

**KFUPM - COMPUTER ENGINEERING DEPARTMENT**

**COE-202 – Fundamentals of Computer Engineering**

**May 6<sup>th</sup>, 2007 – Quiz6 (section 02)**

**Student Name:**

**Student Number:**

**Problem: (50 points)** Consider the JK and D flip-flops:

- a) (10 points) Write the characteristic table for the JK flip-flop.
- b) (10 points) Write the characteristic table for the D flip-flop.
- c) (30 point) Convert a D-type flip-flop into a JK flip-flop, using external gates.

Hint: The gates can be derived by means of a sequential circuit design procedure starting from a state table with the D flip-flop output as the present state and it input as the next state and with J and K as circuit inputs.

**Solution:**

a) & b) the characteristic tables are as follows (refer to slide 19):

(a) JK Flip-Flop			
J	K	Q(t+1)	Operation
0	0	Q(t)	No change
0	1	0	Reset
1	0	1	Set
1	1	Q'(t)	Complement

(b) D Flip-Flop		
D	Q(t+1)	Operation
0	0	Reset
1	1	Set

c) Using the hint - the state table and design are as shown below:

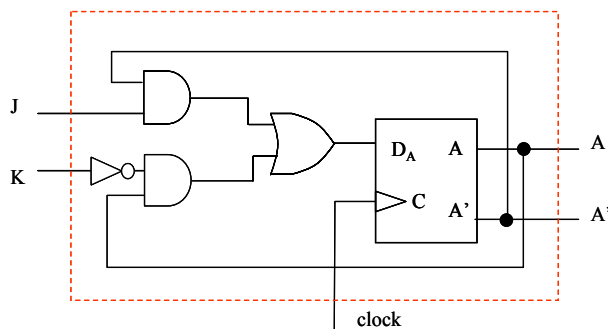
Present State	Inputs		Next State
	J	K	
A			A
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

(10 points)

JK	00	01	11	10
A	0	1	0	1
0	0	0	1	1
1	1	0	0	1

$$D_Q = A'J + AK'$$

K-map and equation (10 points)



(10 points)