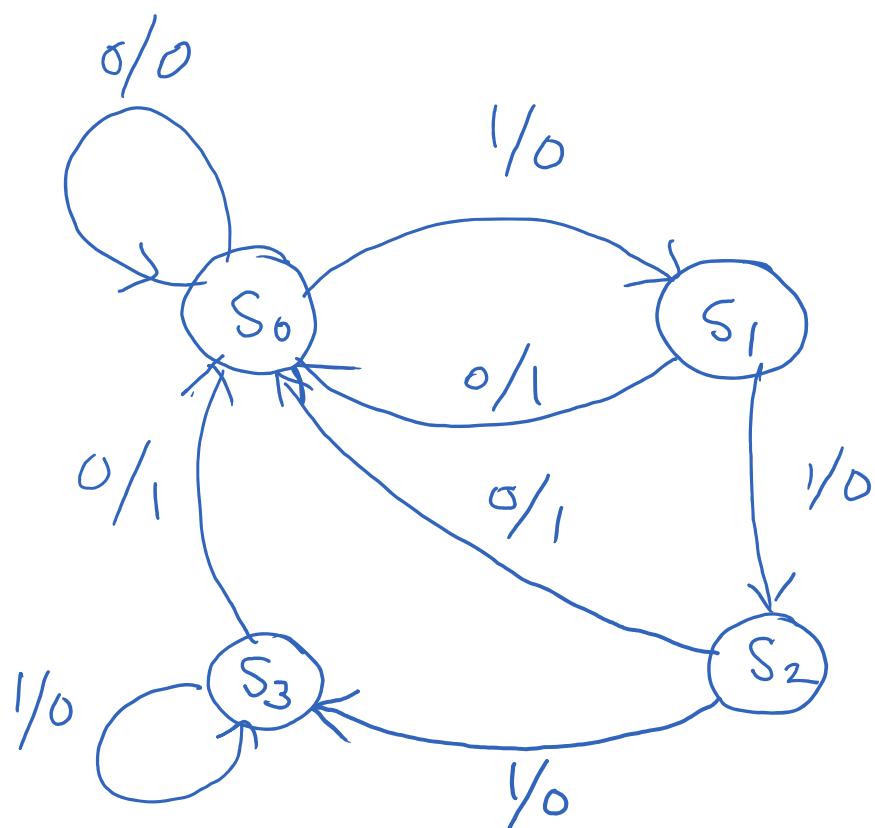


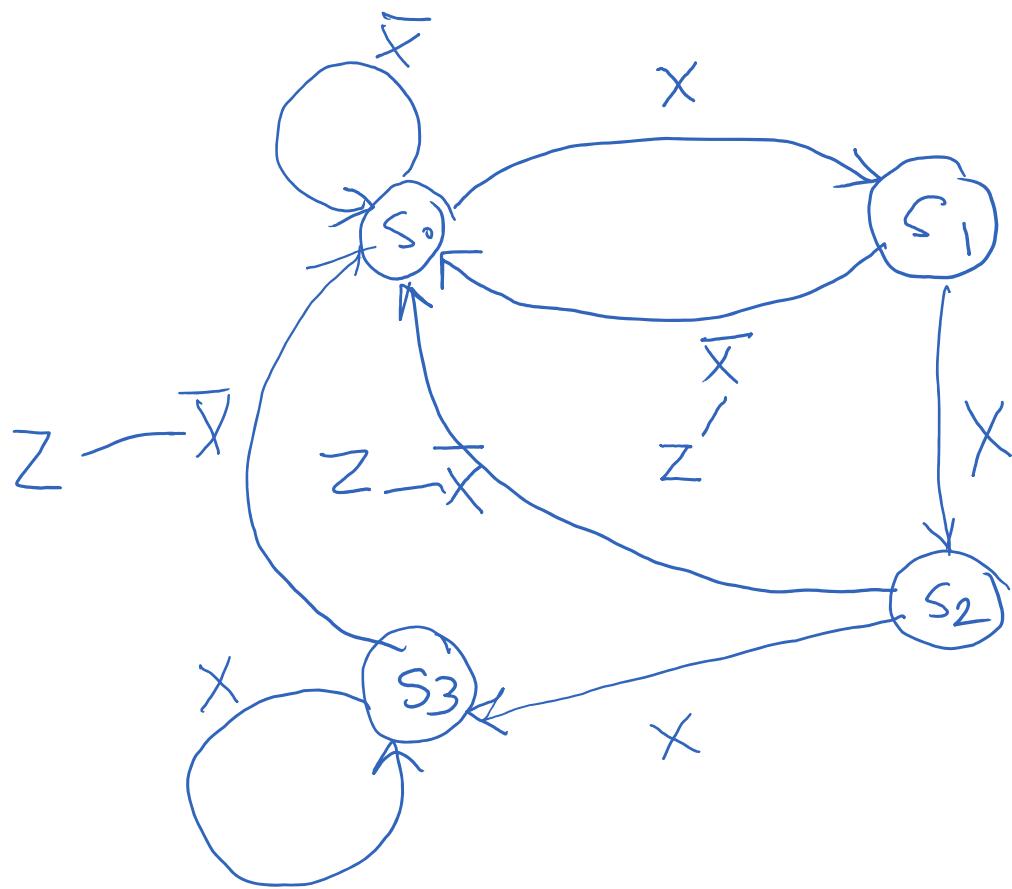
HW4 Solutions ECE2060 Sp 2022

Problem starts on next page. There is only one problem worth 10 points.

1) Design a circuit which implements the State Diagrams given below using four D-Flip Flops.
 Go through the whole design process: i) Convert the State Diagram to a State Machine Diagram ii) Determine the State machine Table iii) Determine the Flip Flop input equations and the output equations and iv) Draw the circuit. You do not have to simplify the equations so no need for K-maps.



1) Continued ...



1) Continued ...

State	static code	TC	Next State	Next State Code	Non output
S_0	1000	\bar{X}	S_0^+	1000	
S_0	1000	X	S_1^+	0100	
S_1	0100	\bar{X}	S_0^+	1000	Z
S_1	0100	X	S_2^+	0010	
S_2	0010	X	S_3^+	0001	
S_2	0010	\bar{X}	S_0^+	1000	Z
S_3	0001	X	S_3^+	0001	
S_3	0001	\bar{X}	S_0^+	1000	Z

$$\begin{aligned}
 D_{S_0} = S_0^+ &= S_0 \cdot \bar{X} + S_1 \cdot X + S_2 \cdot \bar{X} + S_3 \cdot \bar{X} \\
 &= \underbrace{(S_0 + S_1 + S_2 + S_3)}_1 \cdot \bar{X} = \bar{X}
 \end{aligned}$$

D_{S₀} = \bar{X}

$$D_{S_1} = S_1^+ = S_0 \cdot X$$

D_{S₁} = S₀ · X

1) Continued ...

$$D_{S_2} = S_2^+ = S_1 \cdot X$$

$$D_{S_2} = S_1 X$$

$$D_{S_3} = S_3^+ = S_2 \cdot X + S_3 \cdot X = (S_2 + S_3)X$$

output

$$D_{S_3} = (S_2 + S_3)X$$

$$Z = S_1 \cdot \bar{X} + S_2 \cdot \bar{X} + S_3 \cdot \bar{X} = (S_1 + S_2 + S_3) \cdot \bar{X}$$

$$Z = (S_1 + S_2 + S_3) \bar{X}$$

$$Z = (S_1 + S_2 + S_3) \bar{X}$$

$$\begin{aligned}
 D_{S_0} &= \bar{x} \\
 D_{S_1} &= S_0 x \\
 D_{S_2} &= S_1 x \\
 D_{S_3} &= (S_2 + S_3) x
 \end{aligned}
 \quad \left. \begin{aligned}
 Z &= (S_1 + S_2 + S_3) \bar{x}
 \end{aligned} \right\} \text{output equations}$$

FF input equations

