HOMEWORK 5

TEVFIK OZGU

150180082

1. Analyze the synchronous sequential circuit given in the figure below by answering following questions.

• Determine the input functions of the flip-flops.

Input Functions Of J-K Flip Flop:

J =

K = X ⊕ = ( + X) = ()(X + ) = + X

Input Functions of D Flip Flop:

D = X

• Determine the next states (use Q0 for JK-FF, and Q1 for D-FF) and output expression.

= J + = + ( + X)

= + ( + X) = + + X

= + + X = +) + X (Inverse)

= + X (Next State of J-K flip flop)

= D = X (Next State of D flip flop)

Z = X (Output Expression)

• Derive the state/output table.

X

|  |  |  |
| --- | --- | --- |
|  | 0 | 1 |
| 00 | 00,0 | 10,0 |
| 01 | 00,0 | 11,0 |
| 10 | 01,0 | 10,0 |
| 11 | 01,0 | 10,1 |

To make the table more understandable we assign state names to state codes.

00:A

01:B

10:C

11:D

X

|  |  |  |
| --- | --- | --- |
|  | 0 | 1 |
| A | A,0 | C,0 |
| B | A,0 | D,0 |
| C | B,0 | C,0 |
| D | B,0 | C,1 |

• Draw the state transition diagram.

X=0

Z=0

X=0



Z=0

***A B***

*X=1* X=1 X=0

Z=0 Z=0 Z=0

***X=0***

***Z=0***

***D C***



X=1

Z=1

X=1

Z=0

*2****.*** Assume that the machine is in state 00 and the output is also 0. Write the shortest possible sequence of X (consecutive values of X) that makes the output 1.

1. Initially machine is in state 00 so machine is in A state.
2. If X=1 is given new state is c and output is 0.
3. Then we give X=0 so new state is B and output is 0.
4. Then we give X=1 so machine is In state D and output is 0.
5. Finally, we give X=1 so machine is in state C and output is 1.

***Sequence of X: 1 🡪 0 🡪 1 🡪 1***