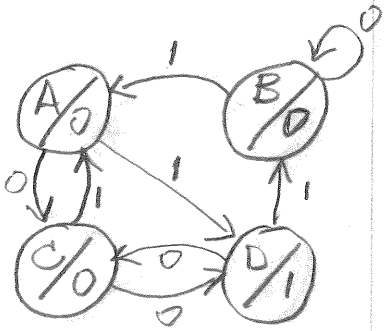
Finite State Machine (FSM) Design

Given the following State/Output Table/Diagram design a FSM with D flip-flops

Current State S	Next State W=0	Next State W=1	Output Z
A	C	D	0
B	B	A	0
C	D	A	0
D	C	B	1

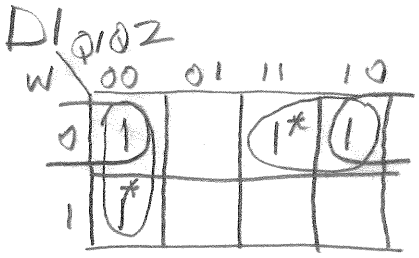
State Diagram



Using the simplest state assignment (binary order) requires two flip-flops. The Transition-Output Table is

Current State Q1	Q2	Next State W=0		Next State W=1		Output Z
0	0	1	0	1	1	0
0	1	0	1	0	0	0
1	0	1	1	0	0	0
1	1	1	0	0	1	1
		Q1*	Q2*	Q1*	Q2*	

Since the Characteristic equation for a D flip-flop is $Q^* = D$, the Excitation ≡ Transition Table. The K-maps for the excitation equation are

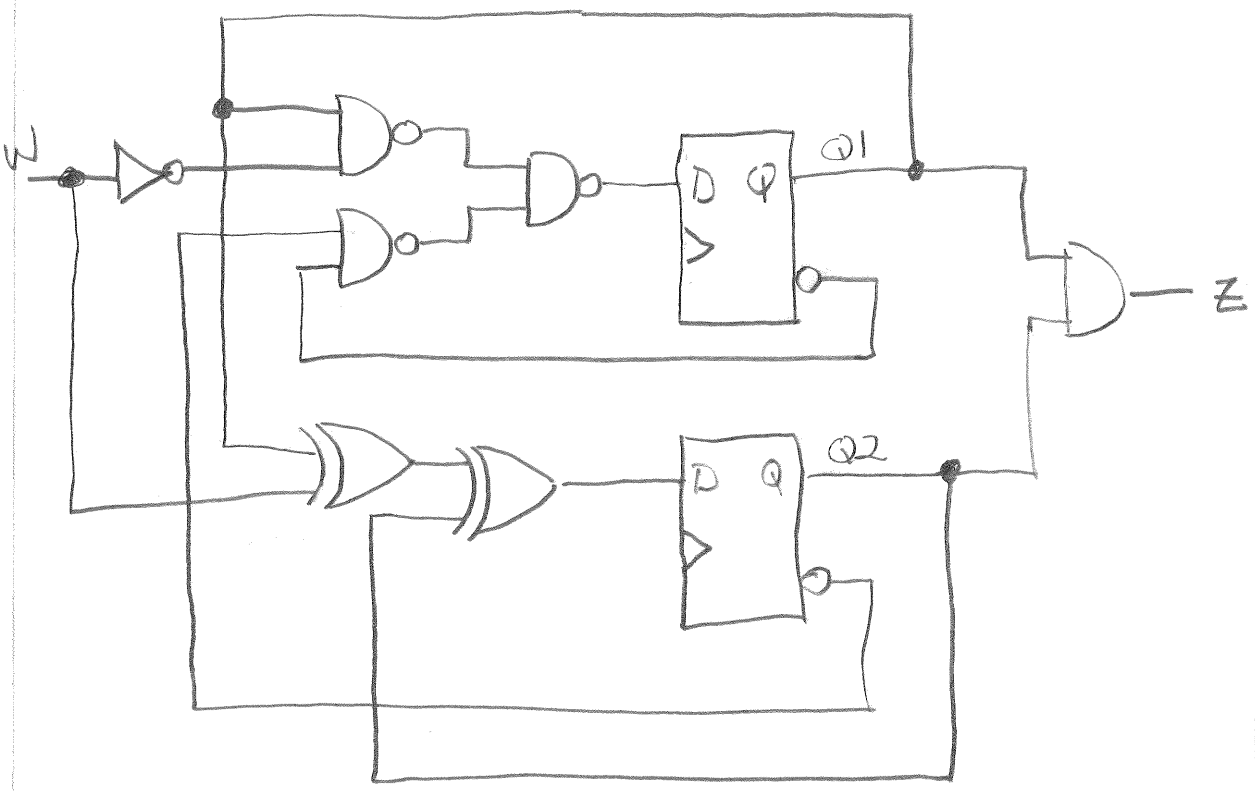


$D1 = Q1' \cdot Q2' + Q1 \cdot W'$

$D2 = Q1' \cdot Q2' \cdot W + Q1' \cdot Q2 \cdot W' + Q1 \cdot Q2 \cdot W + Q1 \cdot Q2' \cdot W'$

$= Q1' \cdot (Q2 \oplus W) + Q1 \cdot (Q2 \oplus W)'$

$= Q1 \oplus Q2 \oplus W$



As an excercise, change state encoding from binary to Gray code and repeat.