

- 1) Design a combinational circuit with three inputs x, y, z, and three outputs a, b, and c. When the binary input is 0, 1, 2, or 3, the binary output is 1 greater than the input. When the binary input is 4, 5, 6, or 7, the binary output is one less than the input. (10 Marks)
- 2) Design a 4bits combinational circuit 2's complementer (the output generates the 2's complement of the input binary number).(10 Marks)
- 3) show that the characteristic equation for the complement output of a JK flip flop is (10 Marks)

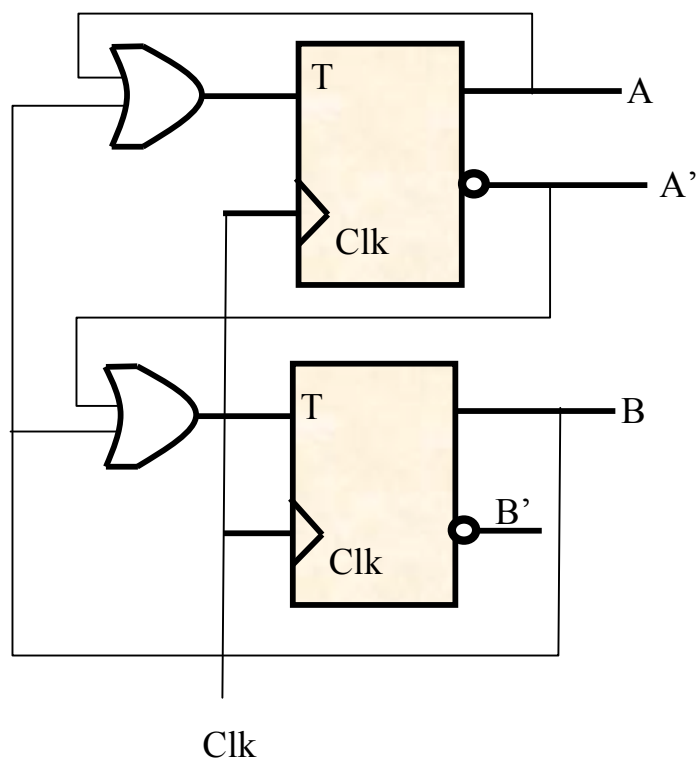
$$Q'(t+1) = J'Q' + KQ$$

- 4) A sequential circuit with two D flip flops A and B, two inputs x and y and one output z is specified by the following next state and output equation (10 Marks)

$$\begin{aligned} A(t+1) &= x'y + xA \\ B(t+1) &= x'B + xA \\ z &= B \end{aligned}$$

- a) Draw the logic diagram of the circuit
- b) List the state table for the sequential circuit
- c) Draw the corresponding state diagram

- 5) Drive the state table and the state diagram of the sequential circuit shown below: (10 Marks)



- 6) A sequential circuit has two JK flip flops A, and B and one input X. The circuit is described by the following flip flop equations. (10 Marks)

$$\begin{array}{ll} \mathbf{J_A = x} & \mathbf{K_A = B'} \\ \mathbf{J_B = x} & \mathbf{K_B = A} \end{array}$$

- a) Derive the state equations $A(t+1)$ and $B(t+1)$.
- b) Draw the state diagram of the circuit