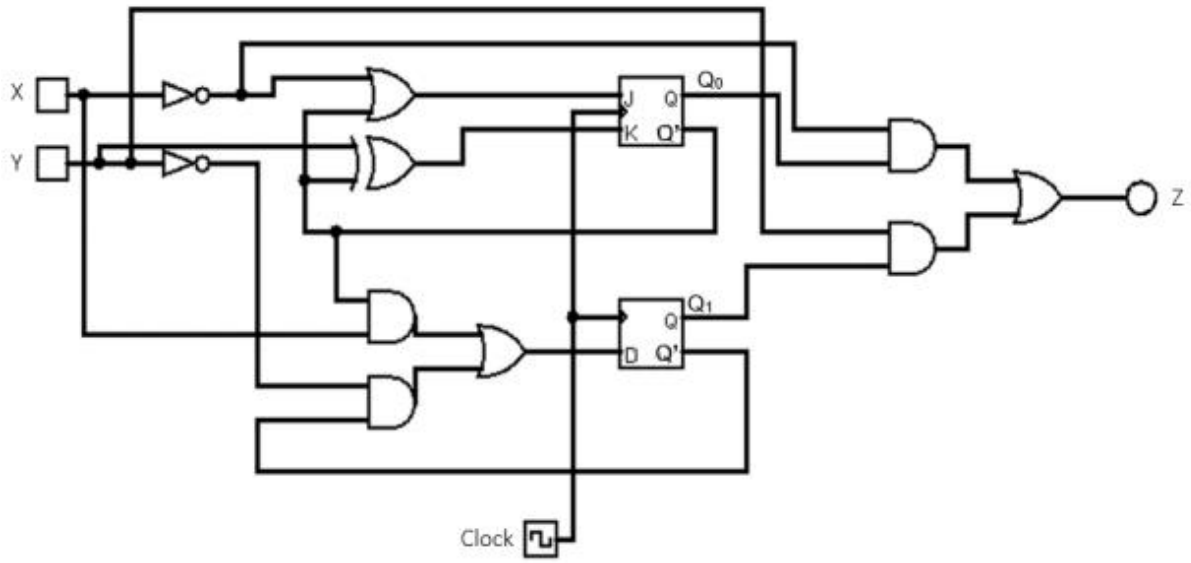
150210022 – Harun Yahya Demirpençe

Questions:

A synchronous sequential circuit is given below:



1. **Determine the type of this circuit: Mealy or Moore. Provide an explanation for your choice.**

a. The inputs, and the current state determine the output of the function. This means it is a Mealy Model sequential circuit. If the output depended only on the current state, this would be a Moore model.

2. **Find the simplest possible expressions for the functions that drive the J_0, K_0, and D_1 inputs of the flip-flops.**
   J_0 =?
   K_0 =?
   D_1 =?
   Present a detailed derivation for each expression.

b. $J_0 = X' + Q_0'$

$K_0 = Y \oplus Q_0' = Y.\ Q_0 + Y'.\ Q_0'$

$D_1 = Q_0'.\ X + Q_1'.\ Y'$

3. Determine the simplest possible expressions for the next states Q_0^+ and Q_1^+ (using Q_0 for the J-K flip-flop and Q_1 for the D flip-flop) and the expression for the output Z.

Q_0^+ =?

Q_1^+ =?

Z =?

c.

$Q_0^+ = J_0 \cdot Q_0' + K_0' \cdot Q_0$ (J-K FF characteristic function)

$Q_0^+ = (X' + Q_0') \cdot Q_0' + (Y' + Q_0') \cdot (Y + Q_0) \cdot Q_0$

$Q_0^+ = X' \cdot Q_0' + Q_0' + (Y' \cdot Y + Y' \cdot Q_0 + Q_0' \cdot Y + Q_0' \cdot Q_0) \cdot Q_0$

$Q_0^+ = Q_0' + (Y' \cdot Q_0 \cdot Q_0 + Q_0' \cdot Y \cdot Q_0)$

$Q_0^+ = Q_0' + Y' \cdot Q_0$

$Q_0^+ = Q_0' + Y'$ (minimization)

$Q_1^+ = D_1$

$Q_1^+ = Q_0' \cdot X + Q_1' \cdot Y'$

$Z = Q_0 \cdot X' + Q_1 \cdot Y$

4. Create the state/output table, detailing the relationships between states and corresponding outputs.

d.

$Q_1^+ Q_0^+$, Z

Q_1Q_0 \ XY	00	01	10	11
00	11, 0	01, 0	11, 0	11, 0
01	11, 1	00, 1	11, 0	00, 0
10	01, 0	01, 1	11, 0	11, 1
11	01, 1	00, 1	01, 0	00, 1

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S^+, Z

X Y / S	0 0	0 1	1 0	1 1
A	D, 0	B, 0	D, 0	D, 0
B	D, 1	A, 1	D, 0	A, 0
C	B, 0	B, 1	D, 0	D, 1
D	B, 1	A, 1	B, 0	A, 1