CPSC 2610

Assignment 4

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1.

$F1(x, y, z) = x'y'z' + xz$

$= x'y'z' + xy'z + xyz$

$= \Sigma m(0, 5, 7)$

$F2(x, y, z) = xy'z' + x'y$

$= xy'z' + x'yz' + x'yz$

$= \Sigma m(2, 3, 4)$

$F3(x, y, z) = xy'z + xy$

$= xy'z + xyz' + xyz$

$= \Sigma m(5, 6, 7)$

Diagram on paper page 1

2. Paper page 1

3.

$F(A, B, C, D) = \sum m(0, 1, 2, 7, 11, 14, 15)$

A	B	C	D	F
0 0	0 0	0 0	0 1	1 1 F = 1
0 0	0 0	1 1	0 1	1 0 F = D'
0 0	1 1	0 0	0 1	0 0 F = 0
0 0	1 1	1 1	0 1	0 1 F = D

1 1	0 0	0 0	0 1	0 0 F = 0
1 1	0 0	1 1	0 1	0 1 F = D
1 1	1 1	0 0	0 1	0 0 F = 0
1 1	1 1	1 1	0 1	1 1 F = 1

Diagram on paper page 1

4. State diagram on paper page 1

$Q_{(t+1)} = D = C = xy + xQ_{(t)} + yQ_{(t)}$

$S = x \oplus y \oplus Q_{(t)}$

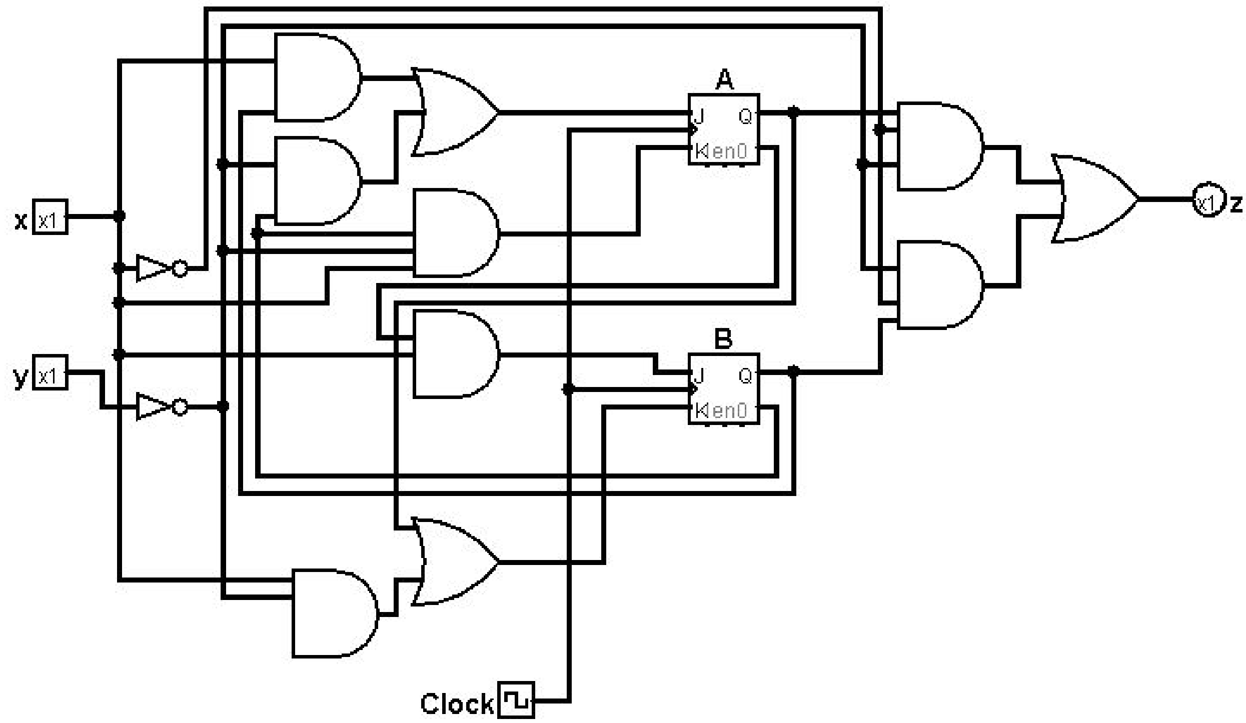
$= (xy' + x'y) \oplus Q_{(t)}$

$= (xy' + x'y) Q'_{(t)} + (xy' + x'y)' Q_{(t)}$

Current States	Input		Next States	Output
$Q_{(t)}$	x	y	$Q_{(t+1)}$	S
0 0 0 0 1 1 1 1	0 0 1 1 0 0 1 1	0 1 0 1 0 1 0 1	0 0 0 1 0 1 1 1	0 1 1 0 1 0 0 1

5.

a.

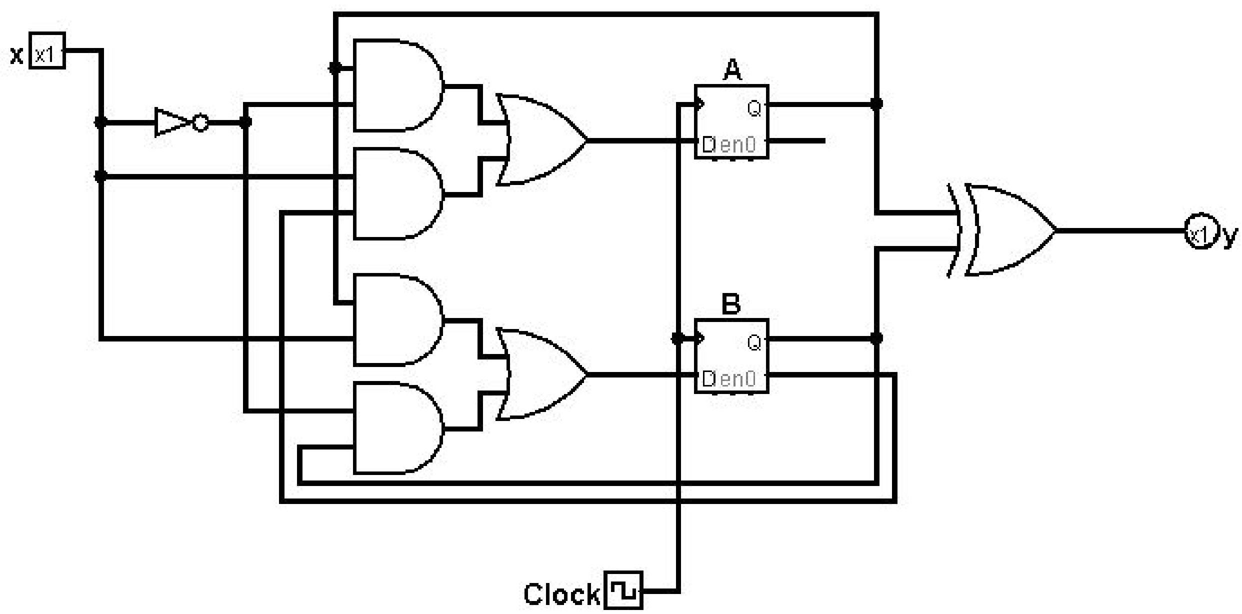


b.

Current States		Input		Input to JK-FF				Next States		Output
A(t)	B(t)	x	y	J_A	K_A	J_B	K_B	A(t+1)	B(t+1)	z
0	0	0	0	1	X	0	X	1	0	0
0	0	0	1	0	X	0	X	0	0	0
0	0	1	0	1	X	1	X	1	1	0
0	0	1	1	0	X	1	X	0	1	0
0	1	0	0	0	X	X	0	0	1	1
0	1	0	1	0	X	X	0	0	1	0
0	1	1	0	1	X	X	1	1	0	0
0	1	1	1	1	X	X	0	1	1	0
1	0	0	0	X	0	0	X	1	0	1
1	0	0	1	X	0	0	X	1	0	0
1	0	1	0	X	1	0	X	0	0	0
1	0	1	1	X	0	0	X	1	0	0
1	1	0	0	X	0	X	1	1	0	1
1	1	0	1	X	0	X	1	1	0	0
1	1	1	0	X	0	X	1	1	0	0
1	1	1	1	X	0	X	1	1	0	0

6. Paper page 2 for state diagram and K-map
State Table

Current States		Input	Next States		Input to D-FF		Output
$Q_{A(t)}$	$Q_{B(t)}$	x	$Q_{A(t+1)}$	$Q_{B(t+1)}$	D_A	D_B	y
0	0	0	0	0	0	0	0
0	0	1	1	0	1	0	0
0	1	0	0	1	0	1	1
0	1	1	0	0	0	0	1
1	0	0	1	0	1	0	1
1	0	1	1	1	1	1	1
1	1	0	1	1	1	1	0
1	1	1	0	1	0	1	0



This diagram is a Moore circuit because its output, y, is a function of current state, $Q_{A(t)} \oplus Q_{B(t)}$. Furthermore, because the circuit uses D-FF, therefore, $Q_{A(t)} = D_A = Q_{A(t+1)}$ and $Q_B = D_B = Q_{B(t+1)}$.

7.

a. We should use 3 FFs because each node has 3 digits, and the state diagram has 5 nodes.
b. State table

Current Statas			Input	Next States			Input to T-FF			Output
$Q_{A(t)}$	$Q_{B(t)}$	$Q_{C(t)}$	x	$Q_{A(t+1)}$	$Q_{B(t+1)}$	$Q_{C(t+1)}$	T_A	T_B	T_C	y
0	0	0	0	0	1	1	0	1	1	0
0	0	0	1	1	0	0	1	0	0	1
0	0	1	0	0	0	1	0	0	0	0
0	0	1	1	1	0	0	1	0	1	1
0	1	0	0	0	1	0	0	0	0	0
0	1	0	1	0	0	0	0	1	0	1
0	1	1	0	0	0	1	0	1	0	0
0	1	1	1	0	1	0	0	0	1	1
1	0	0	0	0	1	0	1	1	0	0
1	0	0	1	0	1	1	1	1	1	0
X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X

K-map on paper page 2

$T_A = \Sigma m(1, 3, 8, 9)$
$\quad = Q_{a(t)} + Q_{b(t)}'$

$T_B = \Sigma m(0, 5, 6, 8, 9)$
$\quad = Q_{A(t)} + Q_{B(t)}'.Q_{c(t)}'.x + Q_{B(t)}.Q_{C(t)}'.x$

$T_c = \Sigma m(0, 3, 7, 9)$
$\quad = Q_{A(t)}.x + Q_{C(t)}.x + Q_{A(t)}'.Q_{B(t)}'.Q_{C(t)}'.x'$

$y = Q_{A(t)}'.x$