

Ques 1:-  $C_0 C_1 = 0\ 0$  : stop Counting

$C_0 C_1 = 0\ 1$  : Count up by 1

$C_0 G = 1\ 0$  : Count down by 1

$C_0 G = 1\ 1$  : Count up by 2.

for these controls  $4 \times 1$  MUX will be used

### 2-Bit Controls Using SR flip flops:

→ Count up by 1.

$P_1$	$P_2$	$N_1$	$N_2$	$S_1$	$R_1$	$S_2$	$R_2$
0	0	0	1	0	x	1	0
0	1	1	0	1	0	0	1
1	0	1	1	x	0	1	0
1	1	0	0	0	1	0	1

$$S_1 = \bar{P}_1 P_2$$

$P_1'$	0	1
0	0	x
1	1	0

$$R_1 = P_1 P_2$$

$P_1'$	0	1
0	x	0
1	0	1

$$S_2 = \bar{P}_2$$

$P_1$	0	1
0	1	1
1	0	0

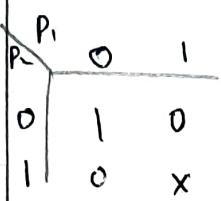
$$R_2 = P_2$$

$P_1$	0	1
0	0	0
1	1	1

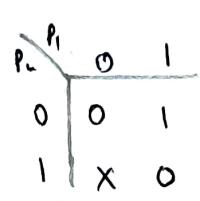
→ Count down by 1.

$P_1$	$P_2$	$N_1$	$N_2$	$S_1$	$R_1$	$S_2$	$R_2$
0	0	1	1	1	0	1	0
0	1	0	0	0	x	0	1
1	0	0	1	0	1	1	0
1	1	1	0	x	0	0	1

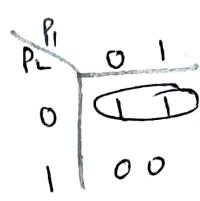
$$S_1 = P_1 \bar{P}_2$$



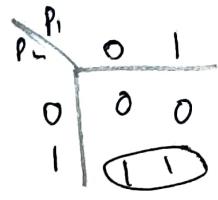
$$P_1 = P_1 \bar{P}_2$$



$$S_2 = P_2$$



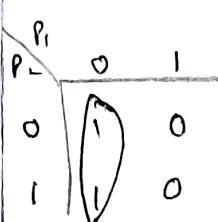
$$R_2 = P_2$$



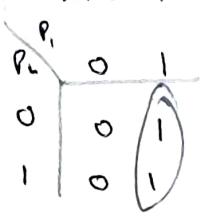
→ Count up by 2

$P_1$	$P_2$	$N_1$	$N_2$	$S_1$	$R_1$	$S_2$	$R_2$
0	0	1	0	1	0	0	X
0	1	1	1	1	0	X	0
1	0	0	0	0	1	0	X
1	1	0	1	0	1	X	0

$$S_1 = \bar{P}_1$$



$$R_1 = P_1$$



$$S_2 = 0$$

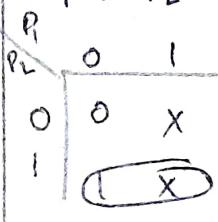
$$R_2 = 0$$

→ 2 Bit Counter Using J-K Flip Flops

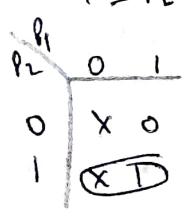
→ Count up by 1.

$P_1$	$P_2$	$N_1$	$N_2$	$J_1, K_1$	$J_2, K_2$
0	0	0	1	0 X	1 X
0	1	1	0	1 X	X 1
1	0	1	1	X 0	1 X
1	1	0	0	X 1	X 1

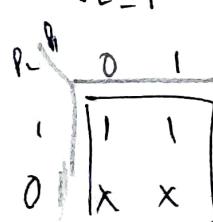
$$J_1 = P_2$$



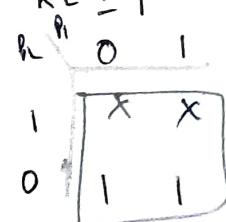
$$K_1 = P_2$$



$$J_2 = 1$$



$$K_2 = 1$$



→ Count down by 1:

$P_1$	$P_2$	$N_1$	$N_2$	$J_1$	$K_1$	$J_2$	$K_2$
0	0	1	1	1	x	1	x
0	1	0	0	0	x	x	1
1	0	0	1	x	1	1	x
1	1	1	0	x	0	x	1

$$J_1 = \bar{P}_2$$

$P_1$	$P_2$	0	1
1	1	x	
0	0	x	

$$K_1 = \bar{P}_2$$

$P_1$	$P_2$	0	1
0	0	x	

$$J_2 = 1$$

$$K_2 = 1$$

→ Count up by 2:

$P_1$	$P_2$	$N_1$	$N_2$	$J_1$	$K_1$	$J_2$	$K_2$
0	0	1	0	1	x	0	x
0	1	1	1	1	x	x	0
1	0	0	0	x	1	0	x
1	1	0	1	x	1	x	0

$$J_1 = 1$$

$$K_1 = 1$$

$$J_2 = 0$$

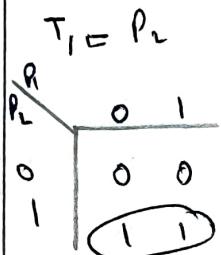
$$K_2 = 0$$

$P_1$	$P_2$	0	1
0	0	x	
1	1	x	

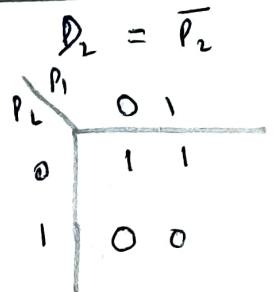
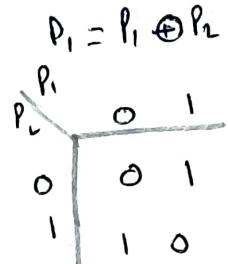
$P_1$	$P_2$	0	1
0	0	x	

→ 2 Bit Counter using T and D flip flops  
 → Count up by 2

$P_1$	$P_2$	$N_1$	$N_2$	$T_1$	$T_2$	$D_1$	$D_2$
0	0	0	1	0	1	0	1
0	1	1	0	1	1	1	0
1	0	1	1	0	1	1	1
1	1	0	0	1	1	0	0

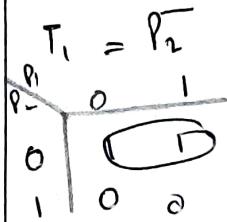


$$T_2 = 1$$

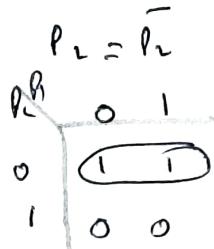
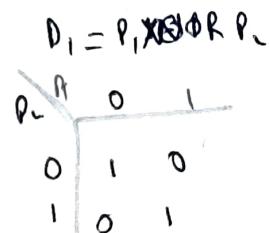


→ Count down by 2.

$P_1$	$P_2$	$N_1$	$N_2$	$T_1$	$T_2$	$D_1$	$D_2$
0	0	1	1	1	1	1	1
0	1	0	0	0	1	0	0
1	0	0	1	1	1	0	1
1	1	1	0	0	1	1	0



$$T_2 = 1$$



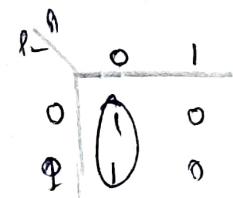
→ Count down by 2.

$P_1$	$P_2$	$N_1$	$N_2$	$T_1$	$T_2$	$D_1$	$D_2$
0	0	1	0	1	0	1	0
0	1	1	1	1	0	1	1
1	0	0	0	1	0	0	0
1	1	0	1	1	0	0	1

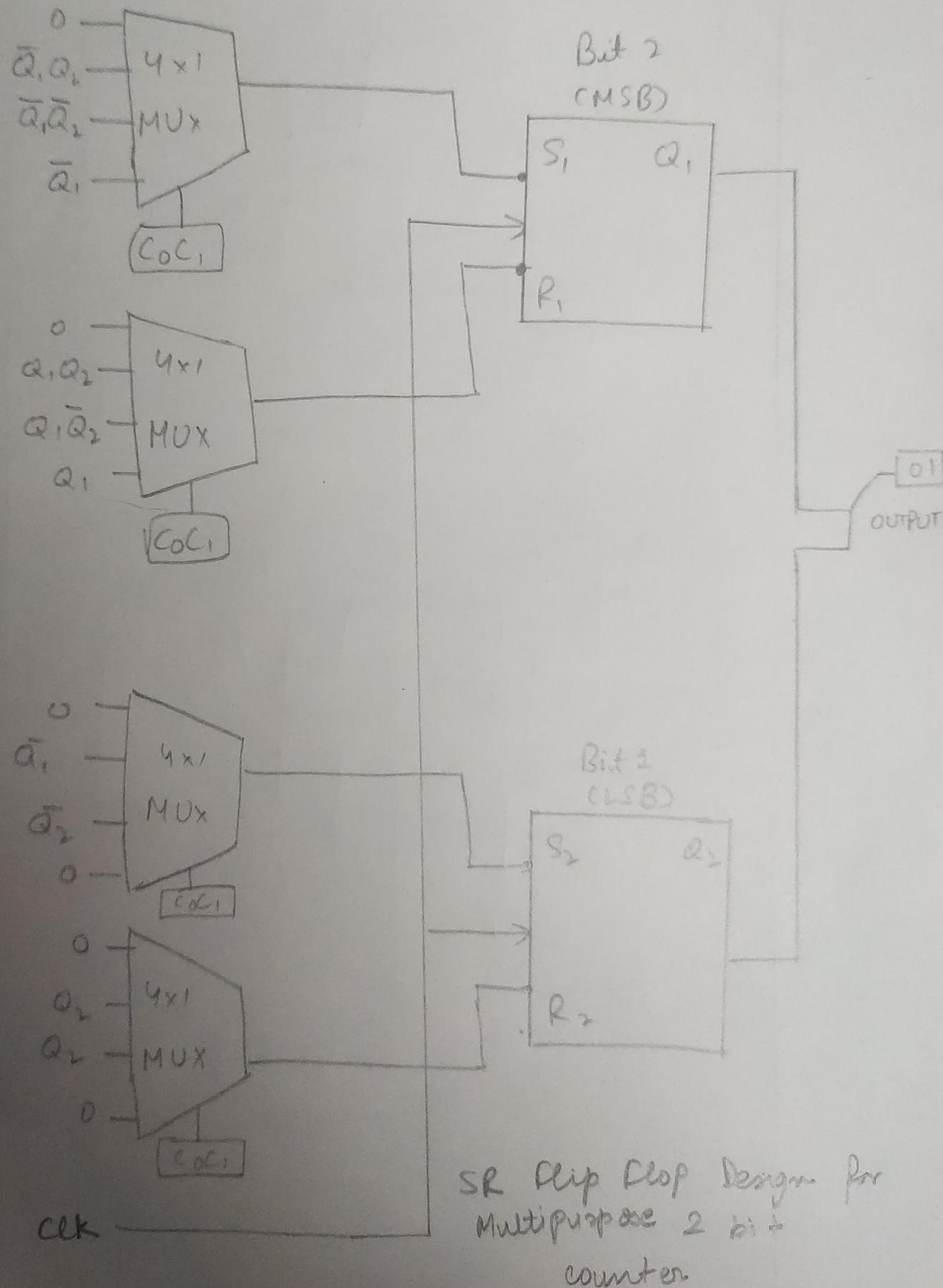
$$T_1 = 1, \quad T_2 = 0$$

$$D_1 = \bar{P}_1$$

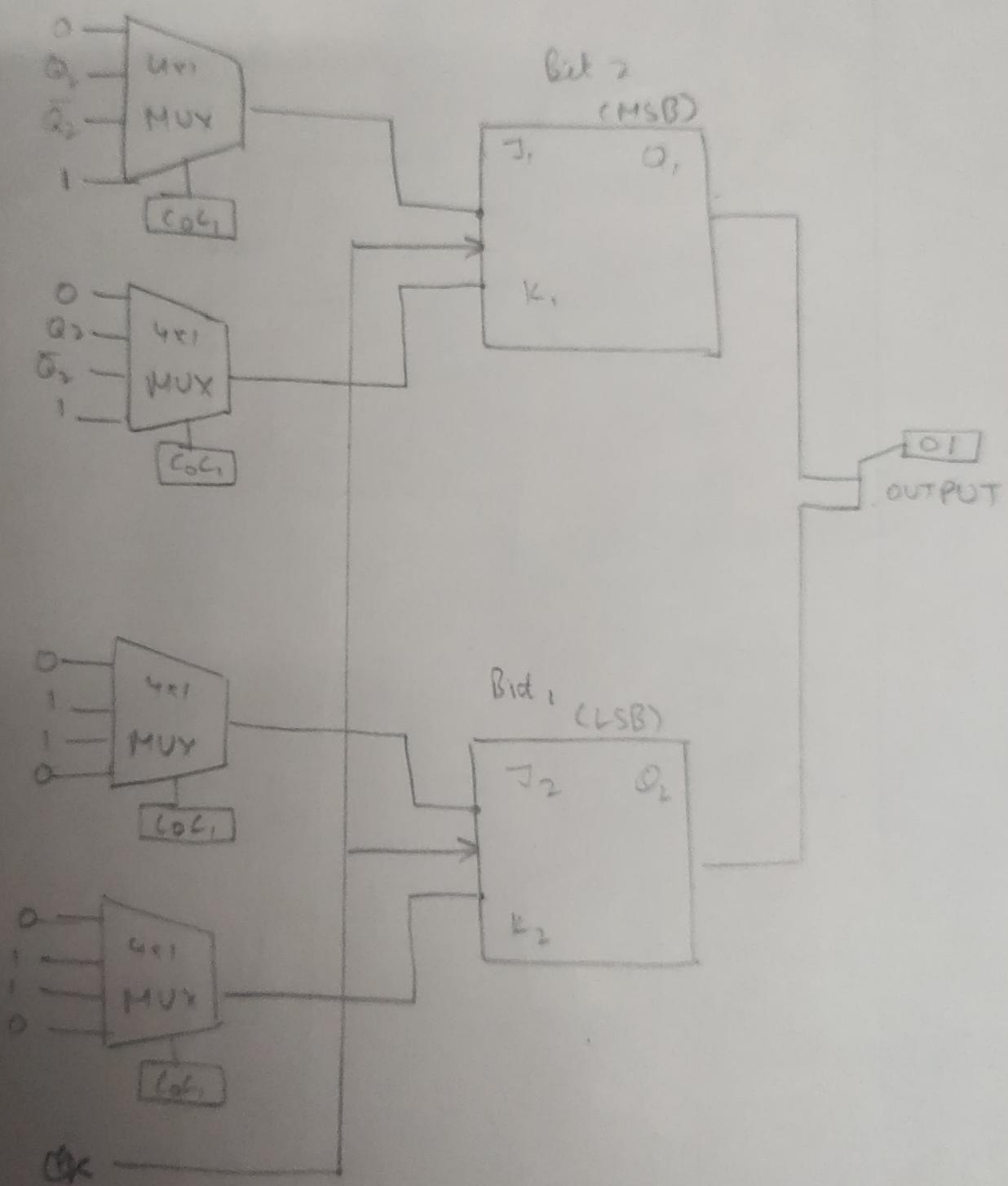
$$D_2 = P_2$$



## SR flip flop Design

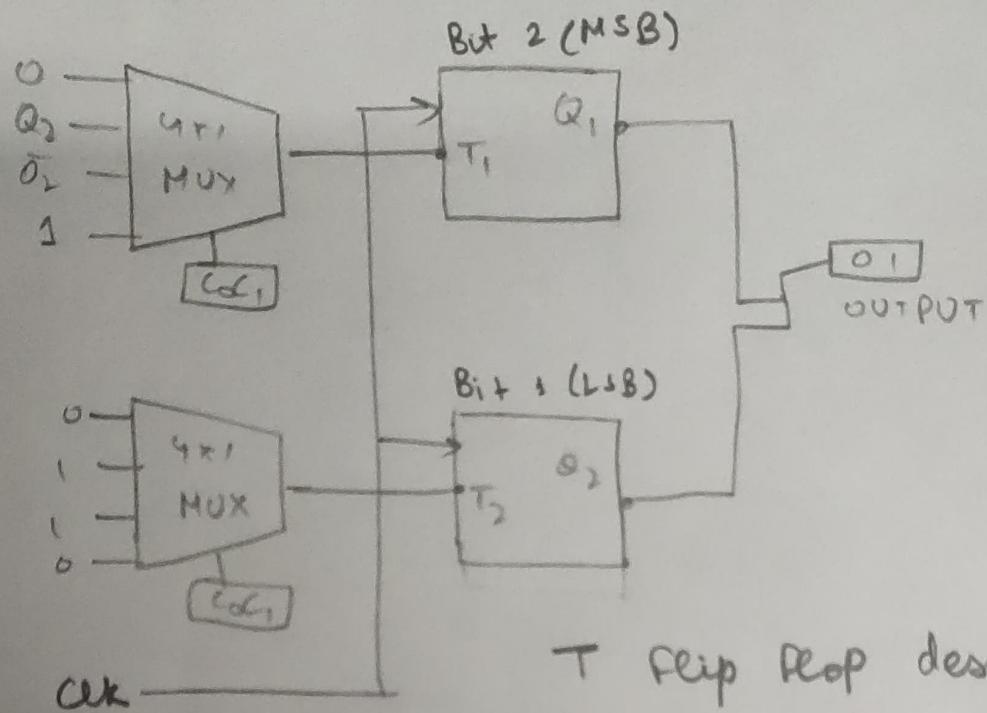


## JK Flip Flop Design



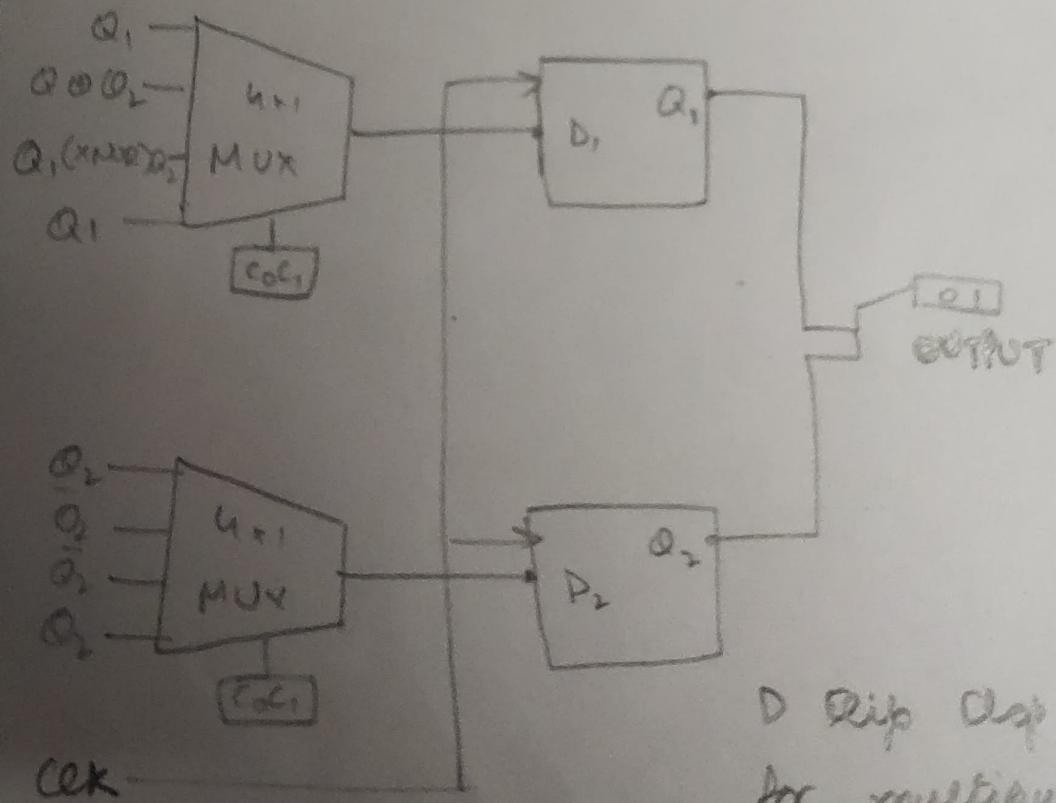
JK Flip Flop design for  
multipurpose 2 bit counter.

## T flip flop Design



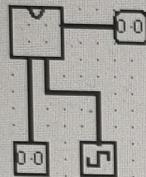
T flip flop design for  
multipurpose 2 bit counter

## D flip flop Design

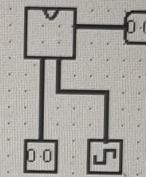


D flip flop design  
for multipurpose 2 bit  
counter

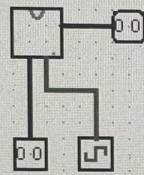
Question 1



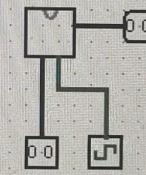
D flip flop



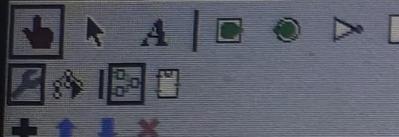
JK flip flop



SR flip flop

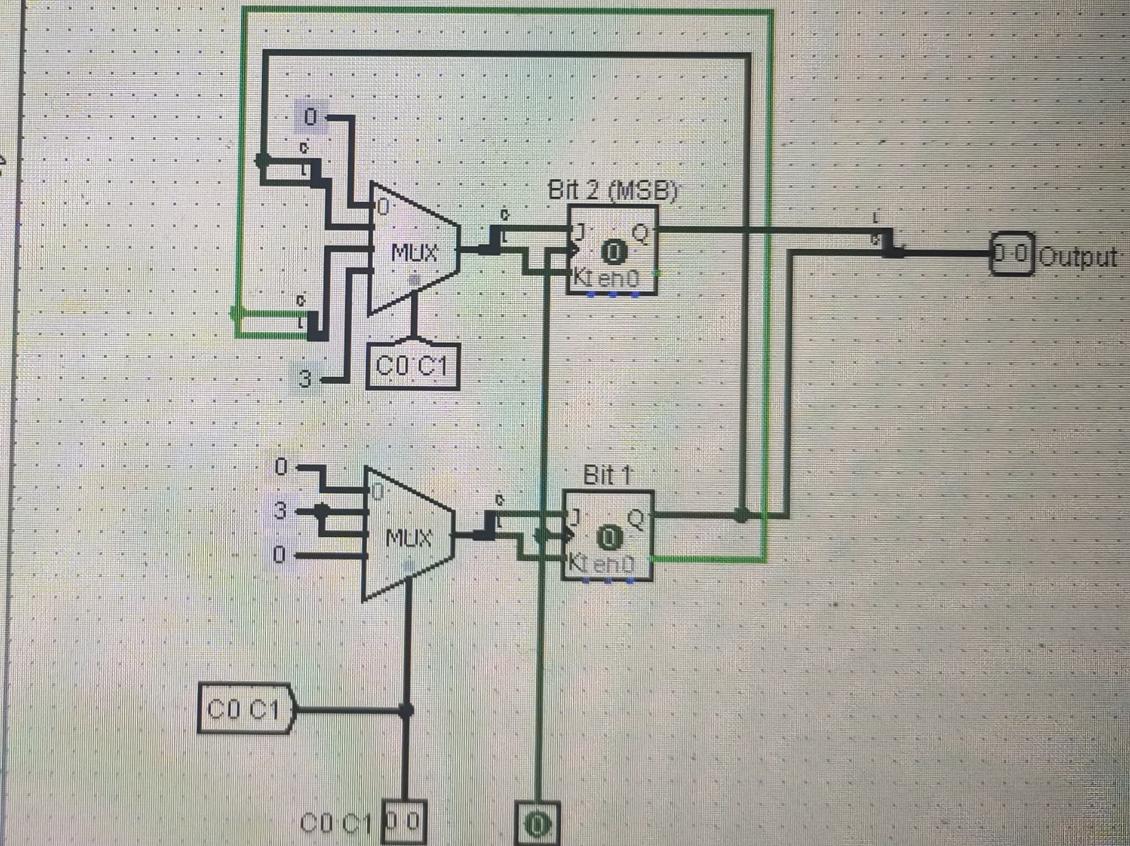


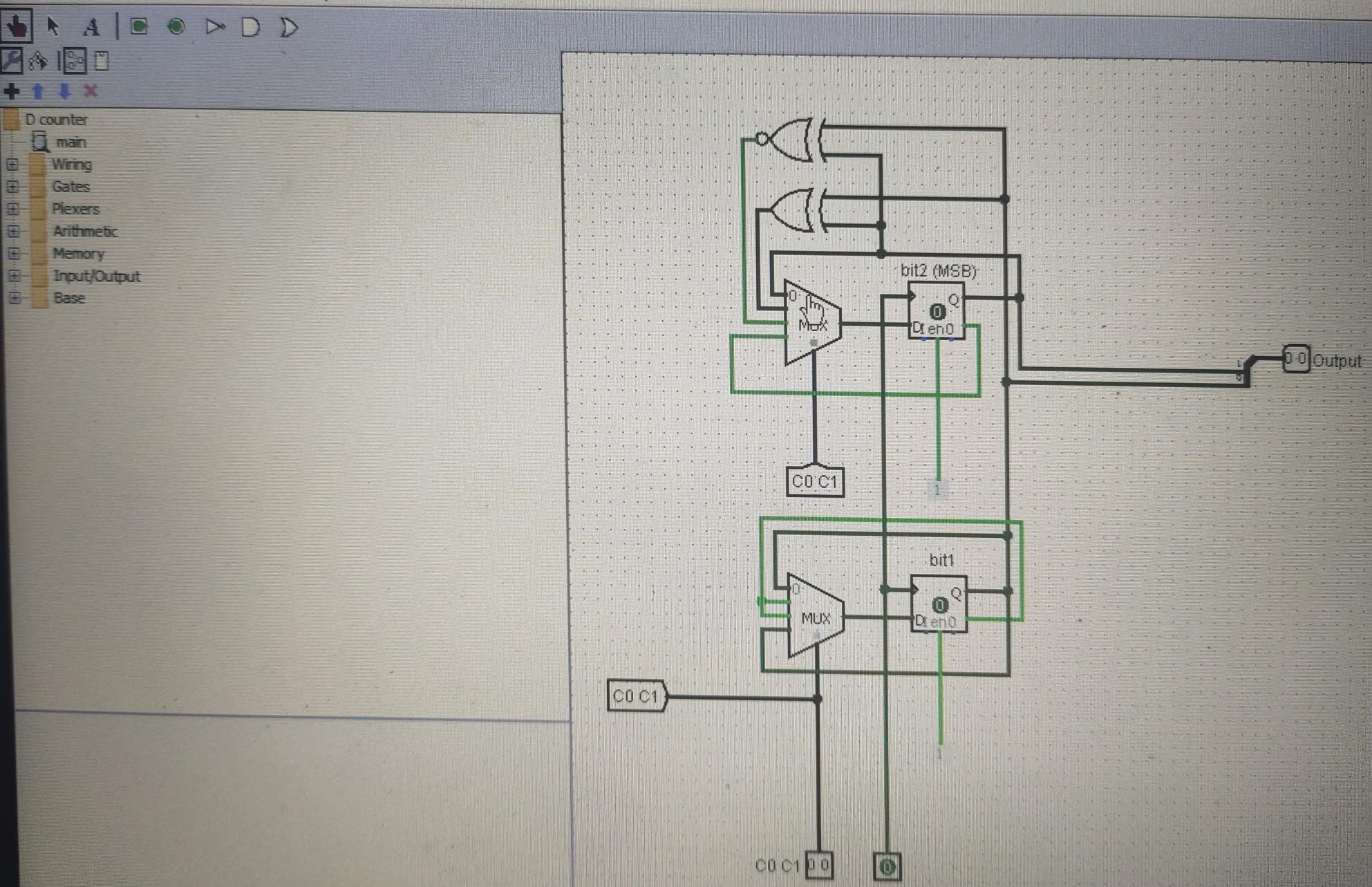
T flip flop



JK counter

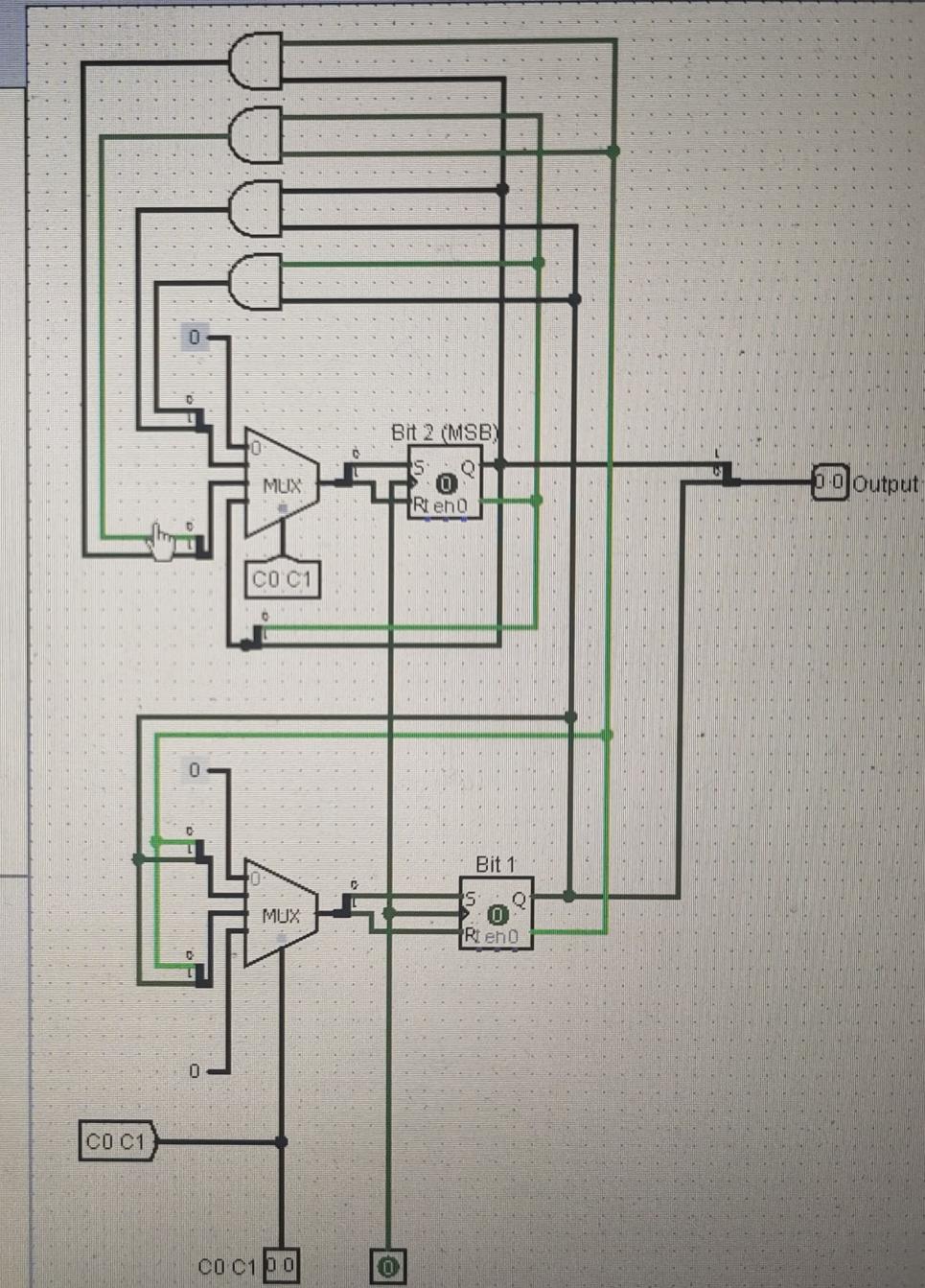
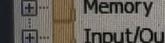
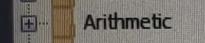
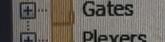
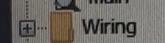
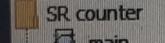
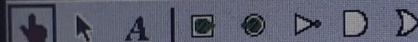
- main
- Wiring
- Gates
- Plexers
- Arithmetic
- Memory
- Input/Output
- Base





# Logisim: main of SR counter

File Edit Project Simulate Window Help

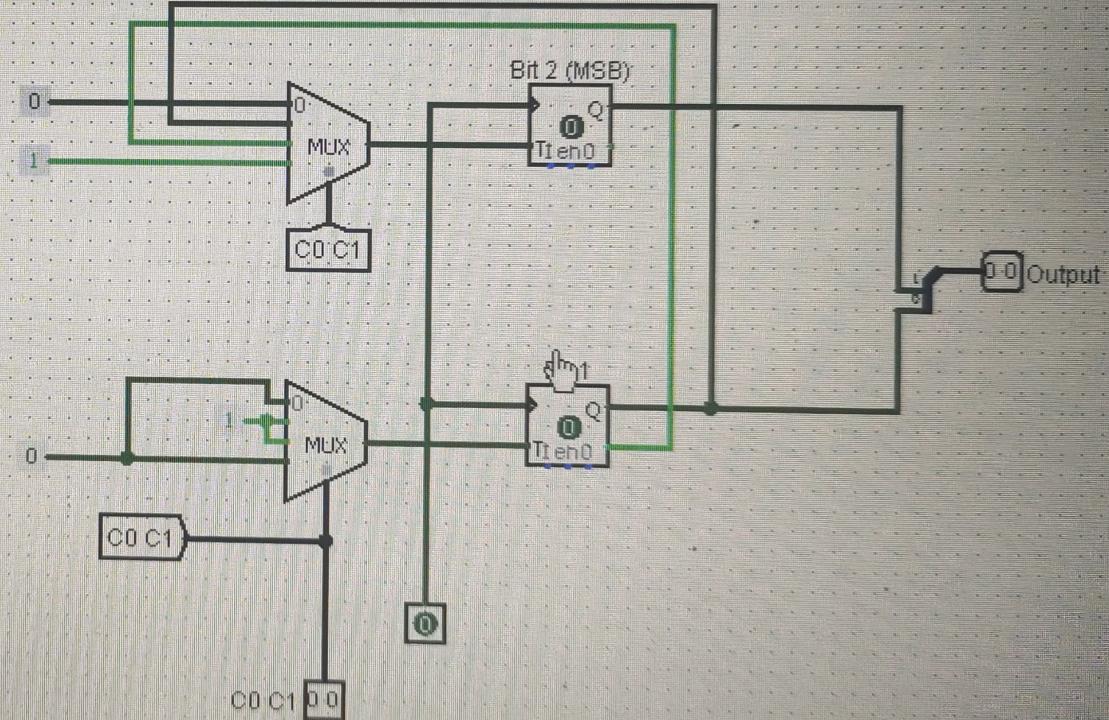


# Logisim: main of T counter

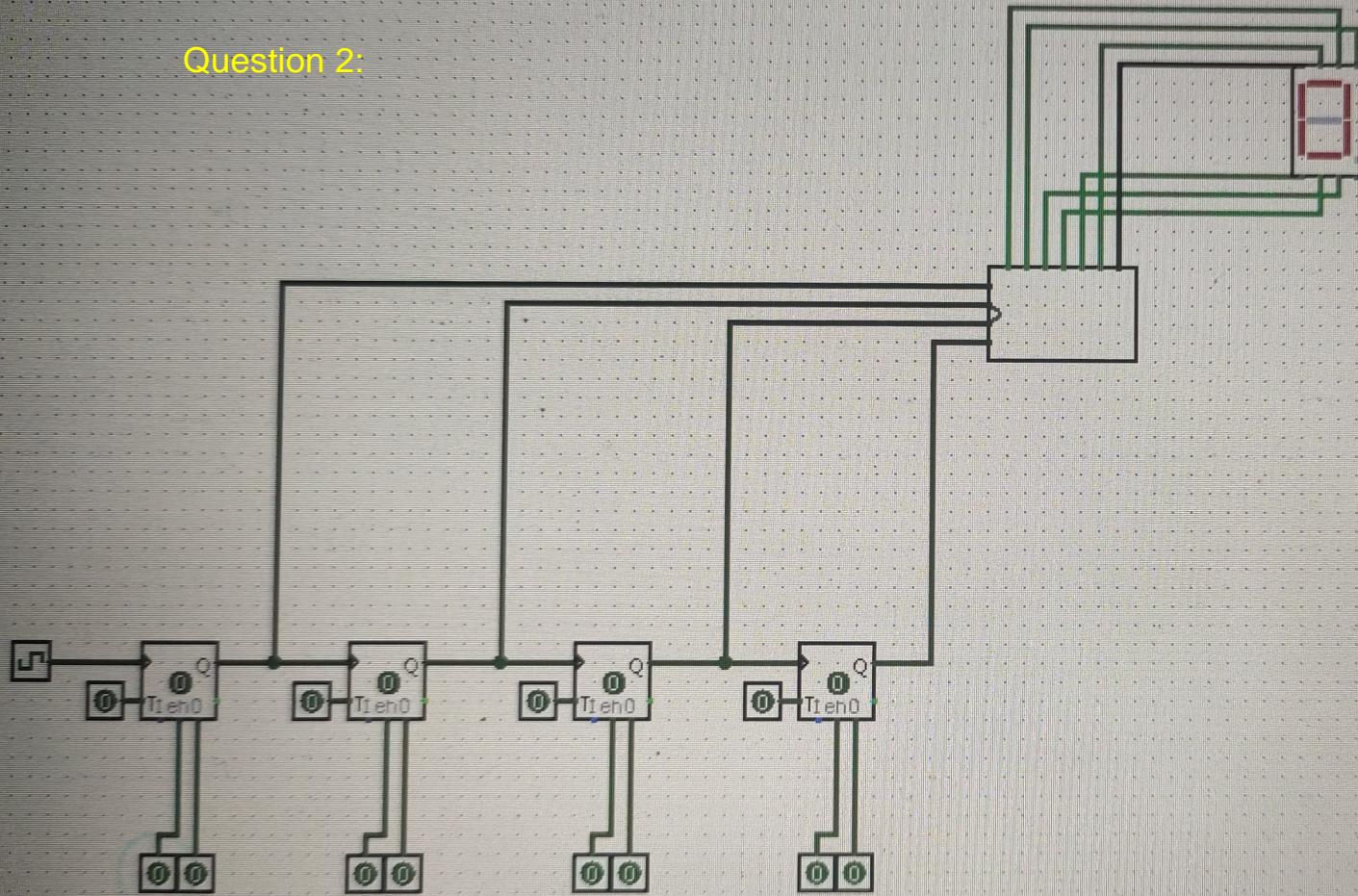
File Edit Project Simulate Window Help



T counter  
main  
Wiring  
Gates  
Plexers  
Arithmetic  
Memory  
Input/Output  
Base

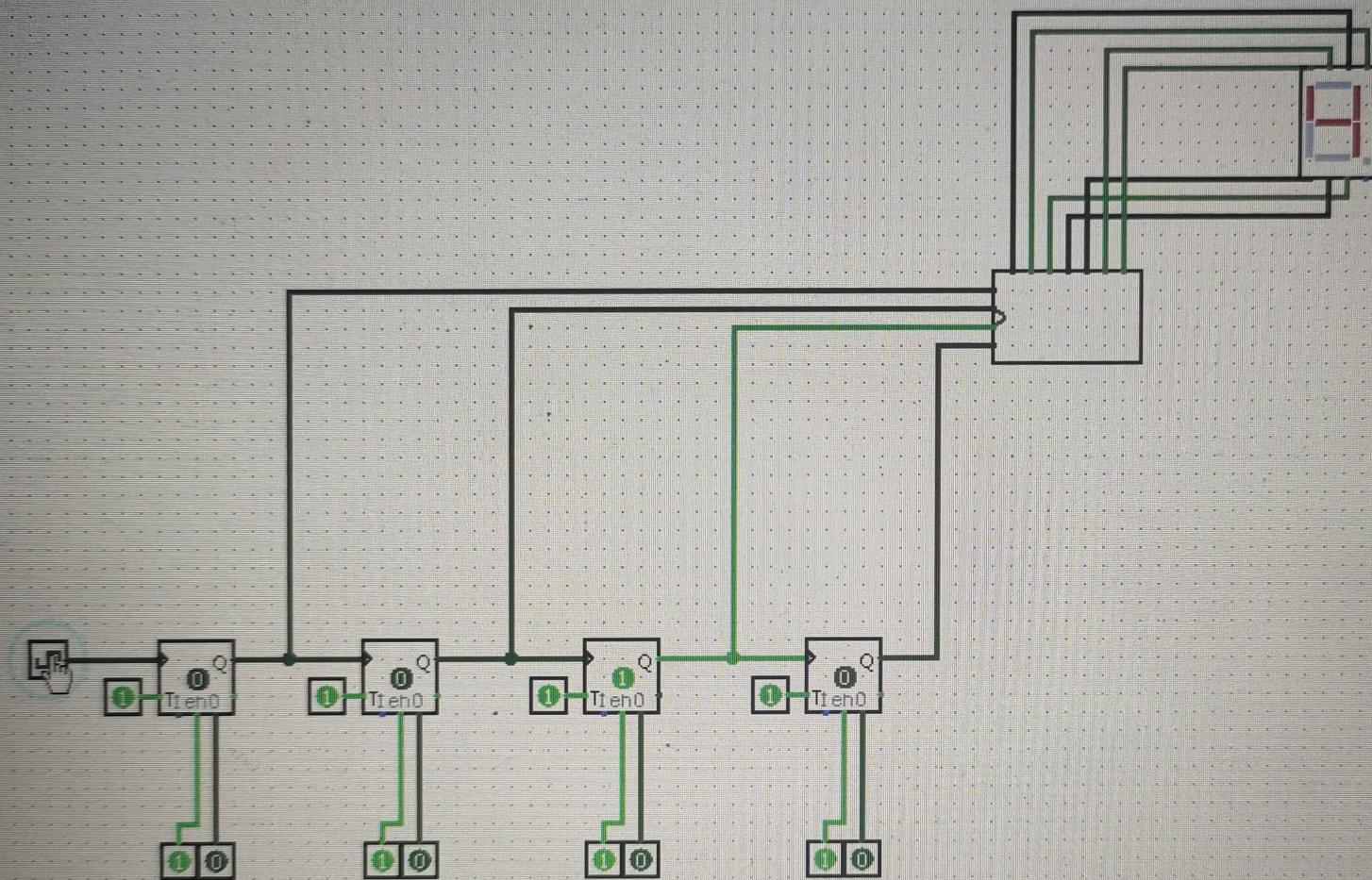


Question 2:

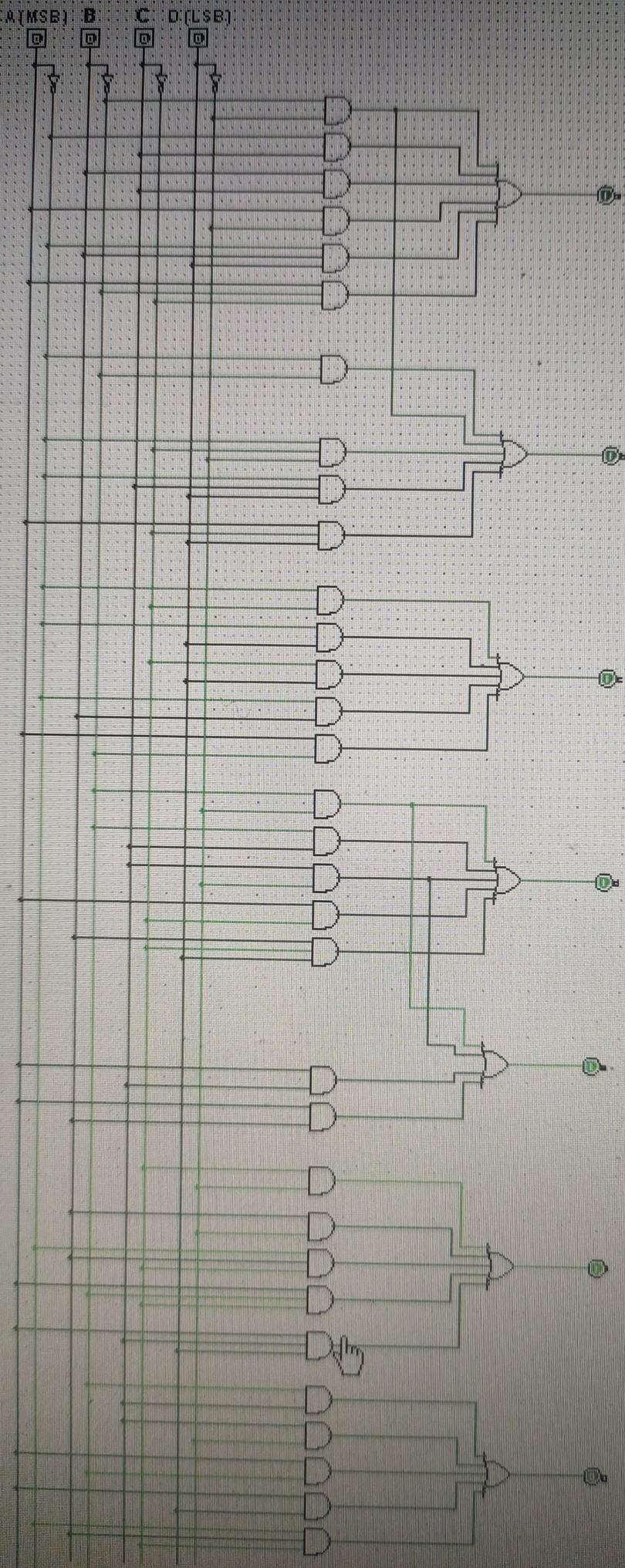


4bit Asynchronous counter

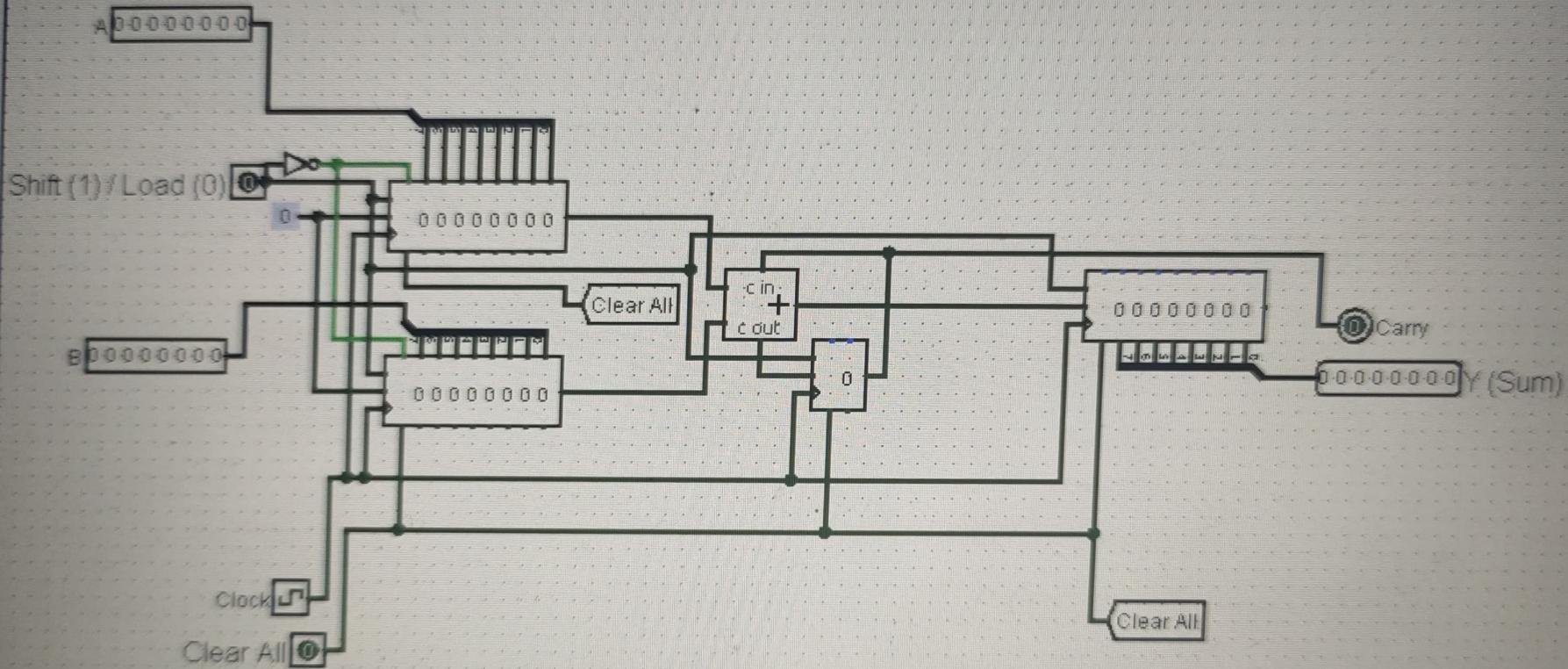




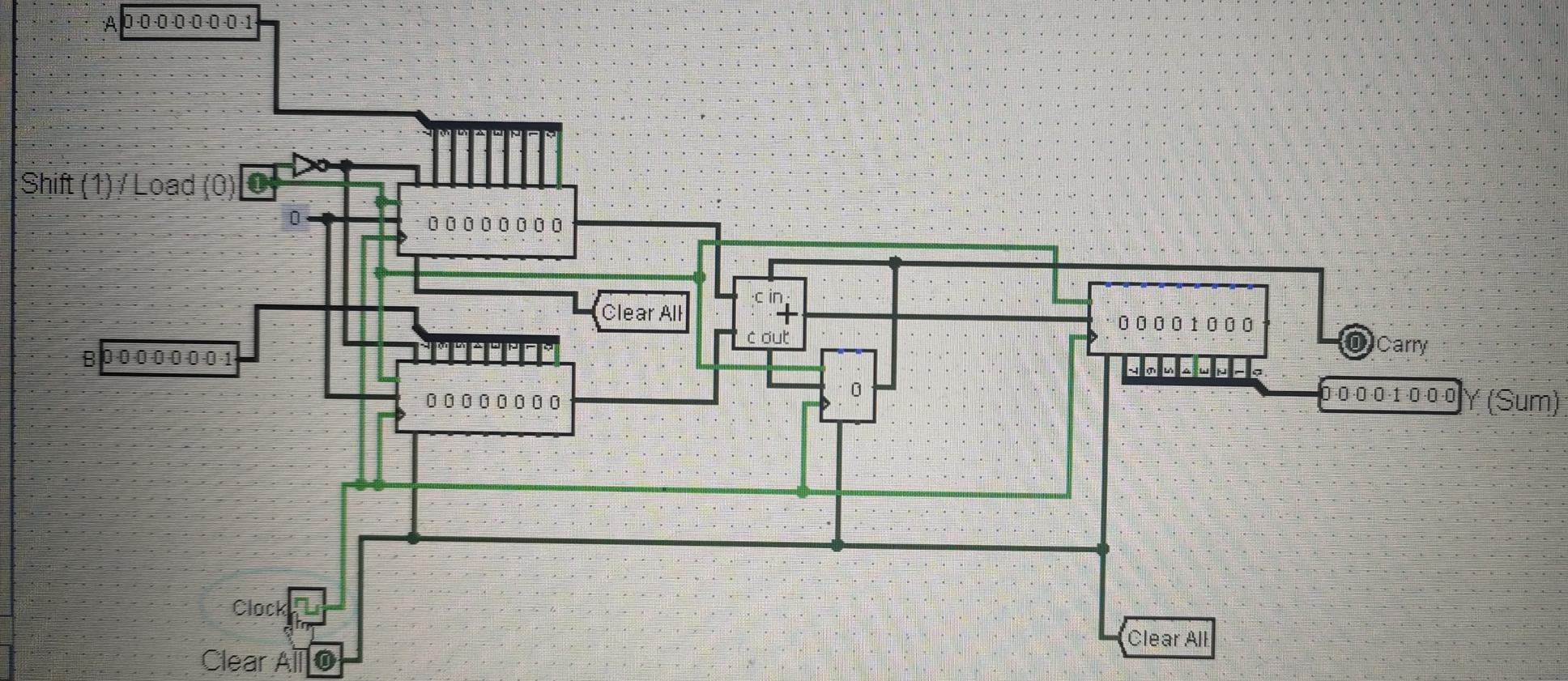
4bit Asynchronous counter



Question 3:



8 Bit Adder using only Shift Registers and a Full Adder



8 Bit Adder using only Shift Registers and a Full Adder