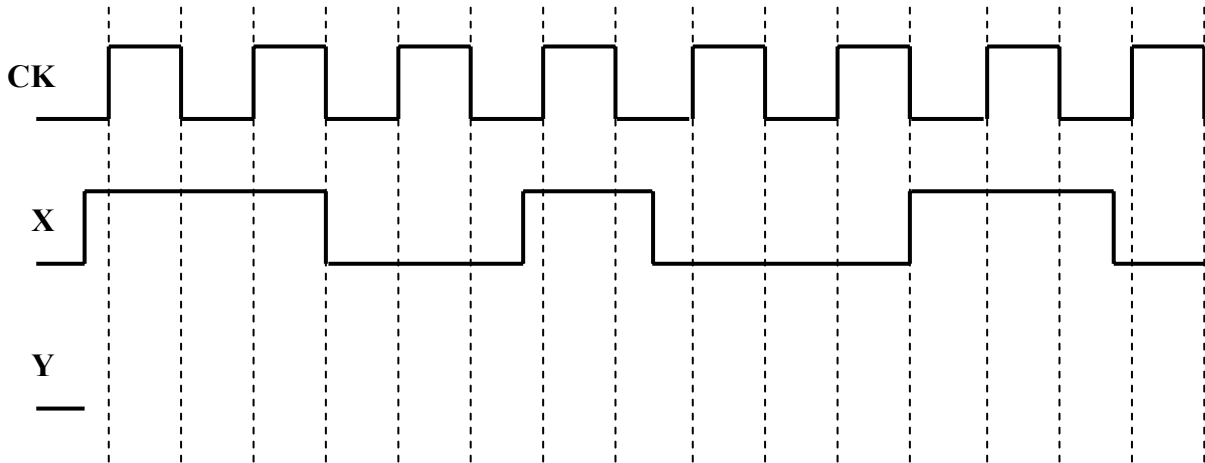


Q.1. Design a circuit that counts the number of 1s in an input stream (i.e. it has a single input X). Every time the number of received 1s reaches 4 the circuit produces a 1 at its output Y and starts counting again. Otherwise the output Y remains at 0. The following streams of X and Y illustrates the operation of this circuit:

X: 0 1 0 0 1 1 0 1 1 1 0 0 0 1 1 0 1 0 1 1 0 0 1 ...
Y: 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0 ...

Use positive edge-triggered FFs (one JK-FF and the rest are D-FF) and specify whether your circuit is a Mealy model or Moore?

Complete the timing diagram below assuming the circuit starts from an initial state where no 1 has been received before.



Q.2. Implement the following Flip-Flops using D-Flip Flops:

- (1) Set-Dominant SR-FF (when S=R=1, Q=1)
- (2) JK-FF
- (3) T-FF

Q.3. A sequential circuit has two D flip-flops A and B, two inputs X and Y, and one output Z. The flip-flop input equations and output function are as follows:

$$D_A = B X + A Y'$$

$$D_B = A' X + B' Y$$

$$Z = X A B$$

- (i) Show the logic implementation of this circuit.
- (ii) Obtain the state diagram for this circuit.
- (iii) Is this is a Mealy machine or a Moore Machine? Explain why