MSAs (e.g., Dallas-Fort Worth-Arlington, TX, Houston-The Woodlands-Sugar Land, TX) represent four of the ten largest regional employer markets for bachelor's- and master's-level statistics professionals during the past 12 months. The Dallas-Fort Worth-Arlington, TX MSA represents the largest employer market for bachelor's- and master's-level statistics professionals in the region during that time, with 11,027 postings (i.e., 29 percent of postings).

©2017 EAB Global, Inc. • All Rights Reserved.

3) Market Considerations

Employer Demand over Time

Regional Demand for Bachelor's- and Master's-Level Statistics Professionals Increased 35 Percent from H2 2013 to H2 2017

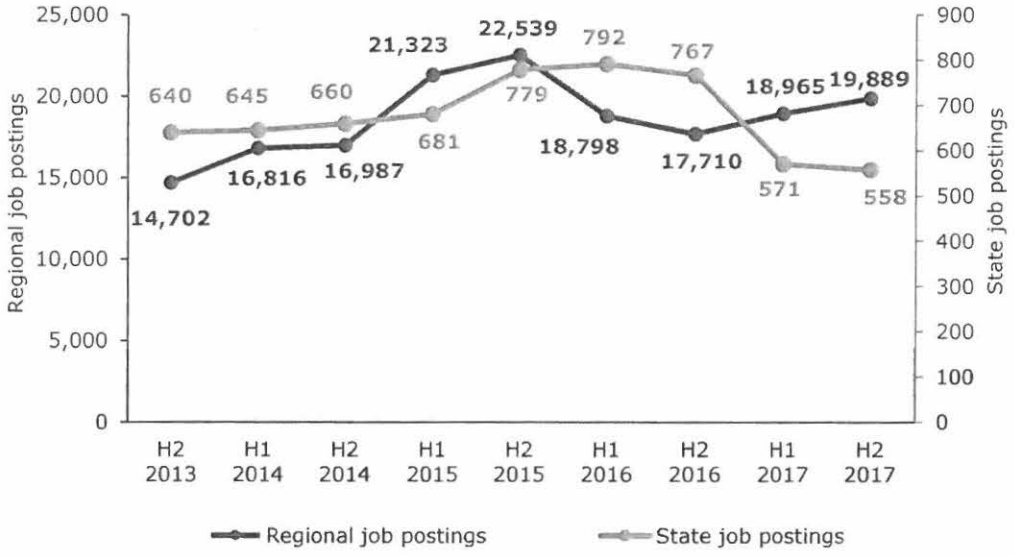
Administrators at **Arkansas Tech University** should note increased employer demand for bachelor's- and master's-level statistics professionals regionally. Regional employer demand for bachelor's- and master's-level statistics professionals increased 35 percent from 14,702 postings in H2 2013 to 19,889 postings in H2 2017. However, statewide demand for bachelor's- and master's-level statistics professionals decreased 13 percent during the same time period (i.e., from 640 to 558 postings). This represents a faster rate of decline than the six percent decrease for all bachelor's- and master's-level professionals in Arkansas during that time (i.e., 16,617 to 15,558 postings).

'Financial analysts' represents one of the **top three most-in demand occupations** for bachelor's- and master's-level statistics professionals during the past 12 months.

Administrators should expect continued growth for statistics-related occupations. The Bureau of Labor Statistics (BLS) projects demand for "statisticians" to increase 33 percent between 2016 and 2026, much faster that the average employment growth of seven and a half percent across all occupations.[2] The BLS attributes increased demand for "statisticians" to heightened demand for workers able to analyze the growing volume of digital and electronic data. Similarly, the BLS projects demand for "financial analysts" to increase 11 percent during the same time period.[3] The BLS attributes employment growth for "financial analysts" to an increase in the range of financial products.

Demand over Time for Bachelor's- and Master's-Level Statistics Professionals

July 2013-December 2017, Regional and State Data[4]



2) Bureau of Labor Statistics
3) Bureau of Labor Statistics
4) Burning-Glass Labor/Insight™

©2017 EAB • All Rights Reserved

In-Demand Titles

Prepare Bachelor's- and Master's-Level Statistics Graduates for In-Demand Analyst-Related Positions

Administrators at **Arkansas Tech University** should ensure prospective bachelor's- and master's-level statistics programs prepare graduates for in-demand analyst-related positions (e.g., 'data analyst,' 'business analyst'). Analyst-related titles represent nine of the 20 titles for which state employers seek bachelor's- and master's-level statistics professionals during the past 12 months. 'Data analyst' represents the most in-demand title for bachelor's- and master's-level professionals during the same time, with 60 relevant postings (i.e., five percent).

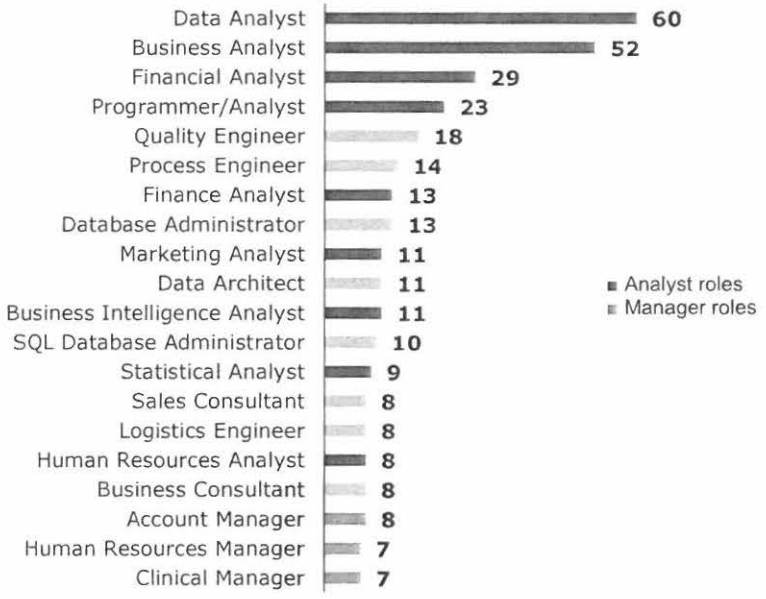
Employers in Arkansas seek bachelors'- and master's-level statistics professionals for analyst-related positions across a variety of industries, such as 'general merchandise stores' and 'insurance carriers and related activities.' To prepare graduates to work across industries and to diversify skillsets, administrators at **Institution F** encourage bachelor's-level statistics students to complete a minor or double major. Contacts at **Institution C** report master's-level predictive analytics students express interest in finance, marketing, and health care industries.

Administrators should also design prospective bachelor's- and master's-level statistics programs to prepare graduates for in-demand management-related positions (e.g., 'account manager,' 'human resources manager'). Management-related positions account for three of the top 20 titles for which state employers seek bachelor's- and master's-level statistics professionals.

Top Titles for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, State Data[5]

n=1,228 job postings, 0 unspecified postings



5) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

Employers with High Demand

Partner with Health Insurance Companies to Provide Students with Experiential Learning Opportunities

Administrators at **Arkansas Tech University** should partner with health insurance companies, such as Anthem Blue Cross, to provide experiential learning opportunities for enrolled students (e.g., internships, applied learning projects). Health insurance companies represent three of the 20 state employers with most demand for bachelor's- and master's-level statistics professionals in the past year. Overall, the 'insurance carrier' industry expresses demand for bachelor's- and master's-level statistics professionals in seven percent of specified statewide postings during the same time (i.e., 87 of 1,160 specified postings). See Appendix B for a full list of in-demand industries.

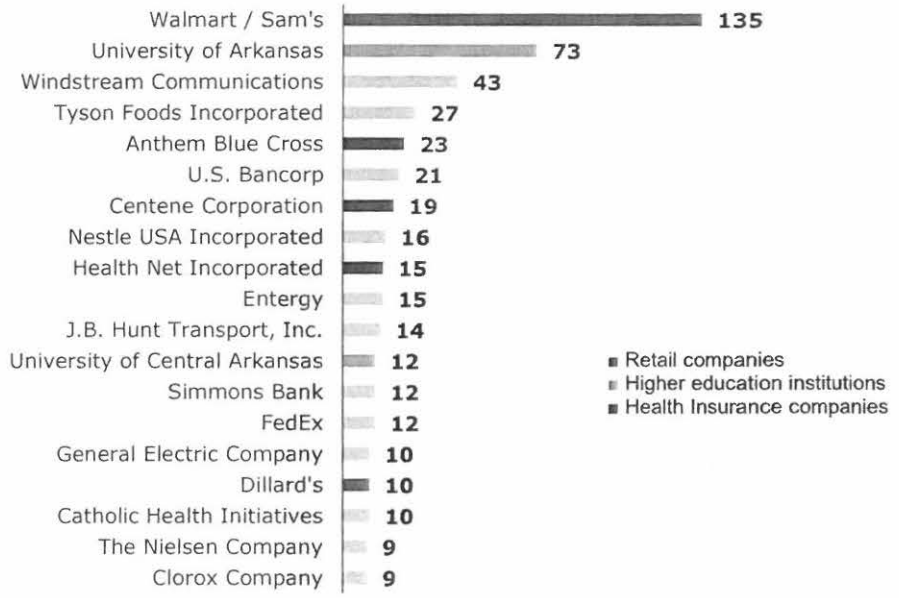
Additionally, administrators should note strong demand from higher education institutions for bachelor's- and master's-level statistics professionals. Higher education institutions (e.g., University of Arkansas, University of Central Arkansas) account for two of the 20 state employers with most demand for bachelor's- and master's-level statistics professionals during the past 12 months. Employers in the 'colleges, universities, and professional schools' industry express demand for bachelor's- and master's-level statistics professionals in 130 postings during the same time (i.e., 11 percent of relevant postings). Higher education institutions frequently seek bachelor's- and master's-level statistics professionals for 'program associate' and 'programmer/analyst' positions.

Lastly, administrators should require students to conduct real-world data analysis through in-class research projects where students source and analyze data. Contacts at **Institution D** report that employers seek bachelor's-level statistics graduates with real-world data analysis experience, rather than only textbook data set experiences. Consequently, administrators at Institution D encourage bachelor's-level statistics students to pursue data analysis internship opportunities to gain the requisite real-world experience with data.

Top Employers for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, State Data[6]

n=1,228 job postings, 108 unspecified postings



6) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

Advertised Salaries

Promote High Earning Potential for Program Graduates to Appeal to Prospective Students

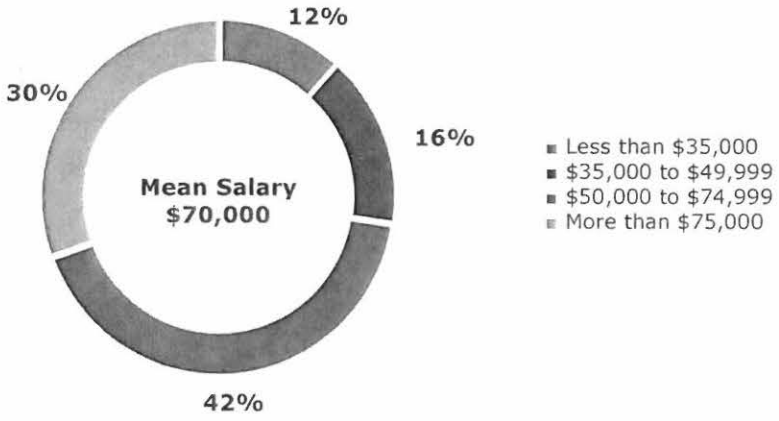
Administrators at **Arkansas Tech University** should note 93 percent of state job postings for bachelor's- and master's-level statistics professionals exclude compensation information. However, of 95 postings that specify for salary level during the past 12 months, 29 advertise an annual salary of more than $75,000 (i.e., 31 percent of specified postings). Additionally, employers advertise a salary between $50,000 and $74,999 in 42 percent of relevant postings during that time (i.e., 40 postings). Employment data from Data USA indicates an average salary of $92,595 for "math and statistics" graduates during 2015.[7] For "statisticians" specifically, the BLS reports an average salary of $80,500.[8]

This data excludes 93 percent of state postings that do not specify for salary.

Advertised Salary for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, State Data[9]

n=1,313 postings, 1,218 unspecified postings



7) Data USA
8) Bureau of Labor Statistics
9) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

4) Program Characteristics

Advertised Education

Prioritize the Development of a Bachelor's-Level Statistics Program to Meet Statewide Employer Demand

Administrators at **Arkansas Tech University** should note strong employer demand for statistics professionals with a bachelor's-level degree. State employers prefer statistics professionals to possess a bachelor's-level degree in 63 percent of specified postings in the past year (i.e., 1,231 of 1,409 specified postings). Furthermore, employers require statistics professionals to possess a bachelor's-level degree in 83 percent of relevant job postings during that that time (i.e., 1,089 of 1,316 postings). However, according to Data USA master's-level degrees represent that most commonly awarded statistics degrees nationally in 2015.[10] Master's-level degrees represent 51 percent of statistics degrees awarded nationally in 2015.

Administrators should further note employers in Arkansas seek bachelor's- and master's-level statistics for similar positions. Employers statewide most frequently seek bachelor's-level statistics professionals for 'data analyst,' 'business analyst,' and 'financial analyst' positions in the past year. Similarly, state employers most frequently seek master's-level statistics professionals for 'data anlyst,' 'statistical analyst,' and 'business analyst' positions during that same time.

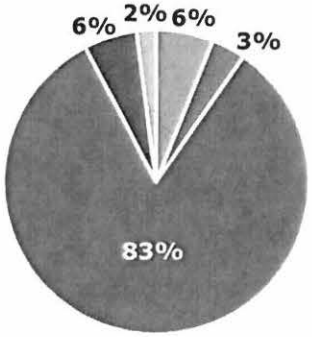
A single posting may contribute more than one data point within the graph as postings may advertise both a required and preferred level of education.

Advertised Education Level for Statistics Professionals

April 2017-March 2018, State Data[11]

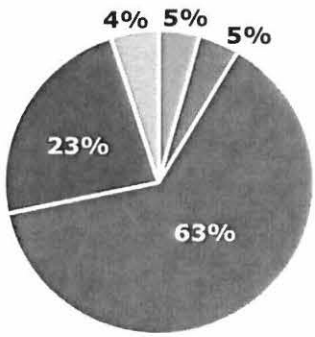
Minimum Advertised Education

n=1,728 job postings, 412 unspecified postings



All Advertised Education

n=1,783 job postings, 374 unspecified postings



- High School or Vocational Training
- Bachelor's-Level Degree
- Associate's-Level Degree
- Master's-Level Degree
- Doctoral-Level Degree

10) Data USA
11) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

In-Demand Skills

Offer Data Analytics Focused Courses to Prepare Graduates for In-Demand Employment Outcomes

As expected, administrators at **Arkansas Tech University** should design prospective bachelor's- and master's-level statistics programs with coursework to confer in-demand data analytics skills. Data analytics skills (e.g., 'data analysis,' 'SQL') represent eleven of the top 20 skills statewide employers seek from bachelor's- and master's-level statistics professionals in the past 12 months. Employers in Arkansas express demand for bachelor's- and master's-level statistics professionals with 'data analysis' skills in 808 of 1,228 postings (i.e., 66 percent of specified postings). Profiled institutions offer courses such as "analysis of qualitative data," "data mining," and "longitudinal data analysis" to confer in-demand data analytics skills.

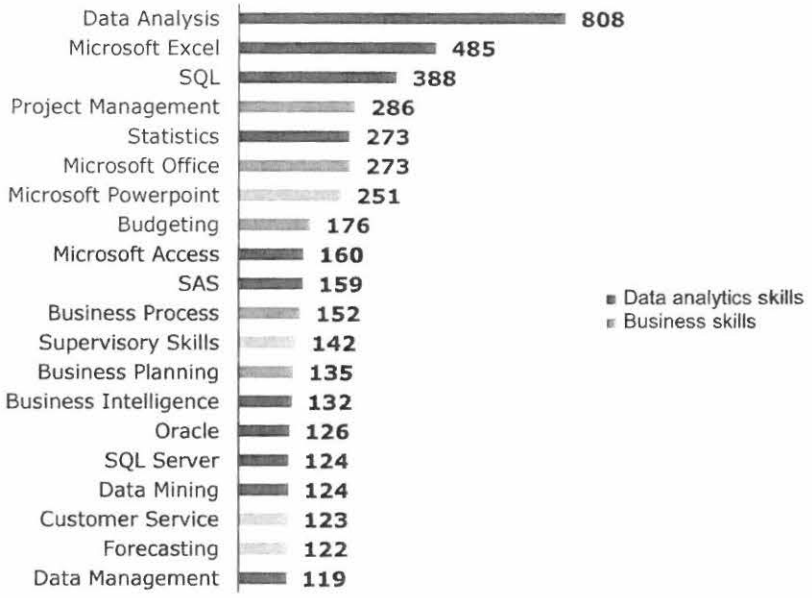
According to a recent study by the Society for Human Resource Management, 59 percent of organizations expect to increase the number of positions requiring data analysis skills between 2016 and 2021.[12] Further, a LinkedIn study suggests "statistical analysis and data mining" represents the second most in-demand technical skill national employers seek in 2018.[13]

Additionally, administrators should require students to complete programming language coursework to confer in-demand programming skills. Administrators at **Institution D** and **Institution F** emphasize employer preference for bachelor's-level statistics graduates with knowledge of programming languages. More specifically, contacts at Institution D and Institution F report employers frequently seek bachelor's-level statistics students experienced with 'SAS' due to the popularity of the language among data science companies. Employers in Arkansas express demand for bachelor's- and master's-level statistics professionals with 'SAS' skills in 159 postings during the past year (i.e., 13 percent of relevant postings). Institution F offers a bachelor's-level course in "advanced SAS programming" to confer in-demand programming skills.

Top Skills for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, State Data[14]

n=1,228 job postings, 0 unspecified postings



12) Society for Human Resource Management
13) LinkedIn
14) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

Program Modality

Offer a Prospective Bachelor's-Level Statistics Program In-Person to Align with Current Offerings

Administrators at **Arkansas Tech University** should note all profiled programs employ a traditional face-to-face format for bachelor's-level statistics programs. However, administrators at **Institution F** offer some bachelor's-level statistics in an online format as elective coursework from the fully online master's-level applied statistics program overlaps with the undergraduate program.

Furthermore, administrators at profiled institutions do not plan to offer bachelor's-level statistics programs online. Contacts at Institution F report current online offerings in the bachelor's-level statistics program do not elicit sufficient enrollments. At **Institution D**, administrators attribute the in-person format of the bachelor's-level statistics program to reluctance among statistics faculty to convert courses to an online format. While administrators at profiled institutions do not offer the bachelor's-level statistics program online, they do not indicate that an online program would be unsuccessful. Feedback from program administrators suggests an online bachelor of science in statistics program may fill a gap in both student and employer demand.

At the master's-level, administrators should note profiled programs deliver master's-level statistics programs in a format convenient for working professionals. **Institution B** and Institution F offer master's-level programs fully online. While Institution C offers the master's-level analytics program in-person due to the complexity of the material, students complete courses in the evening and on Saturdays.

Modality Comparison for Bachelor's- and Master's-Level Statistics Programs

Profiled Institutions

Institution	Program Name	Modality
Institution A	M.S. in Mathematics and Statistics	In-person
Institution B	B.S. in Statistics	In-person
	M.S. in Statistics	In-person
	M.S. in Predictive Analytics	Online
Institution C	B.A. or B.S in Statistics	In-person
	M.S. in Statistics	In-person
	M.S. in Analytics	In-person
Institution D	B.S. in Statistics	In-person
	M.S. in Statistics	In-person
Institution E	B.A. or B.S. in Statistics	In-person
	M.S. in Mathematical Sciences with a track in Statistics	In-person
Institution F	Bachelor's in Statistics	In-person
	M.S. in Statistics	In-person
	M.S. in Applied Statistics	Online

©2017 EAB • All Rights Reserved

5) Enrollment and Recruitment

Student Demographics

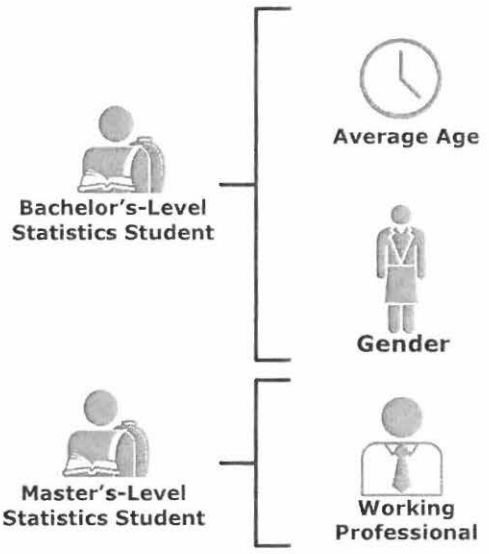
Focus Recruitment Efforts to Traditional Undergraduate Students to Secure Enrollments in a Prospective Bachelor's-Level Statistics Program

Administrators at **Arkansas Tech University** should market a prospective bachelor's-level statistics program to undergraduate students in the 18-22 year old age range. Administrators at **Institution D** and **Institution F** report recent high school graduates account for most enrollments in bachelor's-level statistics programs. Administrators at Institution D and Institution F also note 15-20 percent of students transfer into the bachelor's-level statistics program from community colleges.

Administrators should note a small percentage of high school students in Arkansas and nationwide intend to major in statistics based on reported SAT and ACT data. In 2017, one percent of SAT test-takers in Arkansas and nationwide report "mathematics and statistics" as an intended college major. Similarly, only three percent of ACT test-takers in Arkansas and nationwide reported "computer science and mathematics" as an intended college major in 2017.

Student Demographics for Bachelor's- and Master's-Level Statistics Programs

Profiled Institutions



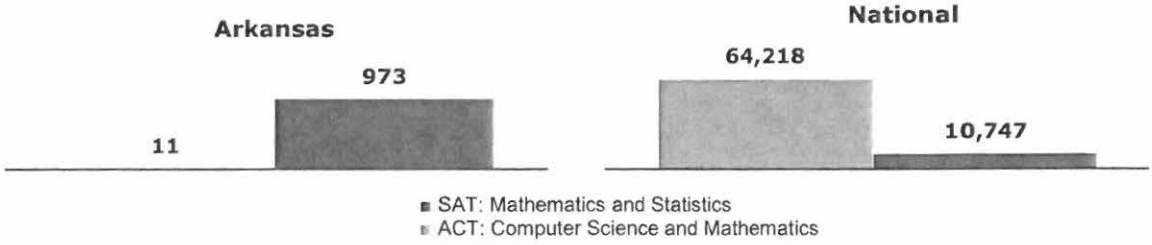
Profiled institutions primarily enroll first time freshmen (i.e., 18-22 year olds recent high school graduates) at the bachelor's-level. Administrators at **Institution D** and Institution F note 15-20 percent of students transfer into the statistics program from a community college.

Administrators at **Institution D** and **Institution F** note equal numbers of men and women enroll in the bachelor's-level statistics program.

Contacts at **Institution B** estimate 90 percent of students enrolled in the master's-level predictive analytics program work full time.

Intended Majors for High School Students

SAT and ACT, 2017 State[15] and National Data[16]



15) ACT and SAT
16) ACT and SAT

©2017 EAB • All Rights Reserved

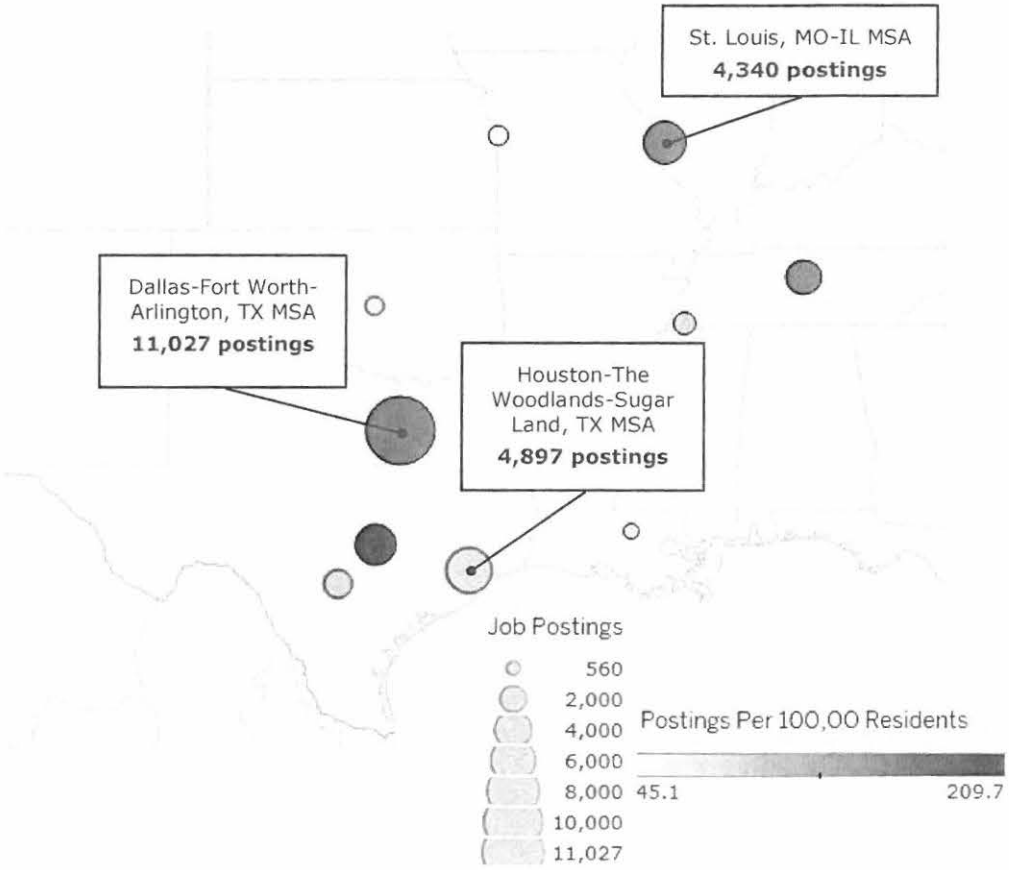
Recruit Students from Metropolitan Statistical Areas in Texas to Secure Program Enrollments

Administrators at **Arkansas Tech University** should focus primary recruitment efforts to metropolitan statistical areas (MSAs) in Texas. Texas MSAs (e.g., Dallas-Fort Worth-Arlington, TX, Houston-The Woodlands-Sugar Land, TX) represent four of the ten largest regional employer markets for bachelor's- and master's-level statistics professionals. The Dallas-Fort Worth-Arlington, TX MSA represents the largest employer market for bachelor's- and master's-level statistics professionals in the region, with 11,027 postings in the past year (i.e., 29 percent of postings regionally). The top four employer markets for bachelor's- and master's-level statistics professionals in Texas account for 57 percent of specified regional postings during the same time (i.e., 21,820 of 38,543 specified postings). See Appendix A for a full list of in-demand locations.

Top Metropolitan Statistical Areas for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, Regional Data[17]

n=40,210 job postings, 1,667 unspecified postings



17) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

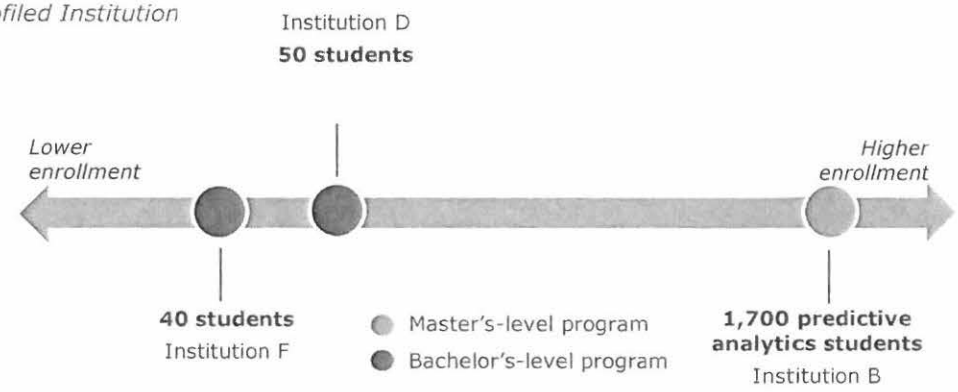
Only One Institution in Arkansas Reports Statistics Program Completions

Administrators at **Arkansas Tech University** should note limited competition from in-state statistics programs. In Arkansas, the **University of Arkansas** represents the only institution with reported bachelor's- and master's-level statistics degree completions from 2013-2015. Regionally, **Rice University**, the **University of Missouri-Columbia**, and **Texas A & M University-College Station** represent the top three institutions with reported bachelor's- and master's-level reported degree completions. Reported regional degree completions increased 47 percent between 2012-13 and 2014-15 (i.e., 248 to 364 reported degree completions).

Administrators should also note steady enrollments at profiled institutions. **Institution D** enrolls the most students of profiled bachelor's-level statistics programs, with 50 students in 2015. Administrators report the program began with 12-13 students; enrollments subsequently increased by 10 students each year. Similarly, contacts at **Institution F** reports steady enrollment numbers for the bachelor's-level statistics program. Administrators cite the increased popularity of AP statistics courses in the late 2000s as a factor in program enrollments.[18] At the master's-level, contacts at **Institution C** report demand for the master's-level predictive analytics exceeds available space.

Reported Enrollments in Comparable Bachelor's- and Master's-Level Statistics Programs

Profiled Institution



The forum analyzed reported bachelor's- and master's-level degree completions for CIP Code 27.05 (i.e., Statistics).

Reported Degree Completions for Bachelor's- and Master's-Level Statistics Programs

2013-2015, National Center for Education Statistics

Geographic Area	Number of Institutions	Reported Degree Completions			Change in Reported Degree Completions (2012-15)
		2012-13	2013-14	2014-15	
Arkansas	One	6	12	8	33 percent
Regional	23	248	319	364	47 percent

18) The College Board

©2017 EAB • All Rights Reserved

Marketing Messages

Highlight Potential Graduate Outcomes in Marketing Collateral to Boost Enrollments

Administrators at **Arkansas Tech University** should ensure marketing efforts emphasize student-centered outcomes to attract prospective students who seek enhanced career prospects upon graduation. EAB research indicates working professionals require tangible evidence of program value prior to enrollment. Consequently, program marketing should demonstrate how skills conferred in the program connect to, and meet, demonstrated labor demand.

For more information about how to effectively utilize student-centered marketing, the Forum suggests administrators see EAB's Competing on Student Outcomes to Attract Today's Career Changers study (2017).

Student-Centered Marketing for Bachelor's- and Master's-Level Statistics Programs

Profiled Institutions and EAB[19]

Student-centered recruitment checklist:

- Are **students like me** successful?
- **Why should I enroll** in this program?
- Will this program help me **achieve my goals**?
- What are my **next steps**?

"Students in Loyola's MS in Applied Statistics program embark on a journey that offers more than a valuable degree. **Each student's educational experience challenges them to think in different ways and learn new, important skills as they prepare for careers in this growing and varied field.** Recent graduates have continued their PhD studies or taken jobs at firms and universities such as A.C. Nielsen, Allstate, Bank of America..."

-Loyola University Chicago

"The undergraduate program in Statistics provides students with fundamental knowledge and skills related to probability, mathematical statistics, data analysis, and statistical computing. With the recent rise of Big Data, Data Science, and Analytics, **the demand for this set of skills has increased substantially.** A BS in Statistics is very flexible and can lead to a career in business, industry or government."

-University of Iowa

"Upon completing the B.A. degree, **students majoring in Statistics will be able to apply fundamental theory in probability and statistical inference**; have the skills and knowledge to apply and evaluate statistical models; will have master the ability to apply statistical computing for data analysis and data science; will be able to demonstrate competency as a professional statistician; and will have developed effective communication skills as a professional statistician."

-Rice University

19) EAB, "Competing on Student Outcomes to Attract Today's Career Changer: Turning Passive Interest into Program Enrollments"

©2017 EAB • All Rights Reserved

Appendix: Top Locations

Top Locations for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, Regional Data[20]

n=40,210 job postings, 1,667 unspecified postings

Metropolitan Statistical Area (MSA)	Number of Job Postings
Dallas-Fort Worth-Arlington, TX	11,027 postings
Houston-The Woodlands-Sugar Land, TX	4,897
St. Louis, MO-IL	4,340
Austin-Round Rock, TX	3,949
Nashville-Davidson-Murfreesboro-Franklin, TN	2,743
San Antonio-New Braunfels, TX	1,947
Memphis, TN-MS-AR	1,178
Kansas City, MO-KS	926
Oklahoma City, OK	819
Baton Rouge, LA	560

20) Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

Appendix B: Top Industries

Top Industries for Bachelor's- and Master's-Level Statistics Professionals

April 2017-March 2018, State Data[21]

n=1,313 job postings, 346 unspecified postings

Industry	Number of Job Postings
Other General Merchandise Stores	132
Colleges, Universities, and Professional Schools	111
Insurance Carriers	70
Wired Telecommunications Carriers	51
Depository Credit Intermediation	48
Management, Scientific, and Technical Consulting Services	46
General Medical and Surgical Hospitals	41
Advertising, Public Relations, and Related Services	31
Elementary and Secondary Schools	30
Animal Slaughtering and Processing	24

21)Burning Glass Labor/Insight™

©2017 EAB • All Rights Reserved

Workforce Analysis Request Form

Directions: An institution shall use this form to request workforce data analysis of a proposed degree program. In completing the form, the institution should refer to the document AHECB Policy 5.11 Approval of New Degree Programs and Units, which prescribes specific requirements for new degree programs. **Note:** This form is required to be submitted by the Chief Academic Officer or individual(s) they designate. Answers need not be confined to the space allotted but may extend to several pages.

Program Information for Analysis

1. Institution:

Arkansas Tech University

2. Program Name – Show how the program would appear on the Coordinating Board's program inventory (*e.g., Bachelor of Business Administration or Associate of Science in Accounting*):

Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

3. Proposed CIP Code: If the proposed program does not fit easily into one CIP Code, provide the code it most closely falls into and explain differences / nuances of your program

27.0599

4a. Standard Occupational Classification (SOC) from CIP-SOC Crosswalk:

Take SOC codes from NCES Crosswalk of CIP to SOC, ranked in order of relevance (i.e., the degree to which program graduates are expected to desire and/or be qualified to work in each occupation) **(See Appendix A)**

15-2041, 15-2011, 15-2031, 13-1111, 13-1161, 15-2021

4b. Standard Occupational Classification (SOC) from Expert/Staff Opinion (optional): If you think the standard NCES crosswalk accurately represents the list of occupations in which graduates of the proposed program will be qualified to work, leave this blank. If you think the list of target occupations is longer, shorter, or different, please provide an alternative list here, ranked in order of relevance. Feel free to add qualitative information about the variety of jobs and pay scales that may exist within target occupations, and where you expect graduates to fit in. **(See Appendix A)**

5. Brief Program Description – Describe the proposed program, the costs and investments involved in implementing it, the students you expect to recruit into it, and its educational objectives.

Demand for professionals with strong quantitative analytical skills is not new, but recent changes in the economy and the growing reliance of our businesses and governments on data have created an even greater need for workers who can manage data, produce informative visualizations of data, and are guided by fundamental statistical principles.

The curriculum in Applied Statistics is tailored to professionals who may be working with data and statistics in any industry including natural resources, environmental agencies, non-profit organizations, healthcare, insurance, business and finance, or any industry

where the analysis of data research results is required. The Applied Statistics degree includes courses in mathematical theory, statistical modeling, computer programing, economics, and business analytics.

Applied statistics with actuarial science option graduates will be able to:
** use mathematics, statistics, and financial theory to study the uncertainty of events.*
** analyze the financial consequences of risk.*
** evaluate the likelihood of future events & reduce the likelihood of undesirable events.*
** decrease the impact of undesirable events that do occur.*
** manage financial risk for an organization.*
** communicate concisely with other team members or the clients.*

Applied statistics with computer science option graduates will be able to:
** gather, view and analyze information to meet an organization's needs.*
** create visualizations and dashboards to help the team interpret the data collected.*
** measure and statistically analyze data.*
** translate data into digestible and accessible information.*
** communicate the findings to help make business decisions.*

The only cost that is associated with this new program is in creating designated statistics faculty. We already have an assistant professor of statistics, an associate professor of statistics without any extra salary cost, and will need an instructor of statistics position which can result from converting an instructor of mathematics position with an increase in salary cost of at most $7,750 according to CUPA numbers. There is no additional library resources or facilities and equipment required for this degree.

6. North American Industry Classification System (NAICS) – List some industries and/or companies which graduates would be most likely and/or qualified to work in (optional), and feel free to comment on why/in what capacity. Also, a description of the target industry in your region, its relative strength or weakness relative to other regions, and the reasons for that relative strength or weakness, is welcome. Lookup NAICS Code

See the EAB report: Market Viability of Bachelor's- and Master's-Level Statistics

7. Region of Possible Position(s) – Describe the region where you think graduates are most likely to work, e.g., in terms of a list of counties, a metropolitan statistical area, or a commuting radius:

See the EAB report: Market Viability of Bachelor's- and Master's-Level Statistics

8. Existing Data – Describe any existing anecdotes or data you have that would shed light on the job prospects of graduates from the proposed academic program. This data can be helpful to ADFA in conducting labor market analysis.

See the EAB report: Market Viability of Bachelor's- and Master's-Level Statistics

9. Proposed Implementation Date – (MM/DD/YY):

Summer 2020 (05/11/20)

10. Contact Person – Provide contact information for the person who can answer specific questions about the program:

Name: Dr. Weijia Jia

Title: Assistant Professor of Statistics

E-mail: wjia@atu.edu

Phone: (479)498-6021

Email the completed form: Dr. Nathan Smith (Nathan.Smith@adfa.arkansas.gov)

After the labor market analysis has been completed, the institution will be invited to respond, providing further information that might shed light and help to interpret the data provided.

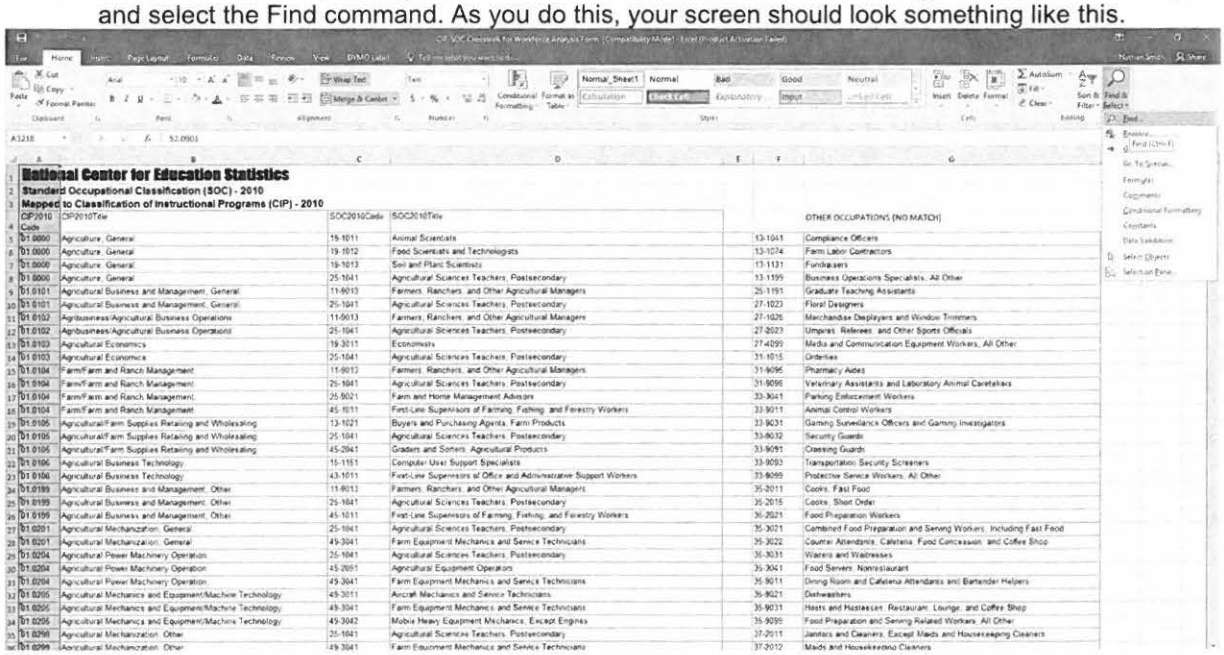
APPENDIX A. CIP-SOC MATCHING AND THE NCES CROSSWALK (Question 4a & 4b)

Labor market analysis for academic program requires the combination of diverse data sources. The National Center for Education Statistics (NCES) and the Bureau of Labor Statistics (BLS) developed a "CIP-SOC crosswalk" linking fields of study, classified by a well-established classification scheme called Classification of Instructional Programs (CIP), with occupations, classified by a well-established classification scheme called Standard Occupational Classifications (SOC). The CIP-SOC crosswalk is available here, and guidelines on how to use the scheme are posted online here.

In question 4a of the form, institutions are asked to copy and paste a list of occupations that match with their instructional programs, taken directly from the NCES CIP-SOC crosswalk, which can be downloaded here: https://static.ark.org/eeuploads/adhe/CIP-SOC_Crosswalk_for_Workforce_Analysis_Form.xls

To use this file to answer question 4a:

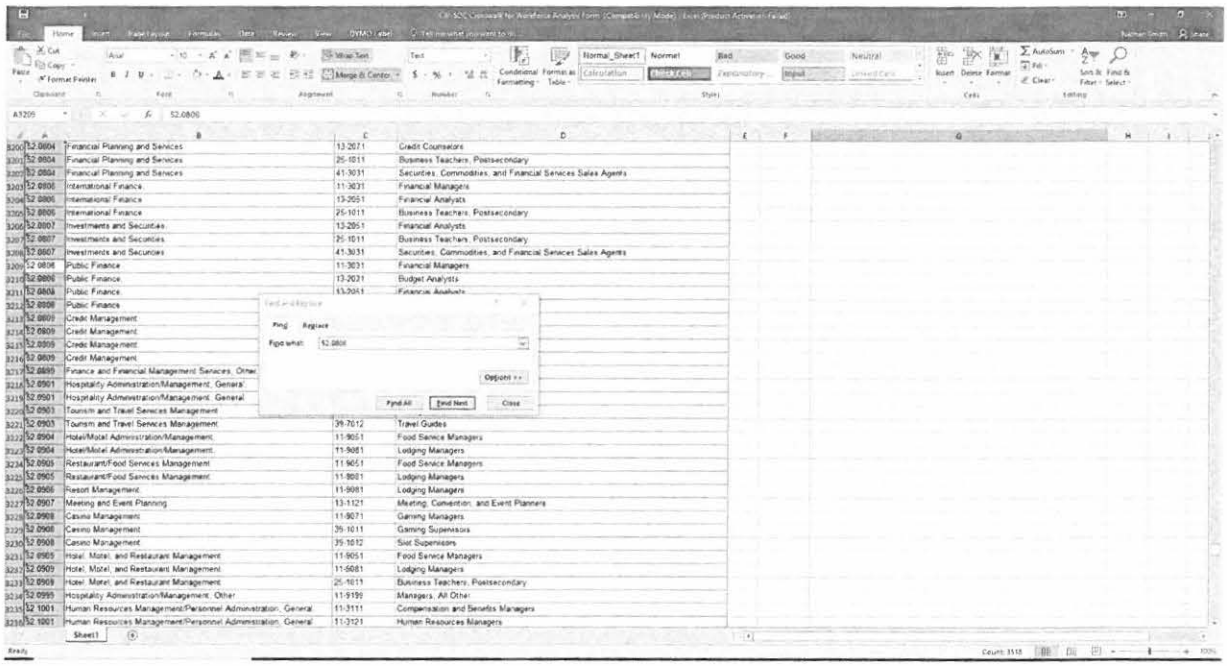
1. Select Column A.
2. In the Home ribbon, Editing section of the toolbar, click Find & Select to get a drop-down menu, and select the Find command. As you do this, your screen should look something like this.



National Center for Education Statistics
Standard Occupational Classification (SOC) - 2010
Mapped to Classification of Instructional Programs (CIP) - 2010

CIP2010 Code	CIP2010Title	SOC2010Code	SOC2010Title		OTHER OCCUPATIONS (NO MATCH)
01.0000	Agriculture, General	19-1011	Animal Scientists	13-1041	Compliance Officers
01.0000	Agriculture, General	19-1012	Food Scientists and Technologists	13-1074	Farm Labor Contractors
01.0000	Agriculture, General	19-1013	Soil and Plant Scientists	13-1131	Fundraisers
01.0000	Agriculture, General	25-1041	Agricultural Sciences Teachers, Postsecondary	13-1199	Business Operations Specialists, All Other
01.0101	Agricultural Business and Management, General	11-9013	Farmers, Ranchers, and Other Agricultural Managers	25-1191	Graduate Teaching Assistants
01.0101	Agricultural Business and Management, General	25-1041	Agricultural Sciences Teachers, Postsecondary	27-1023	Floral Designers
01.0102	Agribusiness/Agricultural Business Operations	11-9013	Farmers, Ranchers, and Other Agricultural Managers	27-1026	Merchandise Displayers and Window Trimmers
01.0102	Agribusiness/Agricultural Business Operations	25-1041	Agricultural Sciences Teachers, Postsecondary	27-2023	Umpires, Referees, and Other Sports Officials
01.0103	Agricultural Economics	19-3011	Economists	27-4099	Media and Communication Equipment Workers, All Other
01.0103	Agricultural Economics	25-1041	Agricultural Sciences Teachers, Postsecondary	31-1015	Orderlies
01.0104	Farm/Farm and Ranch Management	11-9013	Farmers, Ranchers, and Other Agricultural Managers	31-9096	Pharmacy Aides
01.0104	Farm/Farm and Ranch Management	25-1041	Agricultural Sciences Teachers, Postsecondary	31-9096	Veterinary Assistants and Laboratory Animal Caretakers
01.0104	Farm/Farm and Ranch Management	25-9021	Farm and Home Management Advisors	33-3041	Parking Enforcement Workers
01.0104	Farm/Farm and Ranch Management	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	33-9011	Animal Control Workers
01.0105	Agricultural/Farm Supplies Retailing and Wholesaling	13-1021	Buyers and Purchasing Agents, Farm Products	33-9031	Gaming Surveillance Officers and Gaming Investigators
01.0105	Agricultural/Farm Supplies Retailing and Wholesaling	25-1041	Agricultural Sciences Teachers, Postsecondary	33-9032	Security Guards
01.0105	Agricultural/Farm Supplies Retailing and Wholesaling	45-2041	Graders and Sorters, Agricultural Products	33-9091	Crossing Guards
01.0106	Agricultural Business Technology	15-1151	Computer User Support Specialists	33-9093	Transportation Security Screeners
01.0106	Agricultural Business Technology	43-1011	First-Line Supervisors of Office and Administrative Support Workers	33-9099	Protective Service Workers, All Other
01.0199	Agricultural Business and Management, Other	11-9013	Farmers, Ranchers, and Other Agricultural Managers	35-2011	Cooks, Fast Food
01.0199	Agricultural Business and Management, Other	25-1041	Agricultural Sciences Teachers, Postsecondary	35-2015	Cooks, Short Order
01.0199	Agricultural Business and Management, Other	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	35-2021	Food Preparation Workers
01.0201	Agricultural Mechanization, General	25-1041	Agricultural Sciences Teachers, Postsecondary	35-3021	Combined Food Preparation and Serving Workers, Including Fast Food
01.0201	Agricultural Mechanization, General	49-3041	Farm Equipment Mechanics and Service Technicians	35-3022	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop
01.0204	Agricultural Power Machinery Operation	25-1041	Agricultural Sciences Teachers, Postsecondary	35-3031	Waiters and Waitresses
01.0204	Agricultural Power Machinery Operation	45-2091	Agricultural Equipment Operators	35-3041	Food Servers, Nonrestaurant
01.0204	Agricultural Power Machinery Operation	49-3041	Farm Equipment Mechanics and Service Technicians	35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers
01.0205	Agricultural Mechanics and Equipment/Machine Technology	49-3011	Aircraft Mechanics and Service Technicians	35-9021	Dishwashers
01.0205	Agricultural Mechanics and Equipment/Machine Technology	49-3041	Farm Equipment Mechanics and Service Technicians	35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop
01.0205	Agricultural Mechanics and Equipment/Machine Technology	49-3042	Mobile Heavy Equipment Mechanics, Except Engines	35-9099	Food Preparation and Serving Related Workers, All Other
01.0299	Agricultural Mechanization, Other	25-1041	Agricultural Sciences Teachers, Postsecondary	37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners
01.0299	Agricultural Mechanization, Other	49-3041	Farm Equipment Mechanics and Service Technicians	37-2012	Maids and Housekeeping Cleaners

3. In the Find and Replace dialog box, enter the CIP code that you're interested in, and click "Find Next." Your screen should then look like this:



4. Since the CIP-SOC crosswalk file is already sorted by row, you can find all the rows corresponding to your CIP simply by starting from the first cell selected and then reading down in column A until you encounter a different CIP code.
5. Select all of these rows, columns A through D, this will form a table that can be pasted directly into the response field for question 4a.

52.0808	Public Finance.	11-3031	Financial Managers
52.0808	Public Finance.	13-2031	Budget Analysts
52.0808	Public Finance.	13-2051	Financial Analysts
52.0808	Public Finance.	25-1011	Business Teachers, Postsecondary

6. If desired, ask a faculty or staff member to sort the matched occupations from the CIP-SOC crosswalk by relevancy/importance, with the occupations that seem most likely to employ your graduates ranked first.
7. Missing occupations from the list should be addressed in question 4b.

Question 4b, is requesting information from your local staff/workforce experts at your institution on the applicability of the NCES list. We are aware that the NCES might be "globally" wrong—the CIP/SOC match may never have been very accurate, or may become obsolete as fields and occupations evolve—or "locally" wrong—the CIP/SOC match may be reasonably robust in general, but fail to capture the role your particular program plays in students' career paths. Graduates of a particular program may be over or underqualified for some of the matched occupations. Also, there may be SOCs not matched to your CIP by NCES for which, however, your program does help to prepare students, and which are likely to provide gainful employment for your graduates. Question 4b is the place to tell us about those as well.

Bachelor of Science in Applied Statistics with Actuarial Science Option

Curriculum

The matrix below is a sample plan for all coursework required for this program.

Fall	Spring
ENGL 1013 Composition I[1] (3)	ENGL 1023 Composition II[1] (3)
MATH 1001 Orientation to Mathematics (1)	Fine Arts/Humanities[1] (3)
MATH 2914 Calculus I (4)	MATH 2924 Calculus II (4)
BUAD 2003 Business Info Systems (3)	STAT 2303 Statistical Methods (3)
ECON 2003 Principles of Econ I (3)	ECON 2013 Principles of Econ II (3)
Electives[4] (1)	
Total Hours (15)	Total Hours (16)

Fall	Spring
STAT 3153 Applied Statistics (3)	STAT 3113 Regression Analysis (3)
MATH 2703 Discrete Math (3)	MATH 3243 Differential Equations I (3)
MATH 2934 Calculus III (4)	COMS 2104 Found. of Comp. Prog. I (4)
ACCT 2003 Accounting Principles I (3)	ACCT 2013 Accounting Principles II (3)
BDA 2003 Business Problem Solving (3)	Quantitative Elective[2] (3)
Total Hours (16)	Total Hours (16)

Fall	Spring
Fine Arts/Humanities[1] (3)	Social Science[1] (3)
US History/Government[1] (3)	Science/Lab[1] (4)
Science/Lab[1] (4)	STAT 4153 Experimental Design and Analysis (3)
STAT 3203 Actuarial Probability I (3)	STAT 3213 Actuarial Probability II (3)
MATH 4003 Linear Algebra (3)	Quantitative Elective[2] (3)
Total Hours (16)	Total Hours (16)

Fall	Spring
COMM 2173 Business and Prof. Speaking (3)	Social Science[1] (3)
STAT 4283 Financial Math. I (3)	STAT 4293 Financial Math II (3)
MATH/STAT Elective[3] (3)	MATH 4971 Senior Seminar in Math (1)
Electives[4] (3)	MATH/STAT Elective[3] (3)
	Electives[4] (3)
Total Hours (12)	Total Hours (13)

==========

[1]See appropriate alternatives or substitutions in "General Education Requirements".

[2]The quantitative electives must be at the 2000-level or above and may include math, statistics, computer science, business administration, business data analytics, finance, or a course in another area with substantial quantitative content (ask for approval from advisor).

[3]See catalog to assure pre-requisites are met. See advisor to select courses from: STAT 3183 Statistical Process Control, STAT 4113 Categorical Data Analysis, STAT 4393 Statistical Learning, MATH 4123 Mathematical Modeling, or a MATH/STAT course at the 3000-4000 level approved by advisor.

[4]A minimum of 40 credit hours of the 120 total hours required for the B.S. degree must be 3000-4000 level courses.

Bachelor of Science in Applied Statistics with Computer Science Option

Curriculum

The matrix below is a sample plan for all coursework required for this program.

Freshman year

Fall	Spring
ENGL1013 Composition I[1] (3)	ENGL 1023 Composition II[1] (3)
US History/ Government[1] (3)	Fine Arts/ Humanities[1] (3)
MATH 1001 Orientation to Mathematics (1)	STAT 2303 Statistical Methods (3)
MATH 2914 Calculus I (4)	MATH 2924 Calculus II (4)
BUAD 2003 Business Info Systems (3)	BDA 2003 Bus. Problem Solving (3)
Electives[4] (1)	
Total Hours (15)	Total Hours (16)

Sophomore Year

Fall	Spring
Social Science[1] (3)	MATH 3243 Differential Equations I (3)
MATH 2703 Discrete Math (3)	COMS 2104 Found. of Computer Prog. I (4)
MATH 2934 Calculus III (4)	STAT 3113 Regression Analysis (3)
STAT 3153 Applied Statistics (3)	BDA 3053 Bus. Data Analysis (3)
Electives[4] (3)	Electives[4] (3)
Total Hours (16)	Total Hours (16)

Junior Year

Fall	Spring
Fine Arts/Humanities[1] (3)	Science/Lab[1] (4)
Science/Lab[1] (4)	STAT 4153 Experimental Design and Analysis (3)
COMS 2203 Found. of Computer Prog. II (3)	COMM 2173 Business and Prof. Speaking (3)
MATH 4003 Linear Algebra (3)	COMS 2213 Data Structures (3)
STAT 4163 Mathematical Statistics (3)	MATH/STAT Elective[2] (3)
Total Hours (16)	Total Hours (16)

Senior Year

Fall	Spring
Social Science[1] (3)	MATH 4971 Senior Seminar in Math (1)
STAT 4113 Categorical Data Analysis (3)	COMS Elective[3] (3)
COMS Elective[3] (3)	MATH/STAT Elective[2] (6)
Electives[4] (3)	Electives[4] (3)
Total Hours (12)	Total Hours (13)

---

[1]See appropriate alternatives or substitutions in "General Education Requirements".

[2]See catalog to assure pre-requisites are met. See advisor to select courses from: STAT 3183 Statistical Process Control, STAT 4393 Statistical Learning, MATH 4123 Mathematical Modeling, or a MATH/STAT course at the 3000-4000 level approved by advisor.

[3]See catalog to assure pre-requisites are met. See advisor to select courses from: COMS 3233 Database Design and Impl., COMS 3243 Data Mining, COMS 4353 Artificial Intelligence, or a COMS course at the 3000-4000 level approved by advisor.

[4]A minimum of 40 credit hours of the 120 total hours required for the B.S. degree must be 3000-4000 level courses.

.

Syllabus

Department of Mathematics and Statistics
STAT 2000 Statistical Packages Lab

Section: 001

Offered: Fall & Spring

Pre-Requisite: None

Co-Requisites: STAT 2303 Statistical Methods

Course Description: This lab is an introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: None

Bibliography:
For SAS:
Online document https://support.sas.com/en/documentation.html
Delwiche, L.D. and Slaughter, S.J., The Little SAS Book: A Primer, Fifth Edition, The SAS Institute, 2012

For R:
Grolemund, G. and Wickham H., R for Data Science, available for free at http://r4ds.had.co.nz/

Justification/rationale for the course: As the demands for professionals with quantitative analytical skills grows, especially in industry, application of statistical software becomes a more crucial part of data analysis. Among the advanced analytics software, SAS and R are the most popular languages used in statistical analysis in both academia and industry.

Objectives: The main point of this lab is to give the student a working start with the covered software SAS and R for the basic statistical analyses from STAT 2303. The student can learn the use of these software in more depth in the subsequent statistical courses. Student can spend a lifetime using and mastering them.

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The grade in this lab is incorporated into STAT 2303.

Attendance: Students are required to attend the lab regularly to learn and practice with SAS and R -- how they are implemented for the statistical analyses covered in STAT 2303.

Syllabus

Department of Mathematics and Statistics
STAT 2303 Statistical Methods

Section: 001

Offered: Fall & Spring

Pre-Requisite: Math 2914 Calculus I

Co-Requisites: STAT 2000. **Statistical Packages** Laboratory. Introduction to the statistical software SAS and R, including its use for common statistical analyses. A practical complement to the statistical methodology covered in STAT 2303.

Course Description: The goal of this course is to introduce students to statistical methods for analyzing data. Some of the topics included are: Describing Data, Basic Probability, Random variables, Normal and Binomial Distributions, Sampling Distributions, Confidence Intervals, Hypothesis testing, Correlation and Regression, Contingency table, Comparing two populations, ANOVA.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: Moore, David S., McCabe, George P., and Craig, Bruce A. Introduction to the Practice of Statistics, 7th ed., W.H. Freeman and Company, New York.

Bibliography: There is NO required supplemental reading list for this course.

Justification/rationale for the course: The goal of this course is to introduce students to statistical methods for analyzing data. We will emphasize the basic principles and criteria for selecting the appropriate statistical technique. Students will get hands-on experience applying the topics covered to real datasets using R or SAS. From medical studies, research experiments, business information, from polling organizations, and insurance, data are being collected everywhere, and all the time. Knowledge in statistics provides you with the necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

Course objectives - By completing this course the student will learn to perform the following:

1) How to calculate and apply measures of location and measures of dispersion.
2) How to apply discrete and continuous probability distributions to various business problems.
3) Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
5) Compute and interpret the results of Simple Linear Regression and Correlation Analysis, ANOVA and F-test.

Course Content:

- Descriptive statistics & data visualization
- Probability
- Point and interval estimation
- Hypothesis testing
- Inference for a single population
- Comparisons between two populations
- One- way analysis of variance
- Analysis of categorical data
- Simple linear regression

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The final grade will consist of 100 percentage points, with the following breakdown:

In-Class Participation/Projects	15%	
Homework/Quizzes		15%
3 Exams (20% each)	70	%
	100%	

The following percentages will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

Attendance: The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled. *In the event that you must miss, it is your responsibility to find out what material you missed and if any assignments are due.* I DO NOT take doctor's notes for absences.

No Make-Up exams will be given.

Expectations:

- Students must adhere to the rules set forth in the handbook.
- Students must do their own work.
- Consider your actions carefully: There will be no tolerance for conduct that even gives the appearance of cheating.
- Students are expected to respect the rights of others
- Students should not hesitate to clarify any questions regarding the policies of this course with the instructor.

Cheating/Plagiarism : Cheating or copying someone else's work may result in anything from a zero on the assignment (or test) to expulsion from the course with a course grade of F. Talking to others or using notes are NOT allowed during exams, either. *Please note that while I strongly encourage working together on assignments, copying someone else's work is cheating, and will not be tolerated.* Using apps, unapproved websites, etc are also considered cheating.

Syllabus

Department of Mathematics and Statistics

STAT 3113	**Regression Analysis**
Section #	**001**
OFFEREDSpring	
PRE-REQUISITE	An introductory statistics course or permission of instructor
CO-REQUISITES	None
DESCRIPTION	This course introduces the methods for fitting and interpreting regression models. Topics include simple linear regression (SLR), multiple linear regression (MLR), model checking, variable selection methods, dummy variables, diagnostic measures, logistic regression, and time series analysis. Instruction will include the use of a statistical programming language.
NOTES	None
COURSE INSTRUCTOR	**Office** **Phone:** **Email:** To be completed by the faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Mendenhall, W., Sincich, T., A Second Course in Statistics Regression Analysis, 8th edition, Pearson.
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Regression analysis is the most popularly used statistical technique with application in almost every imaginable field. Linear regression model, which relates an outcome to a set of predictors of interest using linear assumptions, is the most important statistical analysis tool in a data scientist's toolkit. This course focus on regression models and associated methods of statistical inference, data analysis, interpretation of results, statistical computation and model building.
OBJECTIVES	After completing this course, the learner will be able to:

- understand regression model and model assumptions in SLR and MLR;
- Use SAS and/or R to get least square estimate, confidence interval, and do hypothesis for the parameters;
- do the estimation and prediction by using the linear regression model;
- do regression for the data with quantitative, qualitative predictors and both;
- do model selection by using SAS and/or R;
- check the model assumptions by residual plots and use some basic measures to remedy the model;
- apply logistic regression for the dependent variable with two discrete values.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**15%**
3 Exams (20% each)	**60%**
Final Exam	**25%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. Students missing more than 2 classes are to be dropped from the class with a grade of F. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Course overview, Review some basic concepts, Introduction to regression analysis		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Simple linear regression (SLR) definition, Least square method (LSE)		
3	SLR model assumptions, Estimation of , Interpretation & inference of the slope parameter		
4	Coefficient of correlation, Coefficient of determination, SLR estimation and prediction, Multiple linear regression (MLR) definition		

5	MLR: LSE, Model assumption, Estimation of ,		
6	MLR: Inference about the parameters, Multiple coefficients of determination, Estimation and prediction		
7	MLR: Interaction model, Curvilinear model, model with qualitative independent variable		
8	Model selection, Problems (misusing) with regressions		
9	Residual analysis		
10	Transformations and weighting to correct model inadequacies, Introduction to weighted least squares		
11	Introduction to piecewise linear regression, Introduction to logistic regression		
12	Introduction to ridge regression, Time series component		
13	Moving average method, Exponential smoothing		
14	Measures of forecast accuracy, Forecasting by regression approach		
15	Autocorrelation and autoregressive error models		

Syllabus

Department of Mathematics and Statistics

STAT 3183	**Statistical Process Control**
Section #	**001**
OFFEREDSpring	
PRE-REQUISITE	STAT 3153 Applied Statistics
CO-REQUISITES	None
DESCRIPTION	This course is an introduction to statistical process control using Deming's philosophy for the improvement of quality, productivity, and competitive position.
NOTES	None
COURSE INSTRUCTOR	**Office** **Phone:** **Email:** To be completed by the faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Introduction to Statistical Quality Control, 7th edition, by D. Montgomery, Wiley, ISBN: 978-1118146811
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Regression analysis is an important topic for anyone interested in applying statistics in industry. This course focus on theory and methods of quality monitoring including process capability, control charts, acceptance sampling, quality engineering, and quality design.
OBJECTIVES	After completing this course, the learner will be able to: • Collect and analyze data with emphasis on basic concepts of quality control. • Understand the importance of variability in statistical quality control. • Understand the role of statistics in engineering and quality improvement.

- To learn various statistical tools of quality monitoring.
- To learn the statistical and economical design issues associated with quality control.
- To understand and implement various process capability analysis techniques.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. Students missing more than 5 classes are to be dropped from the class with a grade of F. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student

who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Course overview, Review some basic concepts, Introduction to Quality Management and Philosophy regression analysis		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2 & 3	Modeling Process Quality: Reviewing probability distributions associated with Quality Control		
4	Inferences about process quality		
5	Statistical Process Control: Methods and Philosophy of Statistical Process Control		
6 & 7	Control Charts for Variables		
8 & 9	Control Charts for Attributes		
10	Control Charts for Short Run Productions, Multiple-Stream Processes		
11&12	Process Capability Analysis		
13	Process Design and Improvement with Designed Experiments		
14&15	Acceptance Sampling		

Syllabus

Department of Mathematics and Statistics

STAT 3203	**Actuarial Probability I**
Section #	001
OFFERED	Fall
PRE-REQUISITE	MATH 2934 Calculus III
CO-REQUISITES	None
DESCRIPTION	In this course we develop knowledge of the fundamental probability tools for quantitatively assessing risk. The application of these tools to problems encountered in actuarial science is emphasized. A thorough command of the supporting calculus is assumed. A very basic knowledge of insurance and risk management is assumed.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Probability Course for the Actuaries: A Preparation for Exam P/1, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop knowledge of the fundamental probability tools for quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to use and apply the following Concepts : • Set functions including set notation and basic elements of probability • Mutually exclusive events

- Addition and multiplication rules
- Independence of events
- Combinatorial probability
- Conditional probability
- Bayes Theorem / Law of total probability
- Commonly used discrete random variables

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction.

If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Set theory		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Counting and combinatorics		
3	Probability: Definitions and properties		
4	Conditional Probability		
5	Bayes' formula		
6	Independent events, Odds and conditional probability		

7	Random variables		
8	Probability mass function and cumulative distribution function		
9	Expected value of a discrete random variable, Expected value of a function of a discrete random variable		
10	Variance and standard deviation of a discrete random variable		
11	Uniform discrete random variable, Bernoulli trails and binomial distribution		
12	The expected value and variance of the binomial distribution		
13	Poisson random variable Geometric random variable		
14	Negative binomial random Variable		
15	Hyper-geometric random variable		

Syllabus

Department of Mathematics and Statistics

STAT 3213	**Actuarial Probability II**
Section #	001
OFFERED	Spring
PRE-REQUISITE	STAT 3203 Actuarial Probability I
CO-REQUISITES	None
DESCRIPTION	This course is a continuation to STAT 3203. At the end of this course, a student is prepared to take Exam P of the Society of Actuaries.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Probability Course for the Actuaries: A Preparation for Exam P/1, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop knowledge of the fundamental probability tools for quantitatively assessing risk and help the students to prepare for Exam P: Probability of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to use and apply the following Concepts : • Probability functions and probability density functions Mutually exclusive events • Cumulative distribution functions • Mode, median, percentiles, and moments • Variance and measures of dispersion • Moment generating functions

- Transformations
- Joint probability functions and joint probability density functions
- Joint cumulative distribution functions
- Central Limit Theorem
- Conditional and marginal probability distributions
- Moments for joint, conditional, and marginal probability distributions
- Joint moment generating functions
- Variance and measures of dispersion for conditional and marginal probability distributions
- Covariance and correlation coefficients
- Transformations and order statistics
- Probabilities and moments for linear combinations of independent random variables

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE

Respect your peers. Students are expected to respect the rights of others.

CONDUCT

Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Cumulative and survival distribution function		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Review improper integrals from Calculus prerequisite I, Distribution functions		

3	Expectation and variance, Median, mode, and percentiles		
4	The continuous uniform distribution function, Normal random variables		
5	The normal approximation to the binomial distribution, Exponential random variable		
6	Gamma distribution, the distribution of a function of a continuous random variable		
7	Review graphing systems of inequalities in two variables and iterated double integrals from Calculus II		
8	Jointly distributed random variables, Independent random variables		
9	Sum of two independent random variables		
10	Conditional distribution		
11	Joint Probability distribution of functions of random variables, Expected value of a function of two random variables		
12	Covariance and variance of sums, The coefficient of correlation		
13	Conditional Expectation, Double Expectation		
14	Conditional variance, Moment generating functions		
15	Moment generating functions		

	of sums of independent RVs, The central limit theorem		

Syllabus
Department of Mathematics and Statistics
STAT 4113 Categorical Analysis

Section: 001

Offered: Fall

Pre-Requisite: STAT 3113 Regression Analysis

Course Description: Statistical tools to analyze univariate and multivariate categorical responses. Emphasis is given to Generalized Linear Models, including logistic regression and loglinear models.

This section is all to be completed by faculty of record for the course.
Course Office: Corley Phone: Email:
Instructor: TBD
Office Hours: To be determined by the faculty of record for this course

Text required: An Introduction to Categorical Analysis. 2nd edition. Author: Alan Agresti. Publisher: John Wiley & Sons, Inc. ISBN: 9780471226185.

Bibliography: There is NO required supplemental reading list for this course.

Justification/rationale for the course: The goal of this course is to introduce students to statistical methods for analyzing data in which the response variables are categorical: either qualitative or quantitative and the explanatory variables can be categorical or continuous. In the real world, often times we have data that require knowledge of how to handle categorical response variables as well as the mixed inputs. By learning categorical analysis, it further deepens knowledge in statistics that will provide necessary tools and conceptual foundations in quantitative reasoning to extract information intelligently from this sea of data.

Course objectives - By completing this course the student will be able to perform the following:

- Students will be able to select the appropriate statistical methodology for the analysis of categorical data.
- Justify the basic theoretical models for categorical data.
- Conduct and/or actively participate in the modeling and analyzing of categorical data.
- Interpret results from contingency tables or generalized linear models that evaluate relationships between categorical variables
- Communicate, both verbally and in writing, results with non-statisticians
- Analyze categorical data using statistical software

Course Content:

1	Overview & Intro.	1.1-1.2
2	Sampling models & Inference	1.3-1.5
3	2-way tables: structure and proportions	2.1
4	2-way tables: odds ratios	2.2, 2.4
5	Inference: Chi-square tests	3.1-3.3
6	Inference: ordinal data, exact tests	3.4-3.6
7	3-way tables: partial association	2.3, 3.7

•	8	Generalized linear models (GLM)	4.1
•	9	GLMs for binary data	4.2
•	10	Poisson regression	4.3
		Inference and model checking	4.5-4.6
•	11	Logistic regression	5.1
•	12	Logistic regression: model checking	5.2
•	13	Logit models (categorical predictors)	5.3
•	15	Multiple logistic regression	5.4-5.5

General Education Requirements: This course does not meet any General Education requirements.

Assessment: The final grade will consist of 100 percentage points, with the following breakdown:

Homework/Quizzes	35%
Projects/Exams (20% each)	65%
	100%

The following percentages will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

Attendance: The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled. *In the event that you must miss, it is your responsibility to find out what material you missed and if any assignments are due.* I DO NOT take doctor's notes for absences.

No Make-Up exams will be given.

Expectations:

- Students must adhere to the rules set forth in the handbook.
- Students must do their own work.
- Consider your actions carefully: There will be no tolerance for conduct that even gives the appearance of cheating.
- Students are expected to respect the rights of others
- Students should not hesitate to clarify any questions regarding the policies of this course with the instructor.

Cheating/Plagiarism : Cheating or copying someone else's work may result in anything from a zero on the assignment (or test) to expulsion from the course with a course grade of F. Talking to others or using notes are NOT allowed during exams, either. *Please note that while I strongly encourage working together on assignments, copying someone else's work is cheating, and will not be tolerated.* Using apps, unapproved websites, etc are also considered cheating.

Syllabus

Department of Mathematics and Statistics

STAT 4153	**Experimental Design and Analysis**
Section #	**001**
OFFERED	Spring
PRE-REQUISITE	An introductory statistics course or permission of instructor
CO-REQUISITES	None
DESCRIPTION	This course introduces students to both design and analysis of experiments as well as statistical computing. SAS and JMP will be the primary software for this course. Topics will include basic principles of experimental design, randomization, replication, completely randomized design, randomized blocks, Latin squares, complete and incomplete block designs, factorial design, blocking in factorial design, 2k factorial design, blocking and confounding in 2k factorials, fractional factorial designs, blocking in fractional factorials, experiments with random factors, nested and split-plot designs, analysis of covariance, repeated measures, regression, ANOVA, and follow-up analysis, sample size determination. Other topics may be discussed if time permits.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley** **Phone:** **Email:** To be determined by faculty of record for this course
OFFICE HOURS	To be determined by faculty of record for this course
TEXTBOOK	Montgomery, D. C., Design and Analysis of Experiments, 9th edition, Wiley.
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Designing experiments to effectively address research questions, performing data analysis by using appropriate software and drawing statistical conclusions are the essential skills for statisticians. Experimental design is also an important tool for engineers and scientists to use for

product design and development as well as process development and improvement. Experimental design should be introduced early in the product cycle to substantially reduce development lead time and cost, leading to processes and products that perform better in the field and have higher reliability than those developed using other approaches.

OBJECTIVES

After completing this course, the learner will be able to:

- understand the principles, models and strategies commonly used for experimental design;
- construct appropriate experiments to effectively address research questions;
- use statistical software to correctly analyze data collected from designed experiments and draw appropriate statistical conclusions.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
Course Project	**15%**
2 Exams (20% each)	**40%**
Final Exam	**25%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. After 2 absences, a student's name may be reported to the advising center's Early Warning staff. After 4 absences, a student may be dropped from the course with an FE* if the grade is below 60%. Students who arrive to class

late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Basic principles and guidelines for designing experiments		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Completely randomized experiment (CRD), Perform single-factor ANOVA for CRD		
3	Perform single-factor ANOVA for CRD, ANOVA model adequacy checking		
4	Practical interpretation of results, Interpret computer output from SAS/JMP,		

	Determining sample size		
5	The regression approach to the ANOVA, Nonparametric methods in the ANOVA		
6	Randomized blocks, Latin squares, Complete and incomplete block designs		
7	Factorial design, Blocking in factorial design		
8	2k series of factorial designs, ANOVA for 2k factorial design		
9	Regression model for 2k factorial design, unreplicated 2k factorial design		
10	Blocking and confounding in 2k factorials		
11	Fractional factorial designs		
12	Blocking in fractional factorials		
13	Experiments with random factors		
14	Nested and split-plot designs		
15	Brief introduction of ANCOVA and repeated measures		

Syllabus

Department of Mathematics and Statistics

STAT 4283	**Financial Mathematics I**
Section #	001
OFFERED	Fall
PRE-REQUISITE	MATH 2914 Calculus I
CO-REQUISITES	None
DESCRIPTION	This is an introductory course in Financial Mathematics. The student will learn about the different types of interest (simple interest, discount interest, compound interest), annuities, debt retirement methods, investing in stocks and bonds.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Basic Course in the Theory of Interest: A Preparation for Exam FM/2, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course will be able to understand:

- and to perform calculations relating to present value, current value, and accumulated value
- and to calculate present value, current value, and accumulated value for sequences of non-contingent payments (annuities)
- key concepts concerning loans and how to perform related calculations
- key concepts concerning bonds, and how to perform related calculations

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a

distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, interest, Accumulation and amount functions, EIR, Simple Interest, Date conventions under simple interest		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Compound interest, Present value and discount functions, Effective rate of discount, Nominal rate of interest and discount		
3	Continuous compounding,		

	Time varying interest rates, Equations of value and time diagrams, Solving for the unknown interest rate/time		
4	Present and accumulated values of an annuity-immediate, Annuity due, Deferred annuity		
5	Perpetuities, Solving for the unknown number of payments/rate of interest of an annuity, Varying interest of an annuity		
6	Annuities payable at a different/less/more frequency than interest is convertible, Continuous annuities		
7	Varying annuity (immediate/due/with payments at a different frequency than interest is convertible), Continuous varying annuities		
8	Discounted cash flow technique, Uniqueness of IRR, Interest reinvested at a different rate		
9	Dollar-weighted/time-weighted interest rate, Portfolio and investment year methods		
10	Yield rate in capital budgeting, Finding the loan balance with prospective and retrospective methods		
11	Amortization schedules, Sinking fund method		

12	Loans payable at a different frequency than interest is convertible, Amortization with varying series of payments		
13	Type of bounds, the various pricing formulas of a bound		
14	Amortization of premium or discount, Valuation of bonds between coupons payment dates		
15	Approximation methods of bonds' yield rates, Callable bonds and serial bonds		

Syllabus

Department of Mathematics and Statistics

STAT 4293	**Financial Mathematics II**
Section #	001
OFFERED	Spring
PRE-REQUISITE	MATH 4283 Financial Mathematics I
CO-REQUISITES	None
DESCRIPTION	This is a continuation of STAT 4283. Topics include Loans, bonds, cash flow and portfolios, immunization, derivatives and options. At the end of this course, a student is prepared to take Exam FM of the Society of Actuaries.
NOTES	None
COURSE INSTRUCTOR	**Office: Corley 236 Phone: 964 - 0854 Email: mfinan@atu.edu** **Dr. Marcel Finan**
OFFICE HOURS	9:00 - 11:00 (MWF)
TEXTBOOK	Marcel B Finan, A Basic Course in the Theory of Interest: A Preparation for Exam FM/2, accessible at faculty.atu.edu/mfinan/actuaries.html
BIBLIOGRAPHY	There is **no** REQUIRED supplemental reading list for this course.
JUSTIFICATION	Employment of actuaries is projected to grow 22 percent in the next ten years, much faster than the average for all occupations. This course is designed to develop the student's understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting and valuing contingent cash flow. The course can help the students to prepare for Exam FM: Financial Mathematics of the Society of Actuaries.
OBJECTIVES	Students successfully completing this course should be able to understand: • key concepts concerning yield curves, rates of return, and measures of duration and convexity, and how to perform related calculations

- key concepts concerning cash flow matching and immunization, and how to perform related calculations
- key concepts concerning interest rate swaps, and how to perform related calculations
- key concepts concerning the determinants of interest rates, the components of interest, and how to perform related calculations.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**20%**
3 Exams (20% each)	**60%**
Final Exam	**20%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

The policy of the University in regard to class absences may be stated as the considered belief that regular class attendance is essential to the maximum growth and development of the student, and that students, in their own interest, are therefore responsible for attending all classes for which they are enrolled.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary,

you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Refer to the rules set forth in the student handbook. Students are expected to do their **OWN** work. **Consider your actions carefully**: there will be no tolerance for conduct that even gives the appearance of cheating. Any questions regarding the policy of cheating or conduct in this class should be clarified with the instructor. Cheating will result in a negative score (deduction from the final course grade) and will be reported to appropriate governing bodies.

COURSE PHILOSOPHY

You learn math by doing math: Mathematics is not a spectator sport! Athletes do not train for sports by watching games on TV--they must exercise and practice. Similarly, you can not learn mathematics by only listening to the lecture; you must actively and consistently participate in the learning process, both in and out of the classroom.

The answer is not the goal: Mathematics is not just getting an answer that matches "what's in the back of the textbook". Mathematics is about taking a set of instructions, understand them and know how to use them in solving mathematical problems.

SCHEDULE

Week			Exercises
1	Syllabus, Review the key concepts of loans and the related calculation		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Review the key concepts of bonds and the related calculation, Preferred and common stocks		
3	Buying stocks, Short sales, Money market instruments		
4	The effect of inflation on interest rates, The term structure of interest rate and yield curves		

5	Macaulay and modified durations, Redington immunization and convexity		
6	Full immunization and dedication, Financial derivatives and related issues		
7	Derivatives markets and risk sharing, Payoff and profit diagrams		
8	Call options/put options: payoff and profit diagrams, stock options		
9	Floors and caps, Covered calls and covered puts		
10	Synthetic forward and put-call parity, Spread strategies		
11	Collars, Straddles, Strangles, and Butterfly spreads		
12	Equity linked CDs, Prepaid forward contracts on stock		
13	Forward contracts on stock		
14	Future contracts, A simple commodity swap		
15	Interest rate swaps, risk management		

Syllabus

Department of Mathematics and Statistics

STAT 4393	**Introduction to Statistical Learning**
Section #	**001**
OFFERED	Spring
PRE-REQUISITE	STAT 3113 Regression Analysis
CO-REQUISITES	None
DESCRIPTION	This course is directed towards advanced undergraduates or master's students in statistics or related quantitative fields. The focus of the course is an accessible overview of the field of statistical learning and provide the students with valuable hands-on experience by illustrating how to implement each of the statistical learning methods using R. Topics covered include: Linear Regression, Logistic Regression, Linear Discriminant Analysis, K-Nearest Neighbors, Cross-Validation, Bootstrap, Variable Selection, Shrinkage Methods, Dimension Reduction, Considerations in High Dimensions, Polynomial Regression, Generalized Additive Models, Decision Trees, Bagging, Random Forests, Boosting, Support Vector Machines, Principal Components Analysis, Clustering, and more.
NOTES	None
COURSE INSTRUCTOR: TBD	**Office: Corley** **Phone:** **Email:**
OFFICE HOURS	
TEXTBOOK	James, G., Witten, D., Hastie, T., and Tibshirani, R. An Introduction to Statistical Learning with Applications in R. New York: Springer. The book webpage is http://www-bcf.usc.edu/~gareth/ISL/.
BIBLIOGRAPHY	Applied Data Mining and Statistical Learning: Very good online lecture notes on Statistical Learning.
JUSTIFICATION	With the explosion of "Big Data" problems, statistical learning has become a very hot field in many scientific areas as well as marketing, finance, and

other business disciplines. People with statistical learning skills are in high demand! This course provides hands-on opportunities for students to apply the methods learned in real-world situations.

OBJECTIVES

After completing this course, the learner will be able to:

- Identify supervised (regression, classification) and unsupervised (clustering) learning problems.
- Understand the fundamental idea behind statistical learning methods, know the pros and cons of each method.
- Understand the limitations of linear models and understand the nonlinear alternatives.
- Explain the challenges with high dimensional data and have a basic understanding of linear model selection and regularization.
- Formulate a mathematical solution to the real-world problems and implement the statistical learning methods by using statistical computing package.

GENERAL EDUCATION REQUIREMENTS

This course does not meet any of the General Education requirements.

ASSESSMENT

The final grade will consist of 100 percentage points, with the following breakdown:

Homework	**15%**
Group Course Project	**25%**
3 Exams (including Final Exam, 20% each)	**60%**
Total	***100 %***

The following percentage table will be used to assign scores:

90-100% - A 80-89% - B 70-79% - C 60-69% - D Below 60% - F

ATTENDANCE

Attendance is required and necessary for success in this course. After 2 absences, a student's name may be reported to the advising center's Early Warning staff. After 4 absences, a student may be dropped from the course with an FE* if the grade is below 60%. Students who arrive to class late or leave class early may be counted as absent. If a student is absent for any reason, it is his/her responsibility to learn what assignment was missed and to complete on time. Being absent is NOT an excuse for missing an assignment.

COURSE CONDUCT

Respect your peers. Students are expected to respect the rights of others. Students must conduct themselves in a professional manner, and maintain an atmosphere that does not distract other students from learning. Students whose behavior the instructor deems to be disruptive will be asked to leave. This includes, but is not limited to, cell phones ringing, talking on a cell phone or text messaging, use of a laptop computer in a distracting manner, consuming food or beverage, and/or having conversations with other students that are not part of the class instruction. If for some reason you feel that one or more of these items are necessary, you must get express permission from the instructor beforehand. A student who is requested to leave will not be excused from missing any class or class activities.

PLAGIARISM & CHEATING

Cheating will not be tolerated. Students are expected to do their **OWN** work. Copying or allowing someone to copy work is cheating. Consequences range from a zero on the assignment (or test) to expulsion from the course. Definitions of cheating and plagiarism are in the Student Code of Conduct from the Student Handbook.

SCHEDULE

Week			Exercises
1	Syllabus, Introduction to Statistical Learning and statistical software package R		The instructor of record will determine the assignments/exercises and point value for each weekly topic.
2	Linear Regression		
3	Logistic Regression		
4	Linear Discriminant Analysis (LDA), K-Nearest Neighbors (KNN)		
5	A Comparison of		

	Classification Methods, Cross-Validation		
6	Cross-Validation, Bootstrap		
7	Variable Selection, Shrinkage Methods		
8	Dimension Reduction, Considerations in High Dimensions		
9	Polynomial Regression, Generalized Additive Models		
10	Decision Trees, Bagging		
11	Random Forests, Boosting		
12	Support Vector Classifiers		
13	Support Vector Machines		
14	Principal Components Analysis (PCA)		
15	PCA, Clustering		

Workforce Analysis

Institution: Arkansas Tech University

Program Name: Bachelor of Science in Applied Statistics with Actuarial Science Option or Computer Science Option

Proposed CIP Code: 27.0599 Statistics, Other

By: ADFA Economic Policy Division

Arkansas Tech's proposed program in Applied Statistics shows promise but can expect challenges. Despite widespread buzz about "big data," outside of one or two narrow occupational niches—notable, that of actuaries—statistical skills tend to be most useful in the labor market when coupled with complementary skills like management, logistics, and/or sales. Math majors who transition directly to the workforce after completing a Bachelor's degree don't have especially good workforce outcomes, and job-rich, well-paid occupations where quantitative skills are applied tend to be matched with other fields of study.

The program description in Arkansas Tech's workforce analysis request suggests that they appreciate and are ready for this challenge, on which the program's success will depend. Graduates will need to be prepared to move outside their comfort zones, cross-train, sell themselves, and learn on the job, or in some cases, get further education if they want to achieve the high potential employability and earning power that understanding statistics can confer.

Matched Occupations

While statistics and "big data" are popular buzzwords in business right now, definite occupational matches are hard to find. This relates partly to the slowness with which occupational concepts to fit new workflows, and official occupational matrices in government statistics to fit organic occupational concepts. The difficulty may also arise from a natural tendency for the range of usefulness of statistical skills to follow data-driven decision-making practices into the heart of organizations, mingling with many different functions.

Table 1 shows occupations matched with CIP 27.0599 (a) by NCES, and (b) by ATU, in their workforce analysis request. NCES finds two matched occupations. Of these, one—Statisticians—tends to require a Master's degree, so most of these jobs would be out of reach for B.S. graduates from Arkansas Tech. The other—Actuaries—is Bachelor's-compatible and well-paid, at $39/hour, but not at all job-rich, with 57 jobs and 7 annual openings.

Table 1: Jobs for occupations proposed as outlets for ATU's BS in Applied Statistics in Arkansas (EMSI)

Description	2018 Jobs	Annual Openings	2018 - 2025 % Change	2018 Location Quotient	Typical Entry Level Education	Work Experience Required	Unique Postings from 2018 – May 2019	Median Hourly Earnings
NCES matched								
Actuaries	57	7	37%	0.27	Bachelor's degree	None	84	$38.99
Statisticians	381	43	23%	1.05	Master's degree	None	94	$36.71
Matches proposed by the school								
Management Analysts	6,124	647	12%	0.83	Bachelor's degree	Less than 5 years	2,501	$27.48
Market Research Analysts and Marketing Specialists	4,871	639	19%	0.86	Bachelor's degree	None	1,711	$29.92
Mathematicians	12	2	33%	0.47	Master's degree	None	0	$72.14
Operations Research Analysts	632	62	23%	0.69	Bachelor's degree	None	517	$26.66

The other four occupations, proposed by Arkansas Tech, are *not* matched by NCES with Statistics as an instructional program, but *are* matched with other fields of study. That is not to deny that a statistics background may be useful in obtaining some of these jobs. Statistics knowledge has a clear value for market researchers, for example. But B.S. grads seeking jobs in these occupations will face competition from people with other backgrounds, which in some cases hiring managers may find to be more relevant.

For example, Operations Research Analysts are matched by NCES with (a) Operations Research, and (b) Management Science. Management Analysts are matched by NCSE with (a) Business/Commerce, General, (b) Business Administration and Management, General, and (c) Organizational Leadership. And Market Research Analysts and Marketing Specialists are matched with (a) Consumer Merchandising/Retailing Management, (b) Applied Economics, (c) Marketing/Marketing Management, General, (d) Marketing Research, and (e) International Marketing. There is a risk that, even if statistics knowledge is an asset in many jobs in these occupations, B.S. graduates will lack complementary skills needed to be competitive for or to flourish in these jobs.

Arkansas Tech's description of the proposed program indicates that they are aware of the need to equip graduates with complementary skills in addition to statistics to make them competitive for the wide range of jobs, not strictly statistical, where statistics knowledge may be applied. The workforce analysis request states that "the curriculum in Applied Statistics is tailored to professionals who may be working with data and statistics in any industry including natural resources, environmental agencies, non-profit organizations, healthcare, insurance, business and finance… The Applied Statistics degree includes

courses in mathematical theory, statistical modeling, computer programming, economics, and business analytics."

If Arkansas Tech B.S. in Applied Statistics graduates prove to be competitive for jobs as Market Research Analysts and Marketing Specialists or Operations Research Analysts, their job prospects should be bright. These occupations pay well—over $25/hour median earnings—and are quite job-rich, especially Market Research Analysts and Marketing Specialists, with hundreds of annual openings statewide. Management Analysts will be a less accessible occupation for new graduates, since it tends to require experience, but might be a rewarding step later on a career path.

Table 2, derived from job postings data, provides evidence somewhat supportive of Arkansas Tech's claims about what occupations their graduates will be fitted for. Among job postings that cite "statistics" as a required hard skill, several of the top occupations—Management Analysts, Market Research Analysts and Marketing Specialists, and Operations Research Analysts—match those proposed by Arkansas Tech, while Actuaries and Statisticians, the NCES-matched occupations, don't appear in the top ten. The occupations not cited as matches by Arkansas Tech may require more computer science knowledge—Computer and Information Research Scientists—or more management experience—Marketing Managers, Financial Managers—or both—Computer and Information Systems Managers. Financial Analysts might be another promising occupational match.

Table 2: Unique Job Postings from Jun 2018 – May 2019 for occupations require "Statistics" as a hard skill in Arkansas

Occupation	Unique Postings from Jun 2018 – May 2019
Computer and Information Research Scientists	163
Management Analysts	114
Market Research Analysts and Marketing Specialists	95
Marketing Managers	60
Unclassified Occupation	51
Financial Analysts	35
Teachers and Instructors, All Other	28
Operations Research Analysts	24
Financial Managers	24
Computer and Information Systems Managers	19

Information Research Scientists is not as out of reach for Bachelor's degree graduates as the name might suggest, as shown in Table 3. Nationally, about one-third of these professionals have no more than a Bachelor's degree.

Table 3: Educational attainment profile of Information Research Scientists

Level of Education	% of Computer and Information Research Scientists

Less than high school diploma	0.4%
High school diploma or equivalent	4.9%
Some College, no degree	2.5%
Associate's degree	0.3%
Bachelor's degree	34.8%
Master's degree	33.0%
Doctoral or professional degree	24.0%

For those graduates wanting to be Actuaries, Table 4 shows that the overwhelmingly demanded qualification for actuaries is to have taken and passed actuarial exams. Professional websites for actuaries report that it is sometimes possible to do junior actuarial work to get experience while preparing for the exams.

Table 4: Top qualifications sought in ads for Actuaries

Qualification Name	Postings with Qualification
Actuarial Exams	60
Associate of the Society of Actuaries	8
Fellow Of the Society of Actuaries	8
Chartered Financial Analyst	1
Certified Financial Risk Management	1
Associates Degree In Nursing	1

For Market Research Analysts and Marketing Specialists, the top skills demanded appear to be directly transactional—merchandising and selling techniques—such as an Applied Statistics degree will not help much with, but these are closely followed by skills like SQL, Analytics, and Tableau, where a statistics graduate should excel.

Table 5: Top hard skills sought in ads for Market Research Analyst and Marketing Specialists

Skill Name	Frequency in Postings
Merchandising	16%
Selling Techniques	13%
SQL (Programming Language)	12%
Analytics	11%
Category Management	11%
Tableau (Business Intelligence Software)	9%
Marketing Strategies	8%
Economics	8%
Market Research	8%
R (Programming Language)	7%

In ads for Operations Research Analysts, most of the top skills are related more to business and logistics than to statistics—forecasting, supply chain management, merchandising, inventory management, and accounting—but two software hard skills, SQL and Microsoft Access, which might be taught in an Applied Statistics program, show up near the top of the list as well.

Table 6: Top hard skills sought in ads for Operation Research Analysts

Skill Name	Frequency in Postings
Forecasting	17%
Supply Chain Management	17%
SQL (Programming Language)	11%
Microsoft Access	10%
Merchandising	9%
Inventory Management	9%
Process Improvement (Business)	8%
Accounting	8%
Business Process	7%
Operation Research	7%

B.S. graduates in Applied Statistics are likely to have bright futures, but finding them could prove tricky. Most jobs where applied statistics skills come in handy also require complementary skills, and graduates may need to venture outside their comfort zone and learn on the job. Arkansas Tech should interface with employers and explore ways to make the transition from the university to the labor market successful.

Job Placement Track Record of Related Programs

There are number of related programs at Arkansas Tech, and their job placement track records are mostly strong, as shown in Table 7. Strongest is the Bachelor's in Computer and Information Sciences, General, 94% of whose graduates had full-time equivalent work in the first year,[1] with salaries of $56,159, far above the mean for Bachelor's degree graduates. Workforce outcomes for the Bachelor's degrees in Information Technology and Computer Systems Analysis are less outstanding but still strong. Bachelor's degree graduates in Mathematics, General have reasonably high job placement rates, but average wages are well below the statewide average of about $40,000/year for new Bachelor's degree graduates. While not disastrous, the job placement track record for Arkansas Tech math majors may illustrate the problem that can occur when math skills come uncoupled with skills that are complementary in labor market applications of those skills. Master's degree graduates in Information Technology had high salaries when employed, but low job placement rates raise the question of what graduates are doing (e.g., out-of-state, self-employed, continuing ed?).

[1] With the usual caveats that the figure tends to understate graduates success because ARC, the compiler of this information, lacks access to out-of-state jobs, federal government jobs, and self-employment.

Table 7: Job placement of all related programs at Arkansas Tech University

Program Type	Major field	Number of graduates	% with earnings	Avg. wage	% with FTE earnings	Avg. wage FTE
Bacc.	Computer and Information Sciences, General	17	100%	$54,200	94%	$56,159
Bacc.	Information Technology	32	91%	$37,347	74%	$44,231
Bacc.	Computer Systems Analysis/Analyst	16	62%	$50,666	56%	$52,921
Bacc.	Mathematics, General	26	77%	$30,819	65%	$33,555
Mast.	Information Technology	35	26%	$58,696	26%	$58,696

Statewide, Table 8 shows workforce outcomes for related programs in math and information technology. A general pattern is that computer science graduates tend to earn more, and have higher job placement rates, than math majors. This may reflect a high tendency of math majors to continue their educations so as to acquire the complementary skills that can enable them to make better use of their quantitative talents. No obvious analogs of Arkansas Tech's proposed program in Applied Statistics exist.

Table 8: Job placement records of all Bachelors' programs in related fields in Arkansas universities

University	Major field	Number of graduates	% with earnings	Avg. wage	% with FTE earnings	Avg. wage FTE
ASU Jonesboro	Computer and Information Sciences, General	37	62%	$39,161	56%	$43,790
ASU Jonesboro	Data Processing and Data Processing Technology/Technician	33	64%	$35,084	59%	$37,339
ASU Jonesboro	Mathematics, General	23	61%	$27,605	38%	$30,143
Arkansas Tech University	Computer and Information Sciences, General	17	100%	$54,200	94%	$56,159
Arkansas Tech University	Information Technology	32	91%	$37,347	74%	$44,231
Arkansas Tech University	Computer Systems Analysis/Analyst	16	62%	$50,666	56%	$52,921

Arkansas Tech University	Mathematics, General	26	77%	$30,819	65%	$33,555
Southern Arkansas University - Magnolia	Computer and Information Sciences, General	12	42%	$33,192	36%	$37,090
UA Fayetteville	Computer and Information Sciences, General	118	53%	$50,494	48%	$58,102
UA Fayetteville	Mathematics, General	39	44%	$36,176	37%	$41,354
UA- Fort Smith	Computer and Information Sciences, General	83	77%	$47,466	65%	$51,341
UA at Little Rock	Computer and Information Sciences, General	33	73%	$49,582	66%	$58,957
UA at Little Rock	Mathematics, General	25	76%	$34,364	53%	$42,036
University of Central Arkansas	Computer and Information Sciences, General	68	78%	$44,616	67%	$49,911
University of Central Arkansas	Mathematics, General	32	66%	$34,365	54%	$46,241

Top Employers

The top employers by job posting frequency looking for statistics skills are shown in Table 9. Wal-Mart is by far the largest employer, with almost as many job postings as the rest of the top ten. Winning Edge Solutions, in the #2 spot, is a staffing and consulting agency in IT. Note that staffing agencies tend to be over-represented in job postings data relative to their share of the workforce. The appearance of large corporations across a variety of industries—logistics (J.B. Hunt and Fedex); health care (Anthem, Bayer); manufacturing and production (Procter & Gamble)—highlights how data-driven decision-making is characteristic of most large organizations and creates a need for statistical skills.

Table 9: Top 10 companies posting jobs that require "Statistics" as a hard skill

Company Name	Total/Unique (Jun 2018 – May 2019)	Median Posting Duration
Wal-Mart Stores, Inc.	1,196/210	40 days
Winning Edge Solutions LLC	80/74	4 days
U.S. Bancorp	146/41	35 days
Anthem, Inc.	96/34	34 days
J.B. Hunt Transport Services, Inc.	136/31	77 days
Fedex Corporation	175/20	52 days
The Procter & Gamble Company	20/20	11 days

Bayer Corporation	57/18	8 days
Oracle Corporation	36/17	52 days
University of Arkansas	67/16	37 days