Digital Logic Design Assignment 10 - EC2011-19

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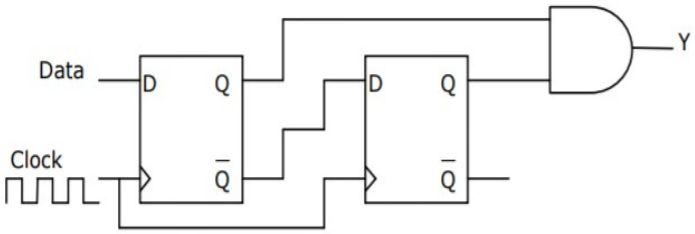
1 Question

When the output Y in the circuit below is '1',it implies that the data has



(A) changed from 0 to 1
(B) changed from 1 to 0
(C) changed in either direction
(D) not changed

2 Solution

In this problem there are two D-flip flops and one and gate. The output of and gate is Y which is the output of the above sequential circuit.
For our convenience let us take the first flip flop as A flip flop and second flip flop as B flip flop.

For A flip flop

- Input is D_A
- Outputs are Q_A and $\overline{Q_A}$

For B flip flop

- Input is D_B

- Outputs are Q_B and $\overline{Q_B}$

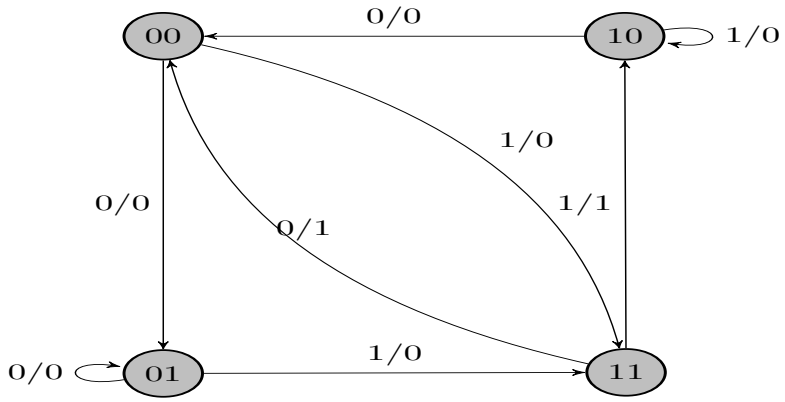
Now we need to find out the change in data when output Y is equal to 1. From the figure , it is clear that

$$Q_A = D_A = Data \tag{1}$$

$$Q_B = D_B = \overline{Q_A} \tag{2}$$

$$Y = Q_A.Q_B \tag{3}$$

2.1 State transition Diagram



2.2 State transition Table

TABLE 2					
Present state		Data	Next state		Y
Q_A	Q_B		Q_A*	Q_B*	
0	0	0	0	1	0
0	0	1	1	1	0
0	1	0	0	1	0
0	1	1	1	1	0
1	0	0	0	0	0
1	0	1	1	0	0
1	1	0	0	0	1
1	1	1	1	0	1

Clock	Data	Q_A	Q_B
-		0	0
1st Pulse	D_1	D_1	1
2nd Pulse	D_2	D_2	$\overline{D_1}$

2.3 Table

- When the clock is not given to the flip flops then Q_A and Q_B will remain in their reset state
- For the first clock pulse , we give the data as D_1
  - From equation (1) we get $Q_A = Data$. Since data = D_1,$Q_A = D_1$
  - From equation (2) we get $Q_B = \overline{Q_A}$. Since $Q_A = 0$,$Q_B = 1$
- For the second clock pulse , we give the data as D_2
  - From equation (1) we get $Q_A = Data$. Since data = D_2,$Q_A = D_2$
  - From equation (2) we get $Q_B = \overline{Q_A}$. Since $Q_A = D_1$,$Q_B = \overline{D_1}$

2.4 Answer

Now we will generalise the case

- The output of first flip flop Q_A is equal to *present data*
- The output of second flip flop Q_B is equal to compliment of *previous data*

We know that $Y = Q_A.Q_B$

This means $Y = (presentdata).(\overline{previousdata})$

So the output of Y is equal to 1 only when the present data is equal to 0.So the data must change from 0 to 1.

In this way option (A) is the correct answer