

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