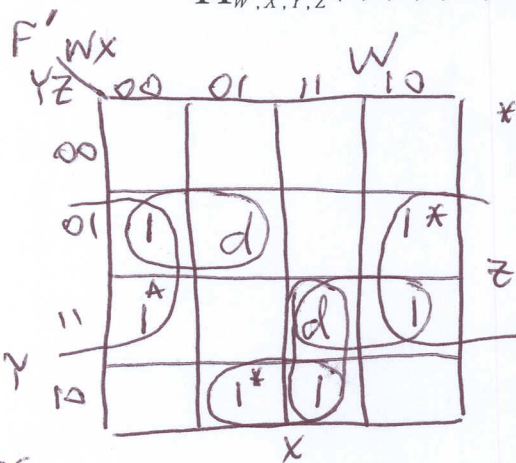


Name: Answer

Instructions: Answer all questions. Do NOT use any notes, book or calculator and show all work using back of page if necessary. Clearly indicate the final answer on the front of the page.

1. (10 points) Minimize the following switching equation utilizing Karnaugh Maps. (a) Identify all the prime implicants, distinguished cells and essential prime implicants, and write the minimal products-of-sums (POS) Boolean equation. Is the POS minimal equation unique? (b) Repeat for minimal sum-of-products (SOP) Boolean equation. Is the SOP equation unique? Which minimal equation, POS or SOP, would yield a circuit with the least number of gates (excluding inverters)? Now include the prime implicants required to prevent static hazards in both the POS and SOP equations. Please draw a separate K-map for the POS and SOP.

$$F = \prod_{w,x,y,z} (1,3,6,9,11,14) \cdot d(5,15)$$



*Distinguished cells

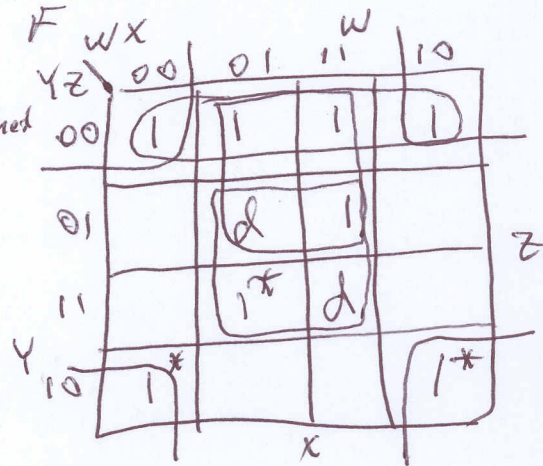
POS

$$F' = X' \cdot Z + X \cdot Y \cdot Z'$$

$$F = (X + Z') \cdot (X' + Y + Z)$$

unique, wins over SOP

no additional PI's required to prevent static hazards



SOP

$$F = X' \cdot Z' + X \cdot Z + \begin{cases} Y' \cdot Z'' \\ X \cdot Y' \end{cases}$$

non-unique
must include both $X' \cdot Z'$ and $X \cdot Y'$ to prevent static hazards