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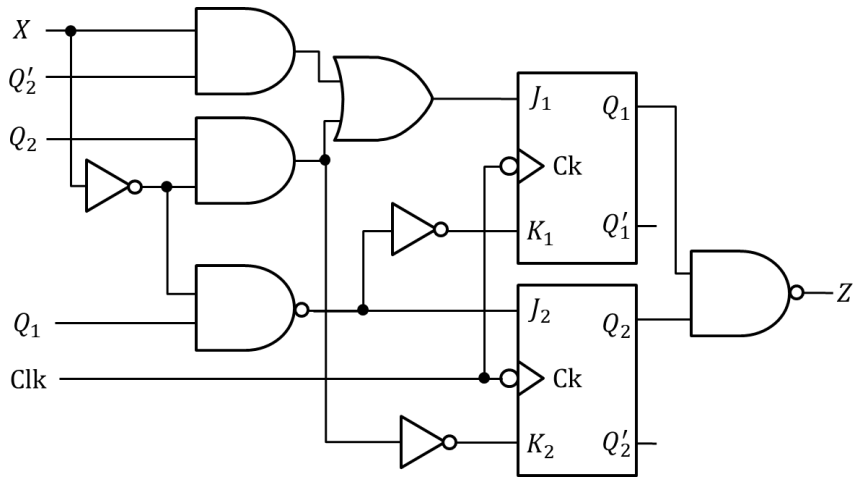
Logic design (2017 fall)

Quiz # 13

Name:_____ID:_____

1. (100%) Consider the circuit shown below.
   (a) (20%) Derive the flip-flop input equations (J_1, K_1, J_2, K_2). Note that each equation needs to be expressed in the minimum SOP form.
   (b) (25%) Derive the next-state equation for each FF from its input equations and derive the equation for output Z. Note that each equation needs to be expressed in the minimum SOP form.
   (c) (30%) Complete the transition table for the circuit.
   (d) (15%) Construct the state graph for the circuit using the given state assignment.
   (e) (5%) Does the circuit have any unused states?
   (f) (5%) Is the circuit a Mealy or Moore machine?



Transition table

Present State	Next State $Q_1^+Q_2^+$		Z
Q_1Q_2	$X=0$	$X=1$	
00	01	11	1
01	11	00	1
11	01	10	0
10	00	11	1

Ans:

(a) $J_1 = XQ_2' + X'Q_2 \quad K_1 = X'Q_1$

$J_2 = X + Q_1' \quad K_2 = X + Q_2'$

(b) $Q_1^+ = J_1Q_1' + K_1'Q_1$

$= (XQ_2' + X'Q_2)Q_1' + (X'Q_1)'Q_1$

$= XQ_1'Q_2' + X'Q_1'Q_2 + XQ_1 = XQ_1 + XQ_2' + X'Q_1'Q_2$

$Q_2^+ = J_2Q_2' + K_2'Q_2$

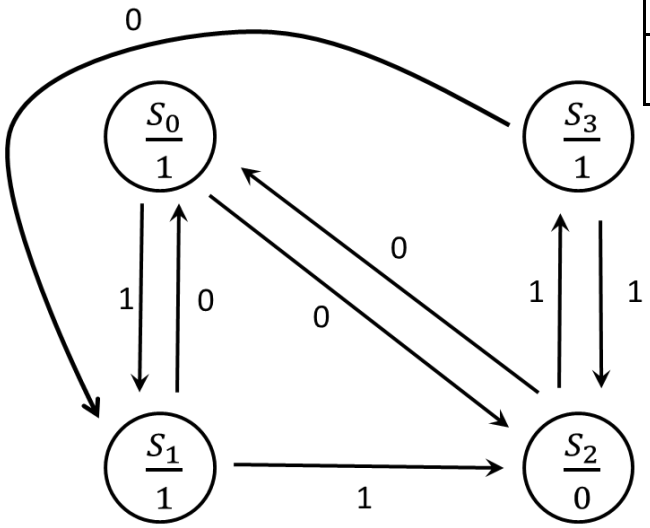
$= (X + Q_1')Q_2' + (X + Q_2')'Q_2$

$= XQ_2' + Q_1'Q_2' + X'Q_2$

$Z = (Q_1Q_2)' = Q_1' + Q_2'$

State assignment

S_0	01
S_1	00
S_2	11
S_3	10



(e) No

(f) The circuit is a Moore machine .