Ahsanullah University of Science and Technology
Department of Computer Science and Engineering

Course No : CSE 3110
Course Title : Digital System Design Lab
Assignment No : 02
Name of Experiment : 4 x 4 booth Multiplication
Date of Performance : 18 December, 2022
Date of Submission : 7th January, 2023

Submitted To : MD. Raqibul Hasan and Anika Rahman

Submitted By

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Name of the Experiment: 4x4 booth multiplication

Problem Statement: Design a 4x4 multiplier.

Introduction: Booth's algorithm is a multiplication algorithm that can be multiply both positive and negative numbers. In this experiment, we made a 4x4 booth multiplier using "Booth's Algorithm". It does not need a large number of additions or substractions. It operates on the fact the strings of 0's in the multiplier require just shifting a string of the 1's in the multiplier from bit weight 2^k to weight 2^m can be treated as 2^{k+1} to 2^m.

Booth's Algorithm (Flow chart):

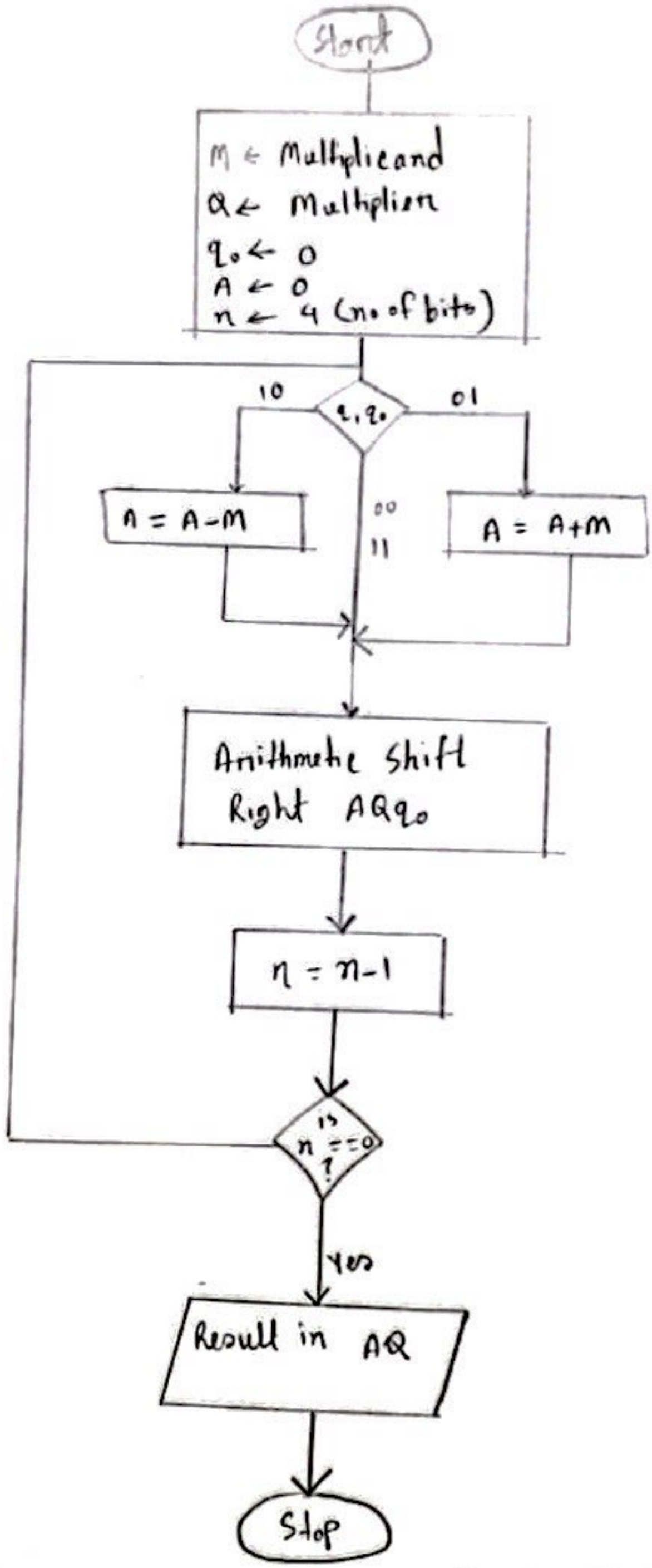
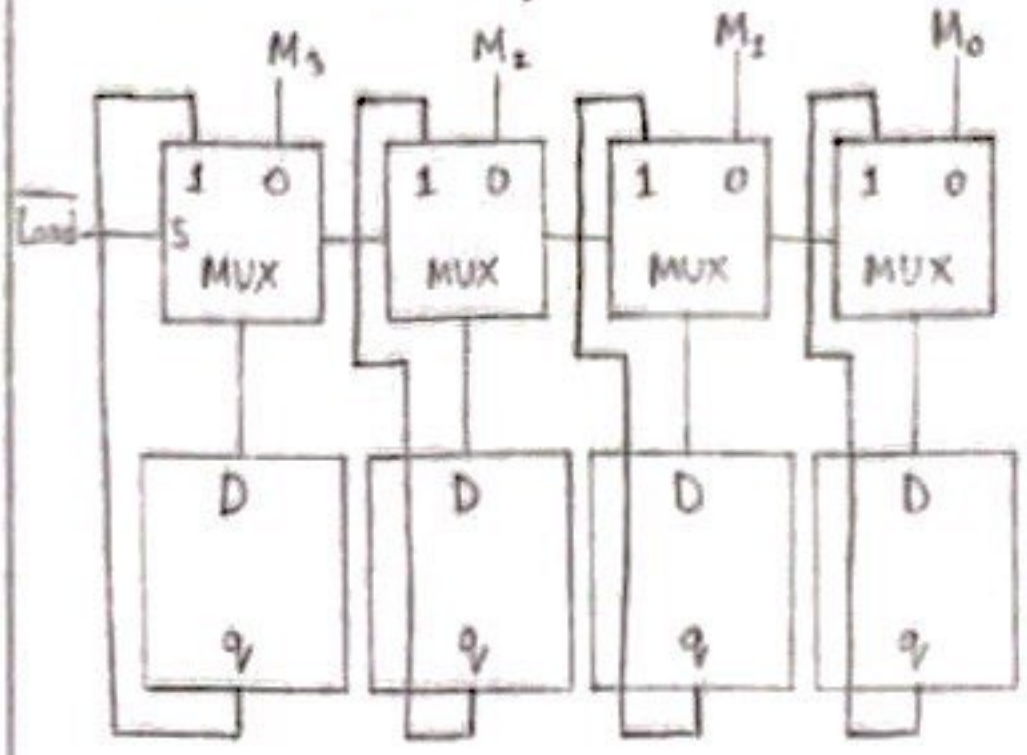


fig: Flowchart of Signed Multiplication (Booth's Algorithm)

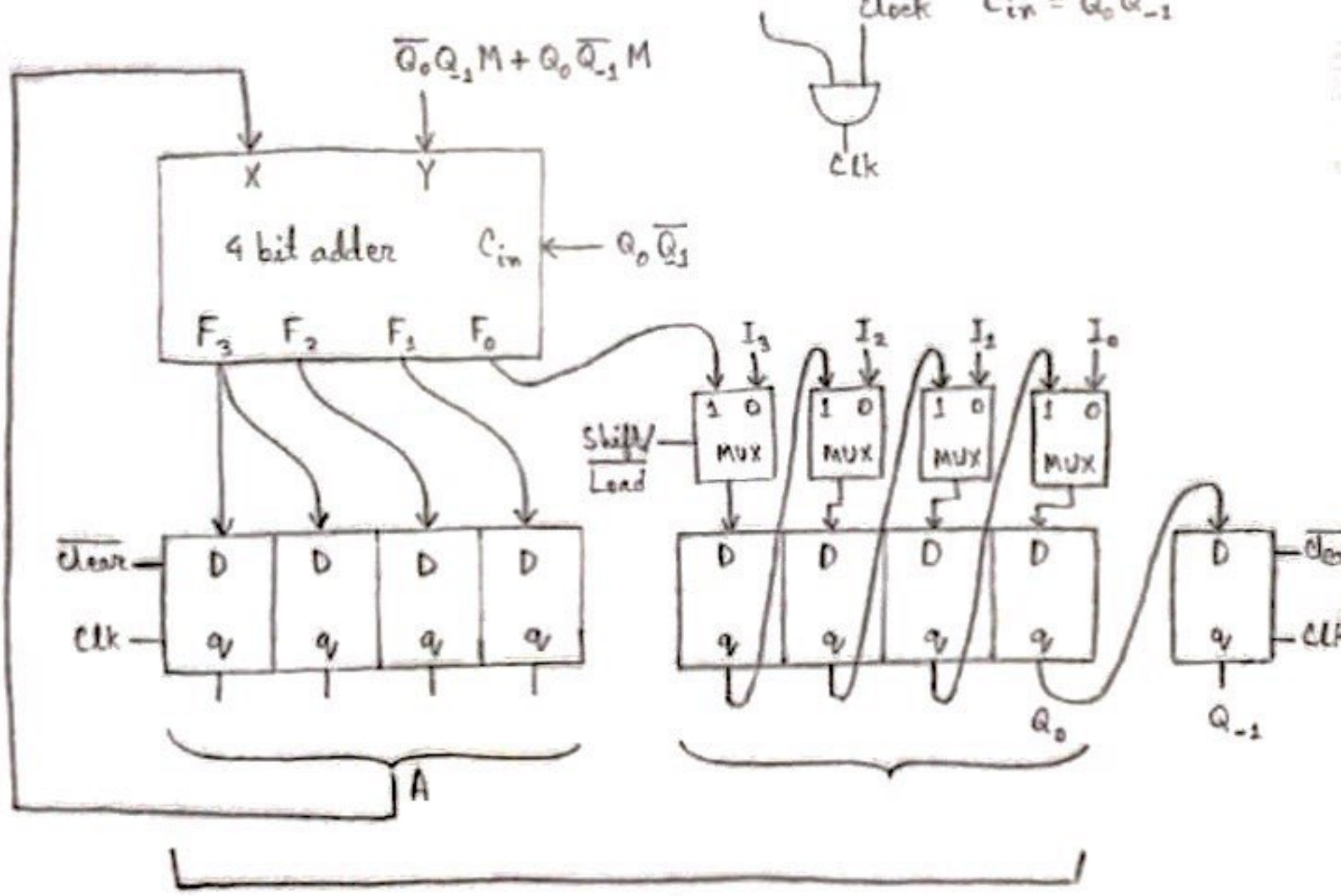
Circuit block diagram:



Q_0Q_{-1}	Operator	X	Y	C_{in}
0 0	A+0	A	0	0
0 1	A+M	A	M	0
1 0	A-M	A	$\overline{M}$	1
1 1	A+0	A	0	0

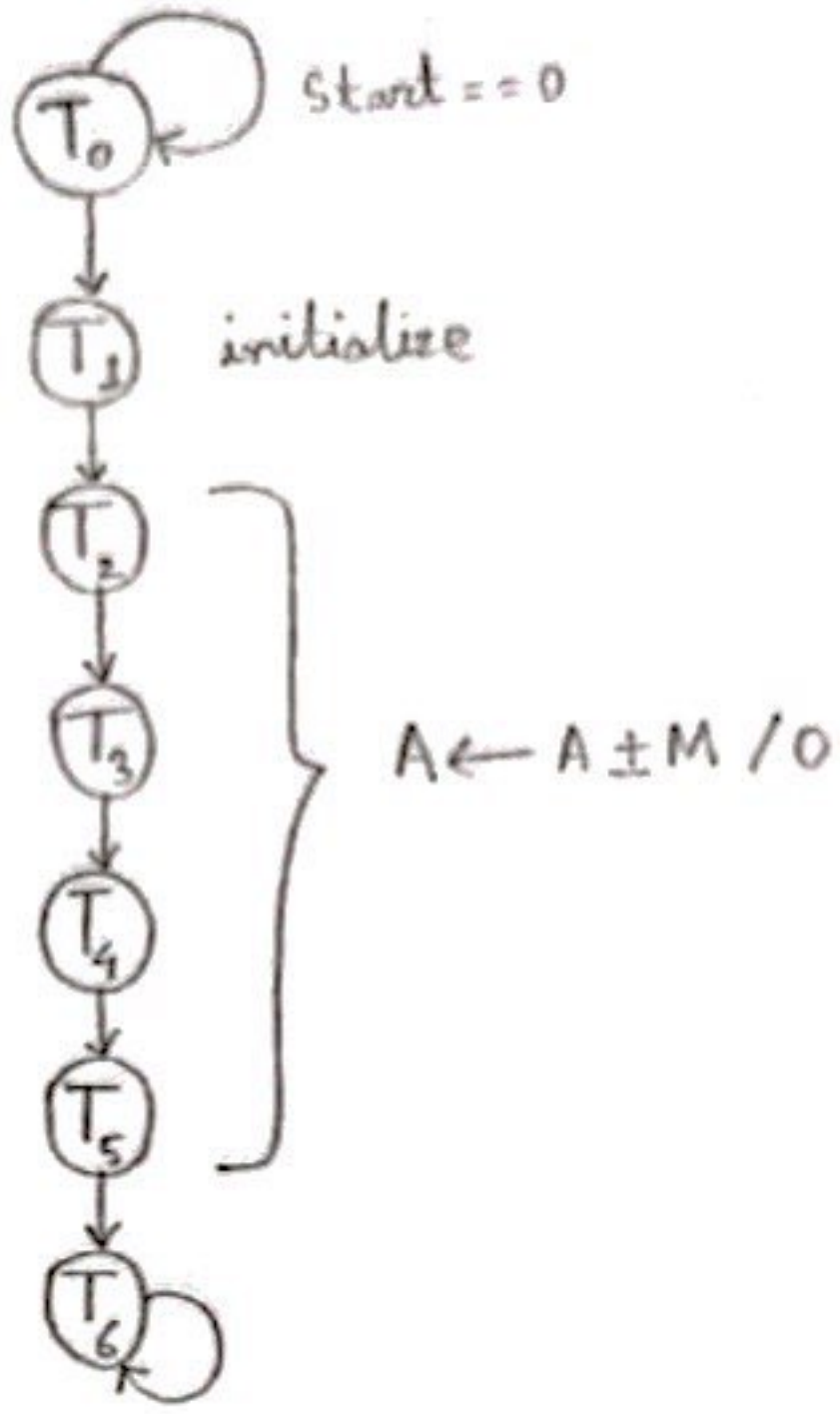
$Y = \overline{Q}_0 Q_{-1} M + Q_0 \overline{Q}_{-1} \overline{M}$

$C_{in} = Q_0 \overline{Q}_{-1}$



Control Unit Design:

State Diagram:



Control Signal:

State	$\overline{\text{Clear}}$	$\overline{\text{Load/Shift}}$	Clk-enable
T_0	0	0	1
T_1	1	0	1
T_2	1	1	1
T_3	1	1	1
T_4	1	1	1
T_5	1	1	1
T_6	1	1	0

Boolean Expression :

$DT_0 = T_0 \overline{Start}$

$DT_1 = T_0 Start$

$DT_2 = T_1$

$DT_3 = T_2$

$DT_4 = T_3$

$DT_5 = T_4$

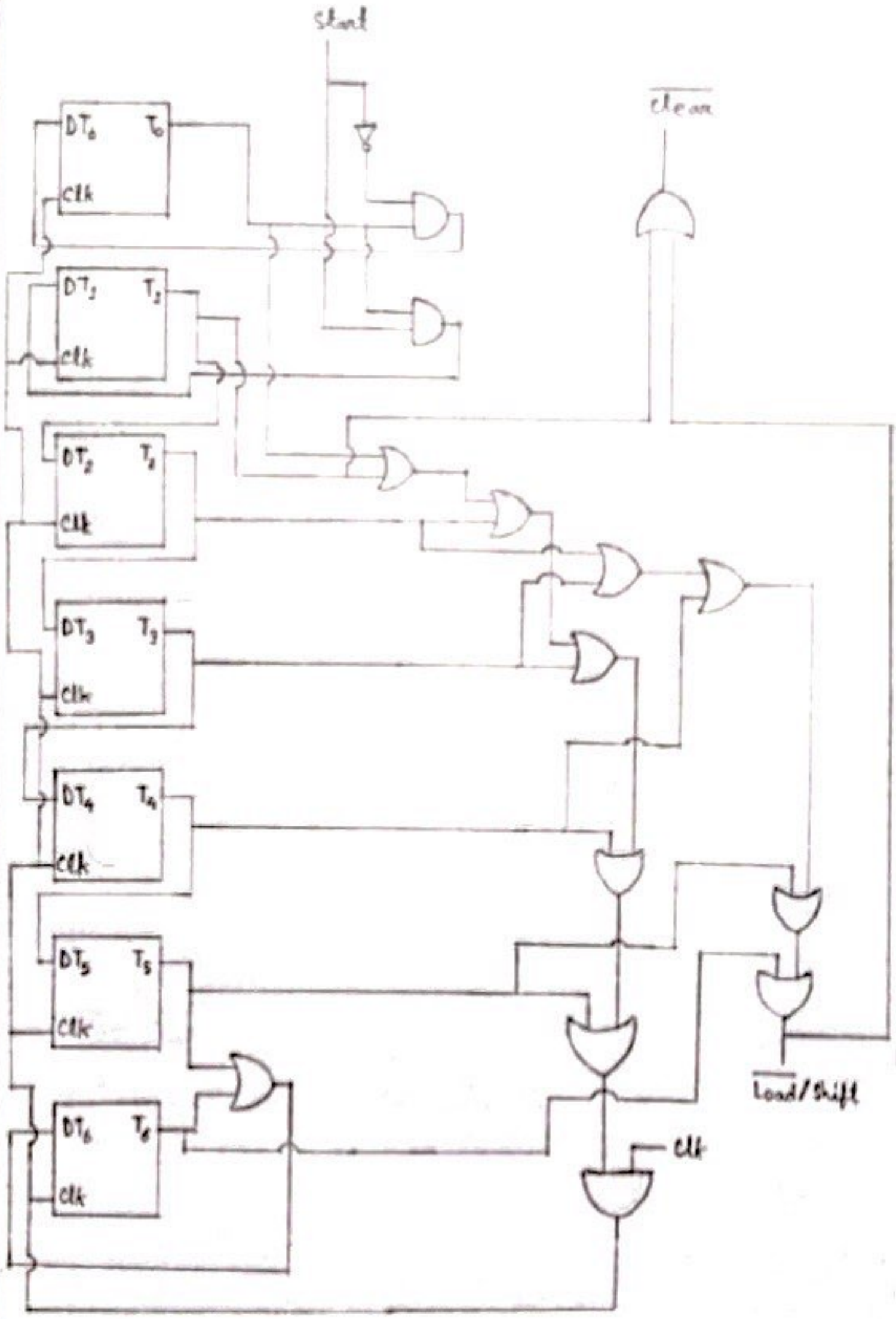
$DT_6 = T_5 + T_6$

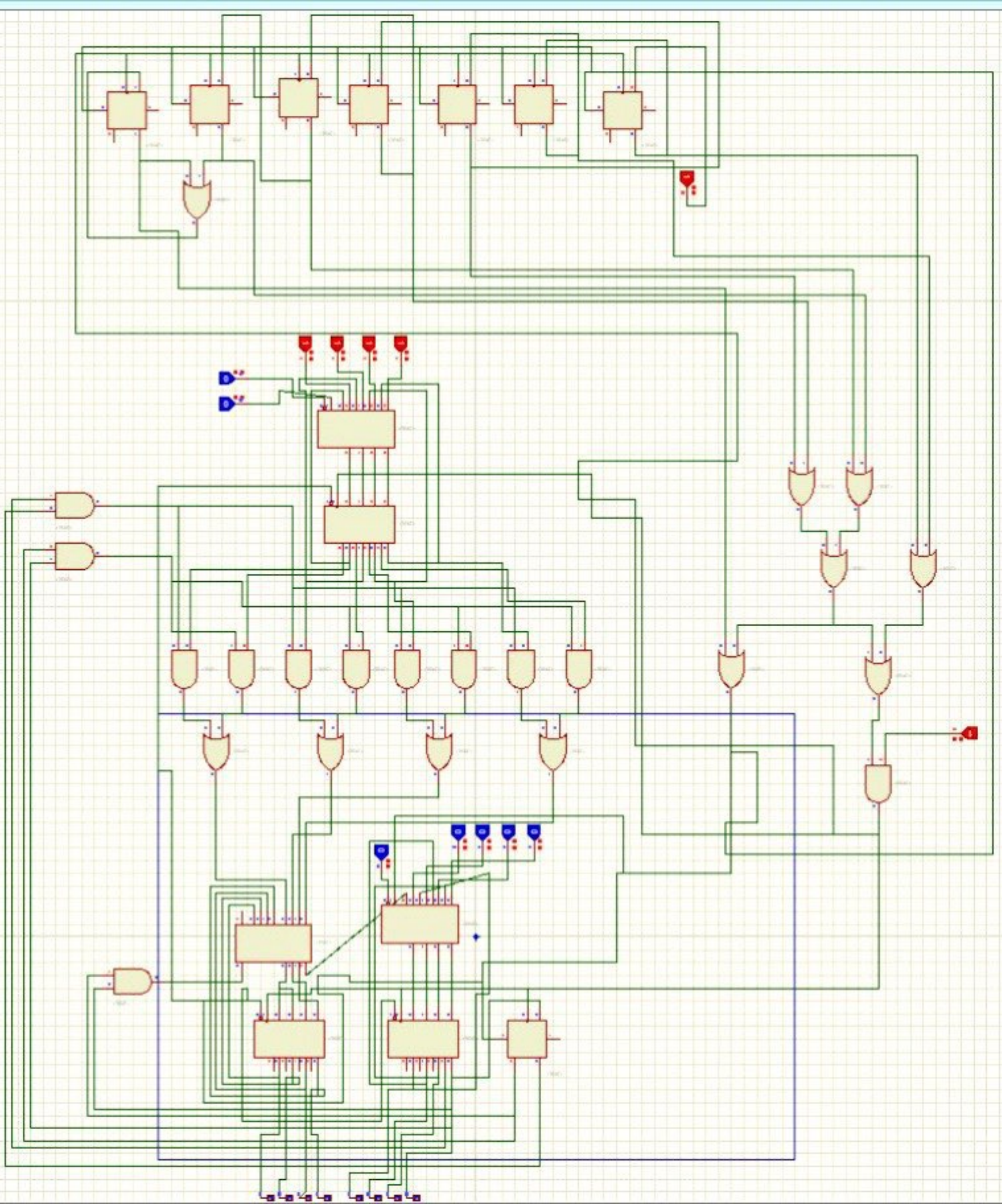
$\overline{Clear} = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$

$\overline{Load}/Shift = T_2 + T_3 + T_4 + T_5 + T_6$

$Clk\text{-}enable = T_0 + T_1 + T_2 + T_3 + T_4 + T_5$

Control Unit Circuit :





Conclusion:-

To design this circuit, we have used proteus simulating system and tested our multiplier with different values and got desired output. So, we can say that our circuit is working properly. During our work, we faced no error. Also, the total cost of performing the simulation was reasonable.