LAB REPORT

Khulna University of Engineering & Technology

Computer Science and Engineering

Name	:	Doniel Tripura
Roll	:	1907121
Section	:	B
Semester	:	2nd
Experiment No	:	11

Experiment Name: Sequential Logic Design and Testing.

AIM:

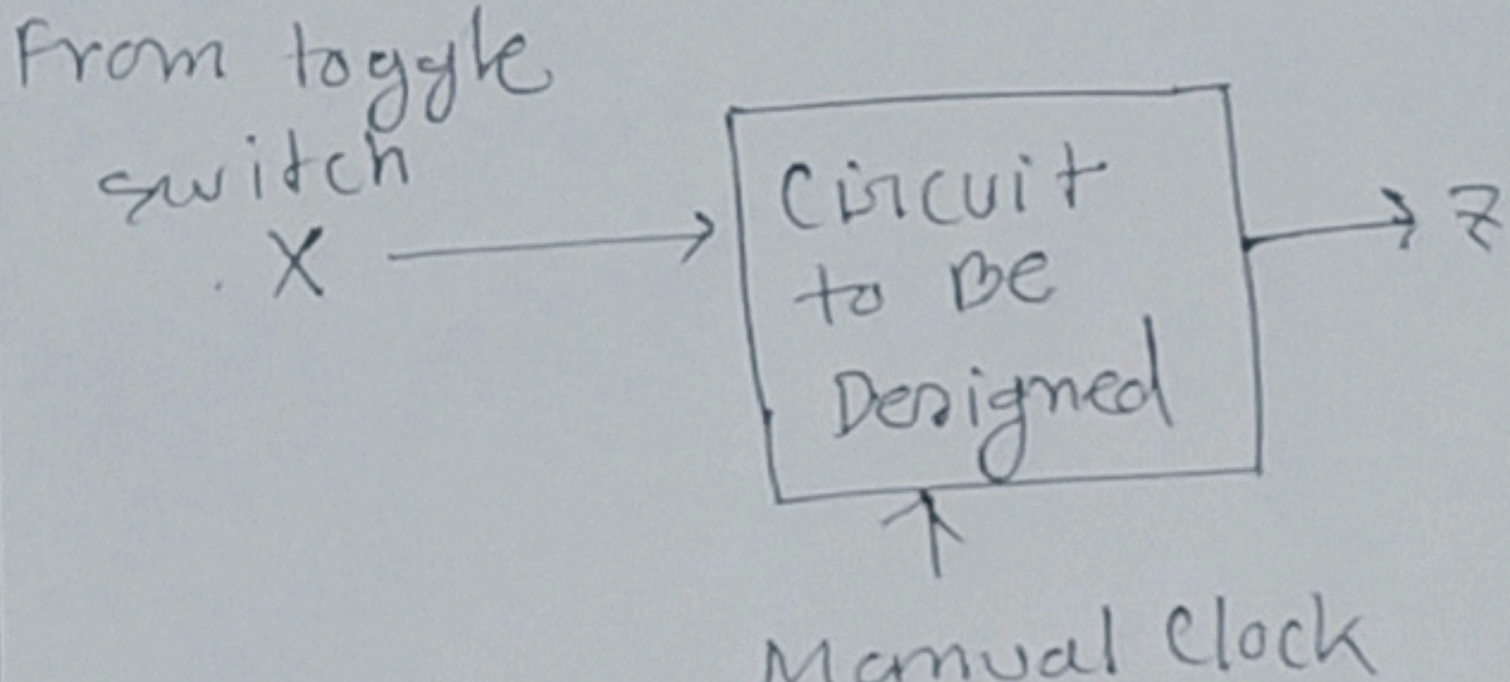
(i) To design a mealy sequential circuit which investigates an input sequence X and will produce an output of Z=1 for any input sequence ending in 0010 or 100. (as odd roll 1907121)

Learning Objectives:

(i) To Learn about Sequence detector (Sequential Logic Design).
(ii) To Learn about the application of Sequence detector.
(iii) To Learn implementing Sequence detector.

Theory:

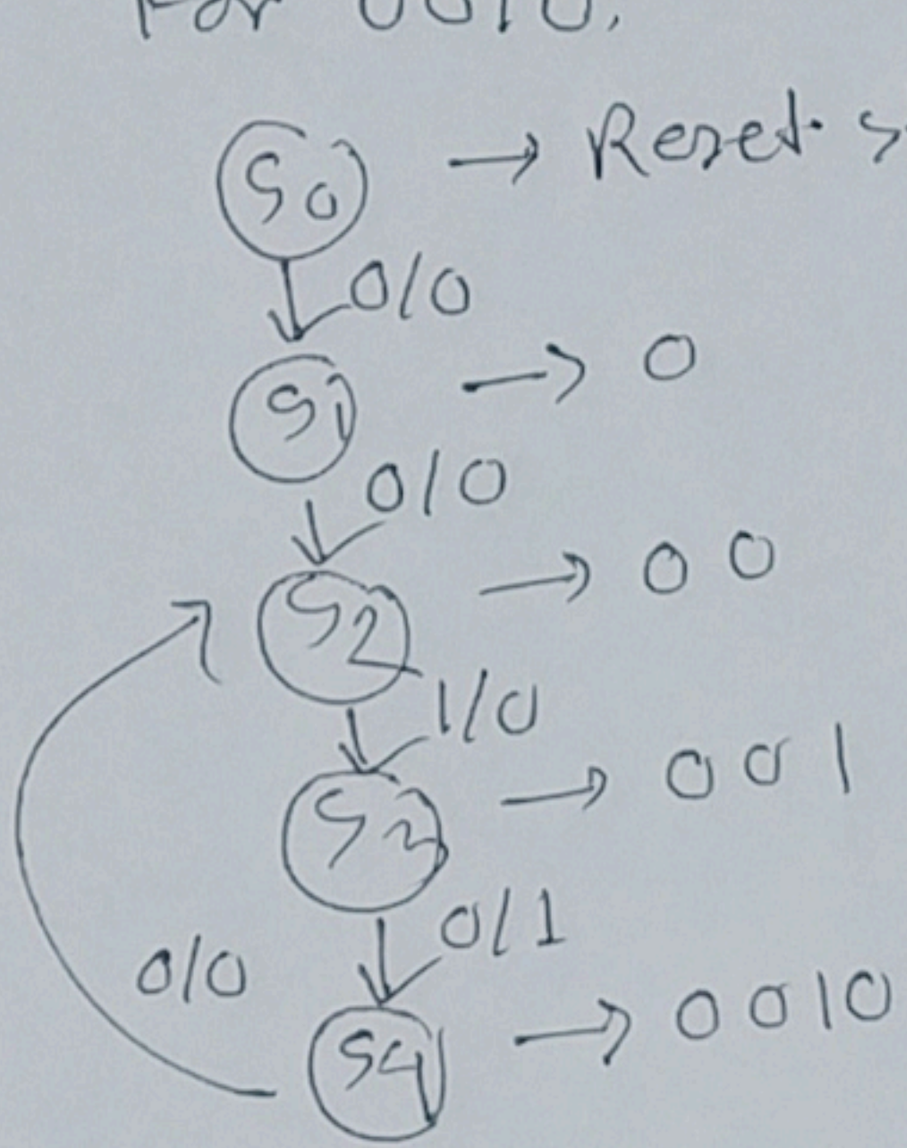
A mealy machine is a finite-state machine whose output values are determined both by its current state and the current inputs.



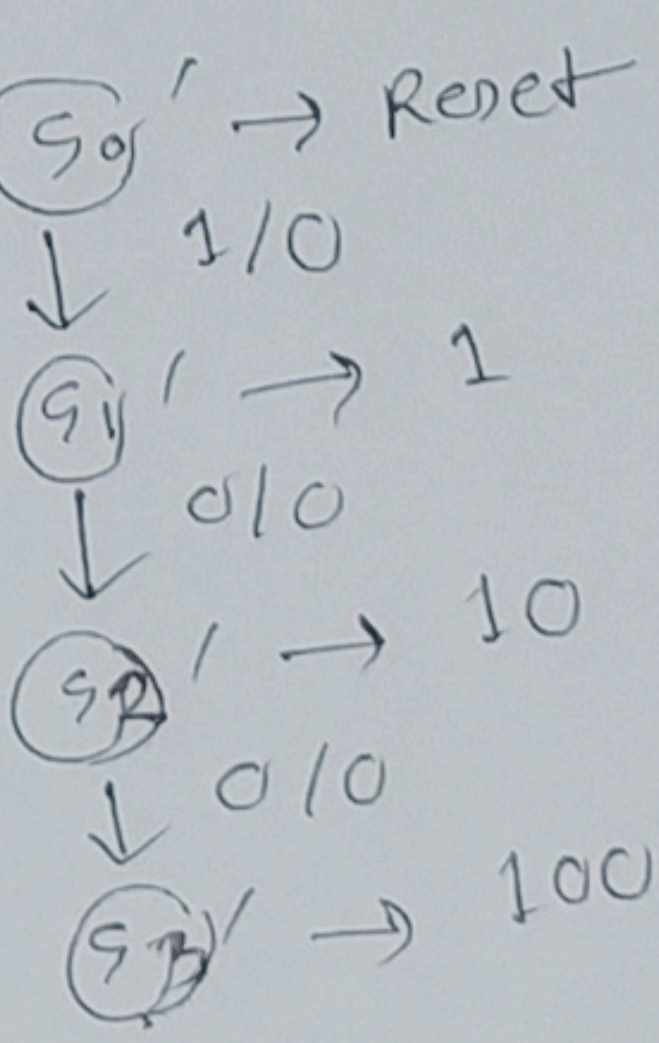
To design our circuit, we need to make a state diagram that shows two paths that lead to an output 1. One is for the sequence 0010 and the other is for 100. A table which lists all of the states and possible next state for the possible next input should be constructed. A state table is to be formed to design the circuit. After that state assignment is required. From the state table, Karnaugh map for next state and output have to be formed to get the minimized equation for the output.

State diagram :

For 0010,

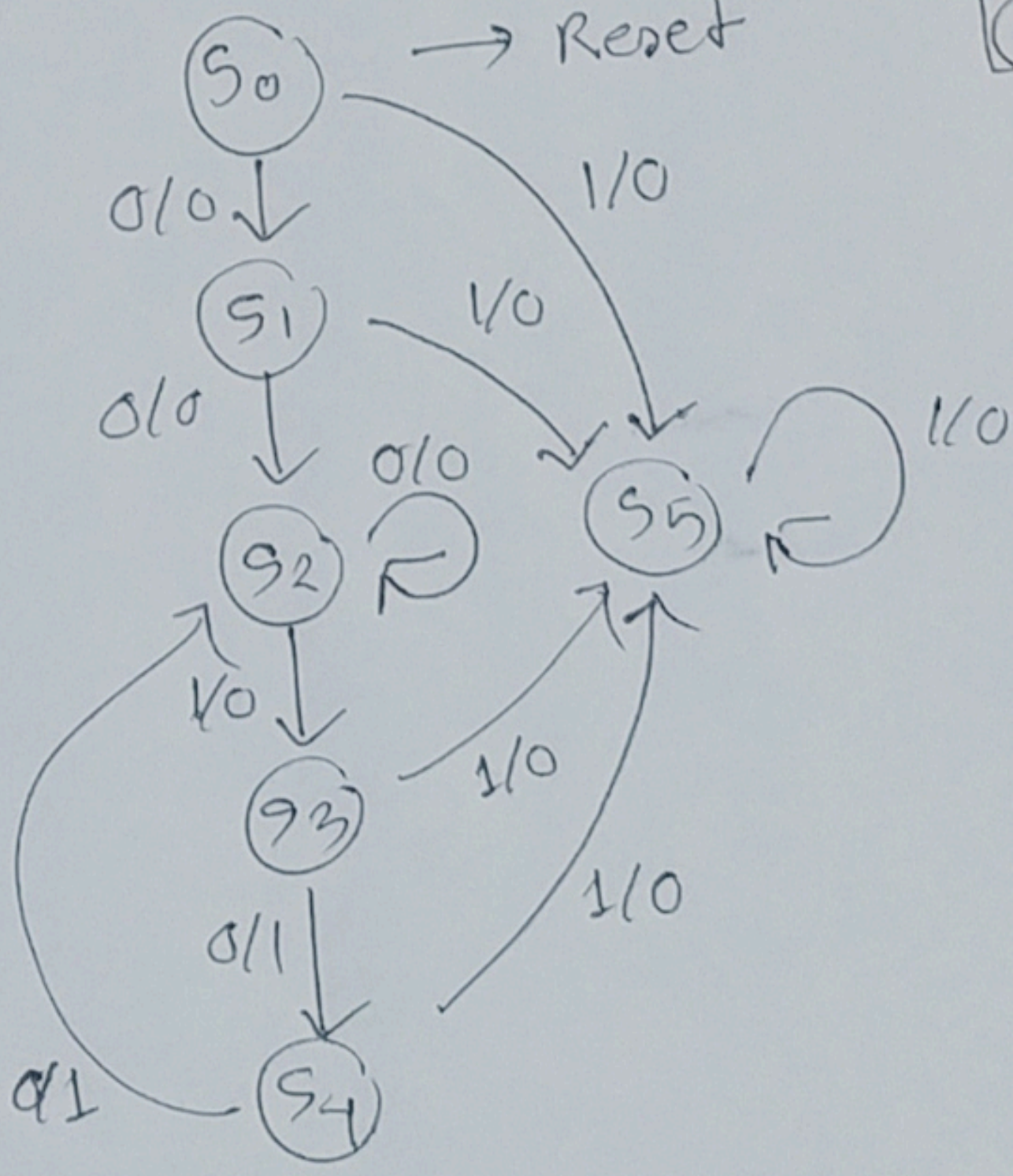


For 100,



as we have to combine it, [S2' ≅ S4]

[S3' ≅ S2]



Lets consider,

$S_0 = 000$

$S_1 = 001$

$S_2 = 010$

$S_3 = 011$

$S_4 = 100$

$S_5 = 101$

State Table:

Present state			Input	Next state			Output	Flipflop input		
Q_A	Q_B	Q_C	x	Q_A^+	Q_B^+	Q_C^+	z	D_A	D_B	D_C
0	0	0	0	0	0	1	0	0	0	1
0	0	0	1	1	0	1	0	1	0	1
0	0	1	0	0	1	0	0	0	1	0
0	0	1	1	1	0	1	0	1	0	1
0	1	0	0	0	1	0	0	0	1	0
0	1	0	1	0	1	1	0	0	1	1
0	1	1	0	1	0	0	1	1	0	0
0	1	1	1	1	0	1	0	1	0	1
1	0	0	0	0	1	0	1	0	1	0
1	0	0	1	1	0	1	0	1	0	1
1	0	1	0	1	0	0	0	1	0	0
1	0	1	1	1	0	1	0	1	0	1

Karnaugh Map:

For $D_A = Q_A^+$

$Q_A Q_B$ \ $Q_C X$	00	01	11	10
00	0	1	1	0
01	0	0	1	1
11	x	x	x	x
10	0	1	1	1

For $D_B = Q_B^+$

$Q_A Q_B$ \ $Q_C X$	00	01	11	10
00	0	0	0	1
01	1	1	0	0
11	x	x	x	x
10	1	0	0	0

$D_A = Q_A^+ = \bar{Q}_B X + Q_B Q_C + Q_A Q_C$

$= \overline{\overline{\bar{Q}_B X} \cdot \overline{Q_B Q_C} \cdot \overline{Q_A Q_C}}$

$D_B = Q_B^+ = Q_B \bar{Q}_C + \bar{Q}_A Q_B Q_C X + Q_A \bar{Q}_C X$

$= \overline{\overline{Q_B \bar{Q}_C} \cdot \overline{\bar{Q}_A Q_B Q_C X} \cdot \overline{Q_A \bar{Q}_C X}}$

For, $D_C = Q_C^+$

For Z

$Q_A Q_B$ \ $Q_C X$	00	01	11	10
00	1	1	1	0
01	0	1	1	0
11	x	x	x	x
10	0	1	1	0

$Q_A Q_B$ \ $Q_C X$	00	01	11	10
00	0	0	0	0
01	0	0	0	1
11	x	x	x	x
10	1	0	0	0

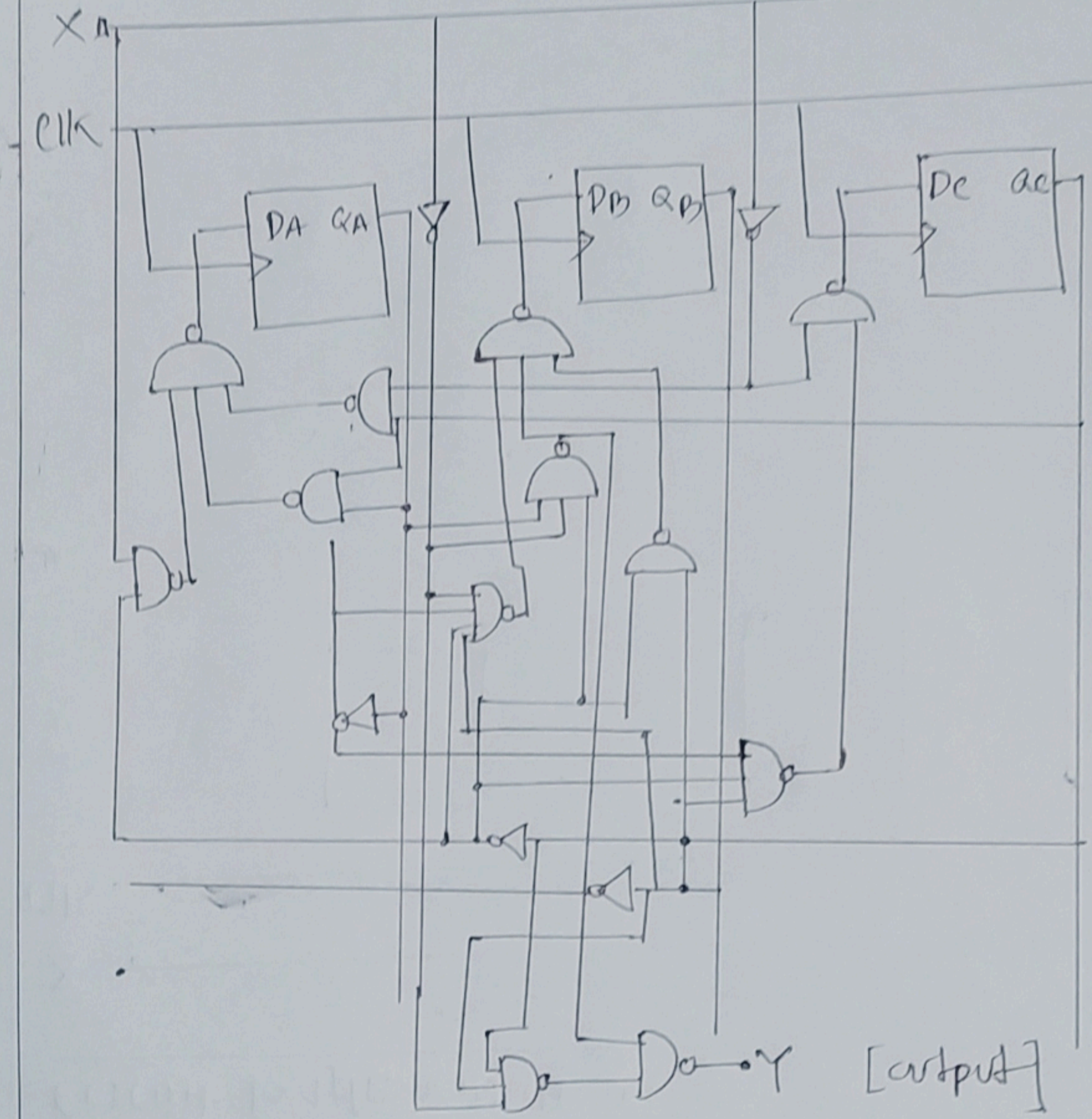
$D_C = Q_C^+ = X + \bar{Q}_A \bar{Q}_B \bar{Q}_C$

$= \overline{\bar{X} \cdot \overline{\bar{Q}_A \bar{Q}_B \bar{Q}_C}}$

$Z = Q_A \bar{Q}_C \bar{X} + Q_B Q_C \bar{X}$

$= \overline{\overline{Q_A \bar{Q}_C \bar{X}} \cdot \overline{Q_B Q_C \bar{X}}}$

Components required: IC7400, IC7404, Patch card, Trainer kit, D flipflop


CLK
DA QA
DB QB
Dc Qc
Y
[output]