

Logic design (2018 fall)

Quiz # 13

Name: \_\_\_\_\_ ID: \_\_\_\_\_

1. (100%) Consider the circuit shown in Fig.1.
  - (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?

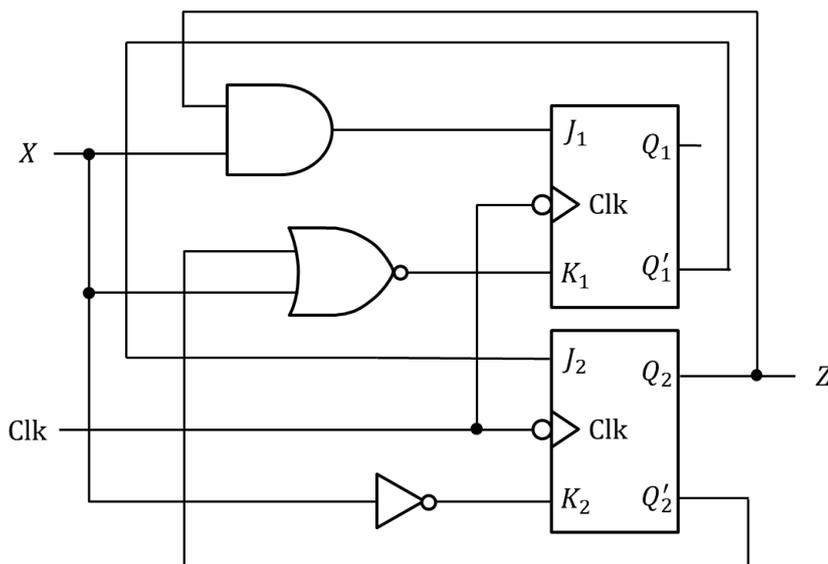


Fig.1

Transition table

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

State assignment

$S_0$	00
$S_1$	01
$S_2$	11
$S_3$	10

Ans:

(a)  $J_1 = Q_2 X$      $K_1 = Q_2 X'$

$J_2 = Q_1'$      $K_2 = X'$

(b)  $Q_1^+ = J_1 Q_1' + K_1' Q_1 = X Q_1' Q_2 + X Q_1 + Q_1 Q_2' = Q_2 X + Q_1 Q_2'$

$Q_2^+ = J_2 Q_2' + K_2' Q_2 = Q_1 Q_2' + X Q_2$

$Z = Q_2$

(e)  $S_3$  (10)

(f) The circuit is a Moore machine .

