ECS 154A Homework 4

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1. Implement the following D flipflop as a JK flipflop.

   D

		QX			
		00	01	11	10
YZ	00	1	0	0	1
	01	1	1	1	0
	11	1	1	1	1
	10	0	1	0	0

   J

		QX			
		00	01	11	10
YZ	00	1	0	d	d
	01	1	1	d	d
	11	1	1	d	d
	10	0	1	d	d

   $J = Z + \overline{X}\ \overline{Y} + XY$

   K

		QX			
		00	01	11	10
YZ	00	d	d	1	0
	01	d	d	0	1
	11	d	d	0	0
	10	d	d	1	1

   $K = X\overline{Z} + Y\overline{Z} + \overline{X}\ \overline{Y}Z$

2. Implement the following D flipflop as a T flipflop.

   D

		QX			
		00	01	11	10
YZ	00	0	0	1	1
	01	1	1	0	0
	11	1	1	0	0
	10	0	0	1	1

T

		QX			
		00	01	11	10
YZ	00	0	0	0	0
	01	1	1	1	1
	11	1	1	1	1
	10	0	0	0	0

$T = Z$

3. Implement the state diagram using D flipflops. Show the state transition table, state encoding, k-maps, and equations.

   (a) State transitions

Current	X_1	X_0	Next
A	d	0	B
A	d	1	A
B	0	0	B
B	0	1	D
B	1	0	D
B	1	1	B
C	0	0	C
C	d	1	D
C	1	0	A
D	0	D	C
D	1	D	D

   Output

State	Z_1	Z_0
A	0	0
B	0	1
C	1	0
D	0	0

   (b) State encoding

State	S_1	S_0
A	0	0
B	0	1
C	1	0
D	1	1

   Encoded state transitions

Current		Input		Next	
S_1	S_0	X_1	X_0	S_1'	S_0'
0	0	d	0	0	1
0	0	d	1	0	0
0	1	0	0	0	1
0	1	0	1	1	1
0	1	1	0	1	1
0	1	1	1	0	1
1	0	0	0	1	0
1	0	d	1	1	1
1	0	1	0	0	0
1	1	0	d	1	0
1	1	1	d	1	1

   Encoded output

S_1	S_0	Z_1	Z_0
0	0	0	0
0	1	0	1
1	0	1	0
1	1	0	0

S_1'

		S_1S_0 00	01	11	10
X_1X_0	00	0	0	1	1
	01	0	1	1	1
	11	0	0	1	1
	10	0	1	0	1

S_0'

		S_1S_0 00	01	11	10
X_1X_0	00	1	1	0	0
	01	0	1	0	1
	11	0	1	1	1
	10	1	1	1	0

$S_1' = (S_1 + S_0)(S_1 + \overline{X_1} + \overline{X_0})(S_1 + X_1 + X_0)(\overline{S_1} + \overline{S_0} + \overline{X_1} + X_0)$

$S_0' = (S_1 + S_0 + \overline{X_0})(\overline{S_1} + \overline{S_0} + X_1)(\overline{S_1} + S_0 + X_0)$

$Z_1 = S_1\overline{S_0}$

$Z_0 = \overline{S_1}S_0$