Department of Computer Science & Engineering

Course No : CSE3110

Course Title : Digital System Design

Experiment No : 02

Experiment Name : a 4 bit signed multiplication system using Booths algorithm

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Section : A

Name of the experiment: 4x4 booth multiplication

Problem statement: Design a 4x4 booth multiplier

Introduction: Booth's algorithm is a multiplication algorithm that is able to multiply both positive and negative numbers. In this experiment, we made a 4x4 booth multiplier using "Booth's Algorithm." It doesnot need a large number of additions or subtractions. It operates on the fact that 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 (Flowchart):

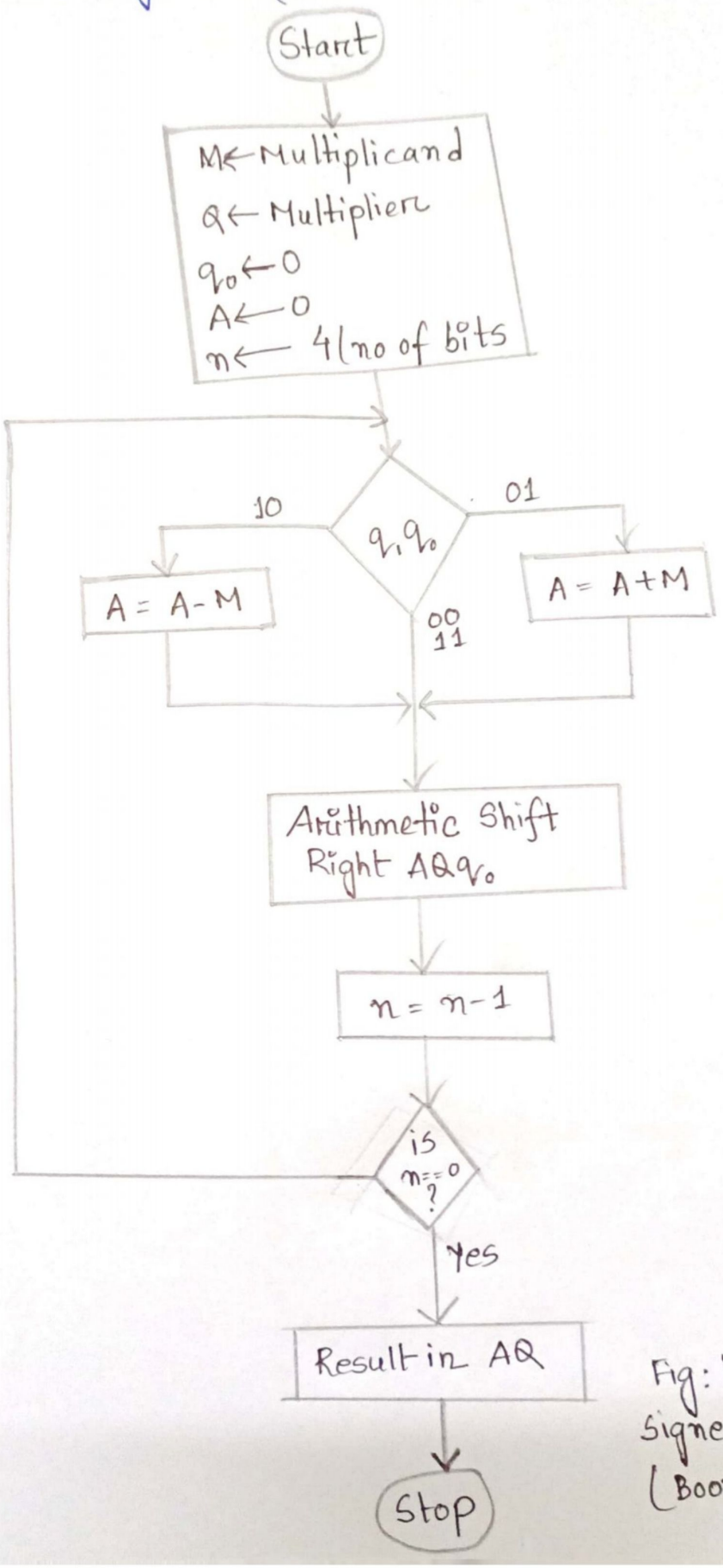
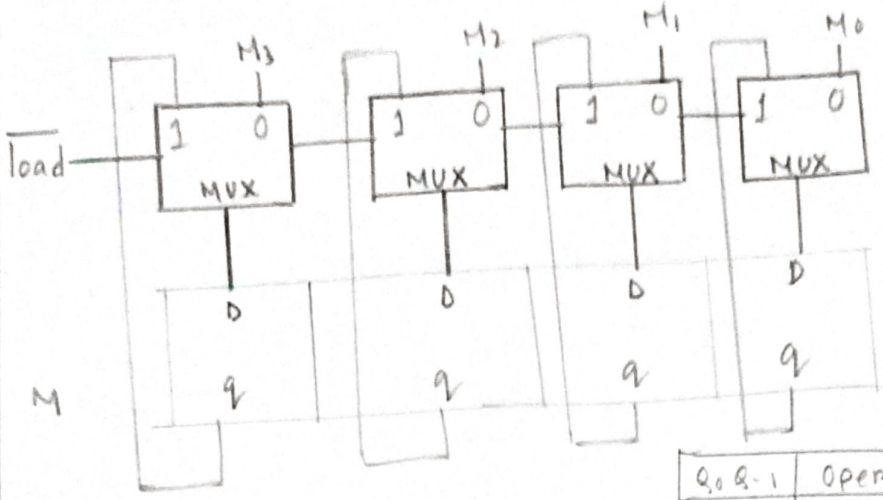


Fig: Flowchart of Signed Multiplication (Booth's Algorithm)

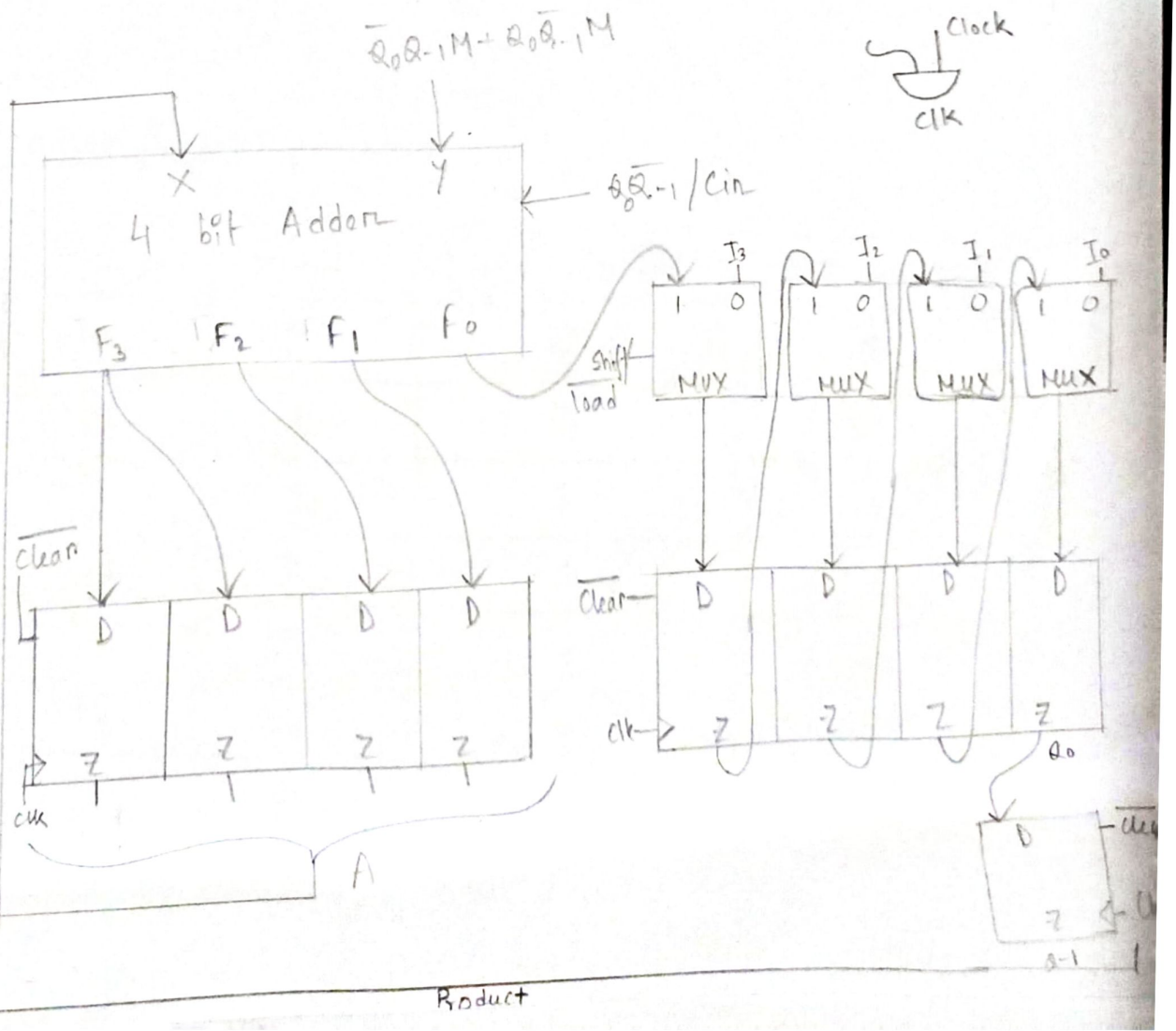
Circuit Block Diagram:



$Q_0 Q_{-1}$	Operation	X	Y	Cin
0 0	A + 0	A	0	0
0 1	A + M	A	M	0
1 0	A − M	A	$\bar{M}$	1
1 1	A + 0	A	0	0

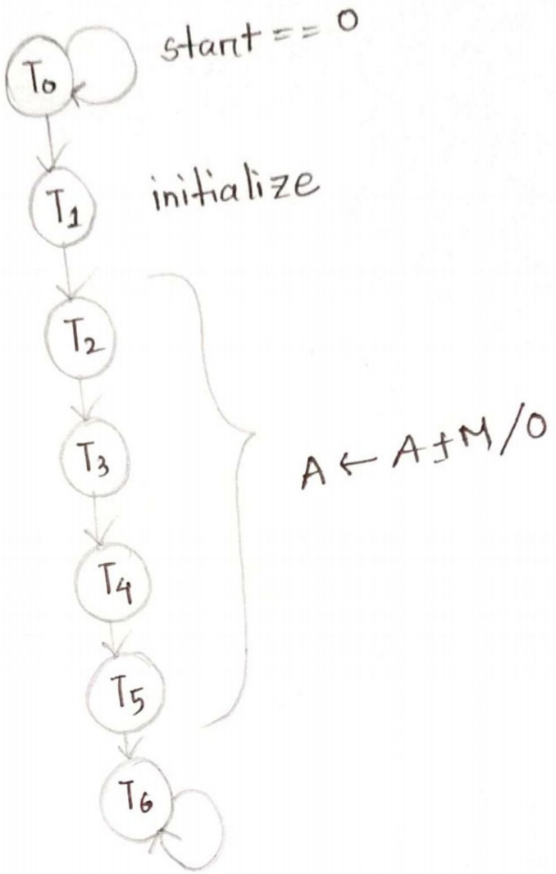
$Y = \bar{Q}_0 Q_{-1} M + Q_0 \bar{Q}_{-1} \bar{M}$

$Cin = Q_0 \bar{Q}_{-1}$



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:

$DT_0 = T_0 \overline{Start}$

$DT_1 = T_0 Start$

$DT_2 = T_1$

$DT_3 = T_2$

$DT_4 = T_3$

$DT_5 = T_4$

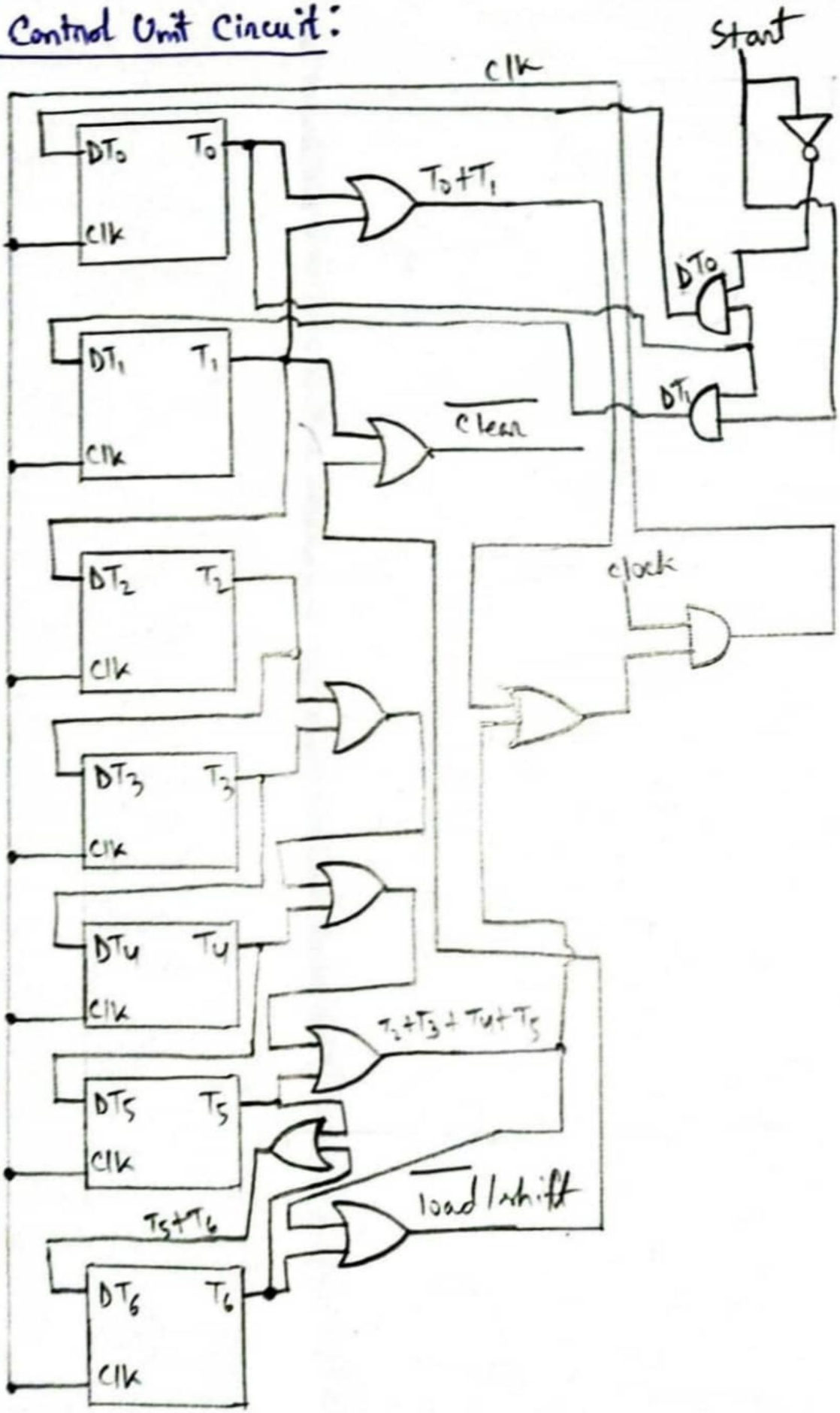
$DT_6 = T_5 + T_6$

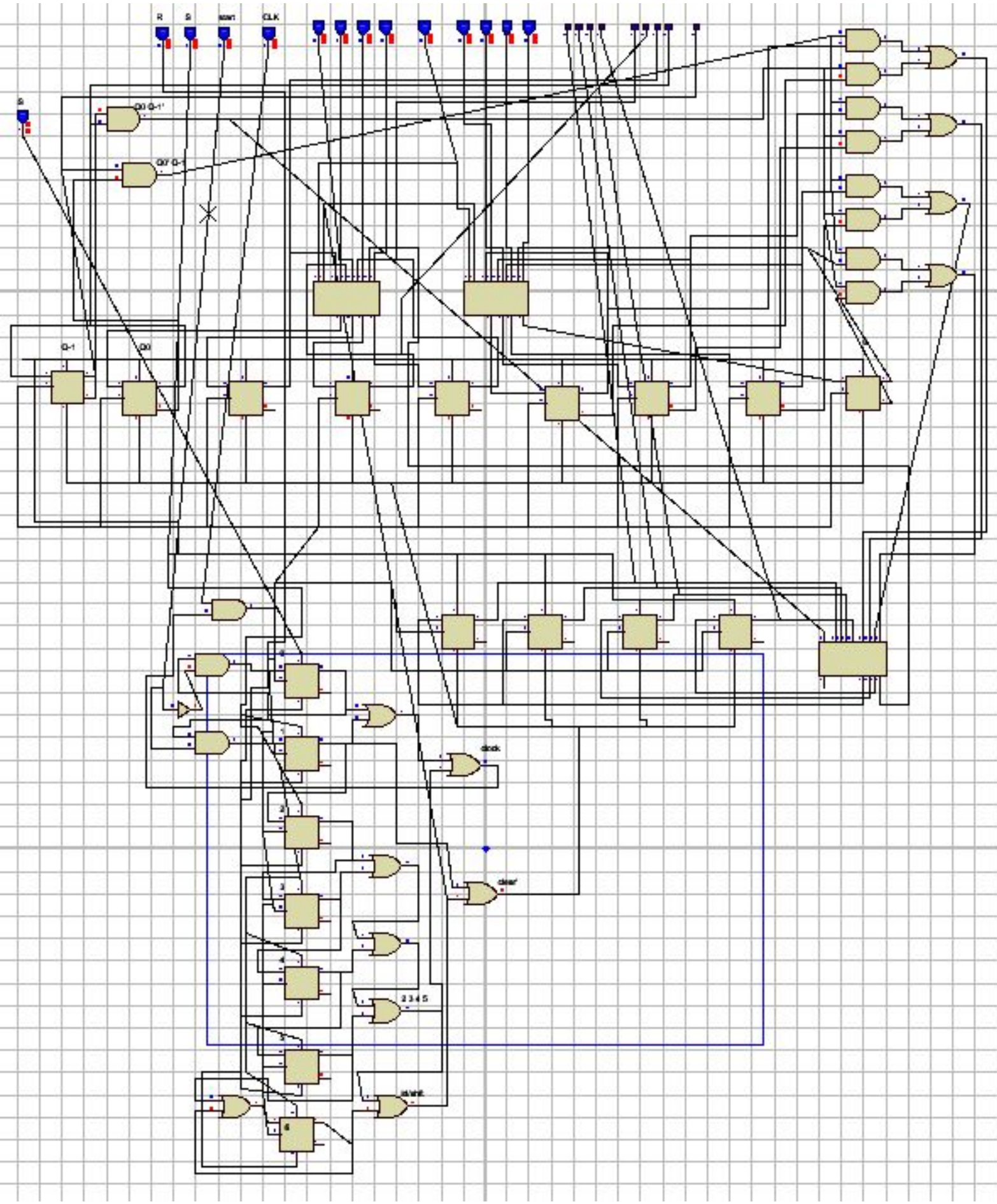
$\overline{Clear} = T_1 + T_2 + T_3 + T_4 + T_5 + T_6$

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

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

Control Unit Circuit:




R
S
scan
CLK
Q-1
Q0
clock
clear
2 3 4 5
clkinit

Conclusion: To design this circuit, we have used proteus software stimulating 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 errors. Also the total cost of performing the ~~stimuta~~ stimulation was reasonable.