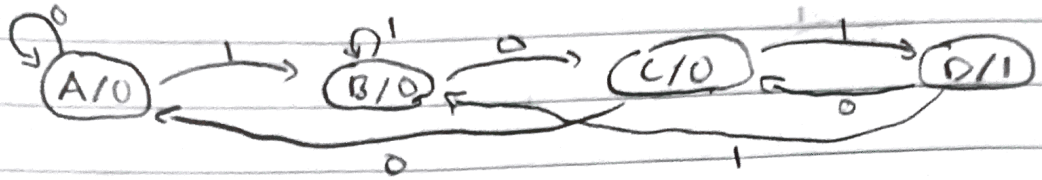
Homework 8

1a.



1b.

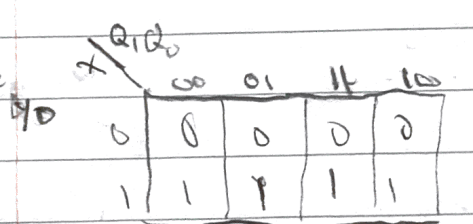
Present State	Next State x=0	Next State x=1	Output
A 00	A 00	B 01	0
B 01	C 10	B 01	0
C 10	A 00	D 11	0
D 11	C 10	B 01	1
Y_1 Y_0	$Y_1 Y_0$	$Y_1 Y_0$	

1c 4 states are needed

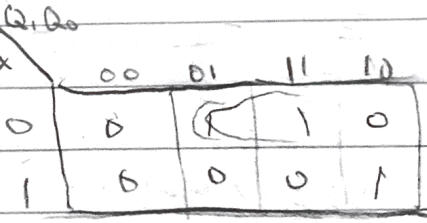
The minimum number of FlipFlops is 2.

1d. A=00 B=01 C=10 D=11

1e.

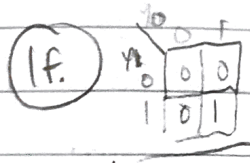


$D_0 = x$



$D_1 = x'Q_0 + xQ_1Q_0'$

1f.



$Z = Q_1Q_0$

2a.

2b.

Present state	Next State x=0	Next State x=1	Output
A 00	B 01	A 00	0
B 01	B 01	C 10	0
C 10	B 01	A 00	1
11	d	d	d

2c. 3 states are needed. The minimum number of flip flops needed is 2.

2d. A = 00 , B = 01 , C = 10

2e.

Q_1 :	Q_1Q_0 \ x	00	01	11	10
	0	0	0	M	0
	1	0	1	M	0

$D_1 = xQ_1'Q_0$

Q_0 :	Q_1Q_0 \ x	00	01	11	10
	0	1	1	M	1
	1			M	

$D_0 = x'Q_1'Q_0' + x'Q_1'Q_0 + x'Q_1Q_0'$

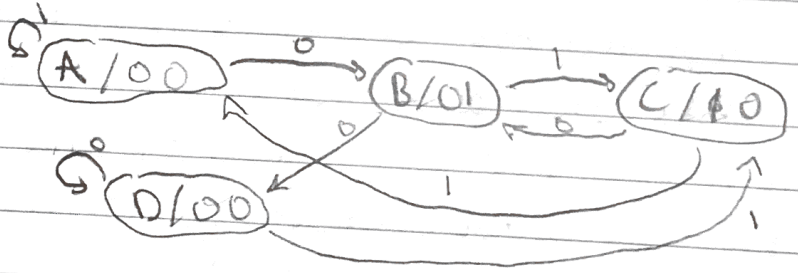
$D_0 = x'Q_1' + x'Q_1Q_0'$

2f.

Q_1 \ Q_0	0	1
0	0	0
1	1	M

$Z = Q_1Q_0'$

3a.



3b.

Present State		Next state x=0		x=1		Output
A	00	B	01	A	00	00
B	01	D	11	B	01	01
C	10	B	01	A	00	10
D	11	D	11	C	10	00

3c 4 states are needed, 2 flip flops.

3d. A = 00, B = 01, C = 10, D = 11

3e. D_1

x \ Q_1Q_0	00	01	11	10
0	0	1	1	0
1	0	0	1	0

$D_1 = x'Q_0 + Q_1Q_0$

D_0

x \ Q_1Q_0	00	01	11	10
0	1	1	1	1
1	0	1	0	0

$D_0 = x' + Q_1'Q_0$

3f.

Q_1 \ Q_0	0	1
0	0	0
1	1	0

$Z = Q_1Q_0'$

Q_1 \ Q_0	0	1
0	0	1
1	0	0

$Y = Q_1'Q_0$

4a. For one-hot implementation, encodings of states need to change, since each state is represented by one high value in the corresponding positional value. So the parameter value of the state need to change to match the number of state variables.

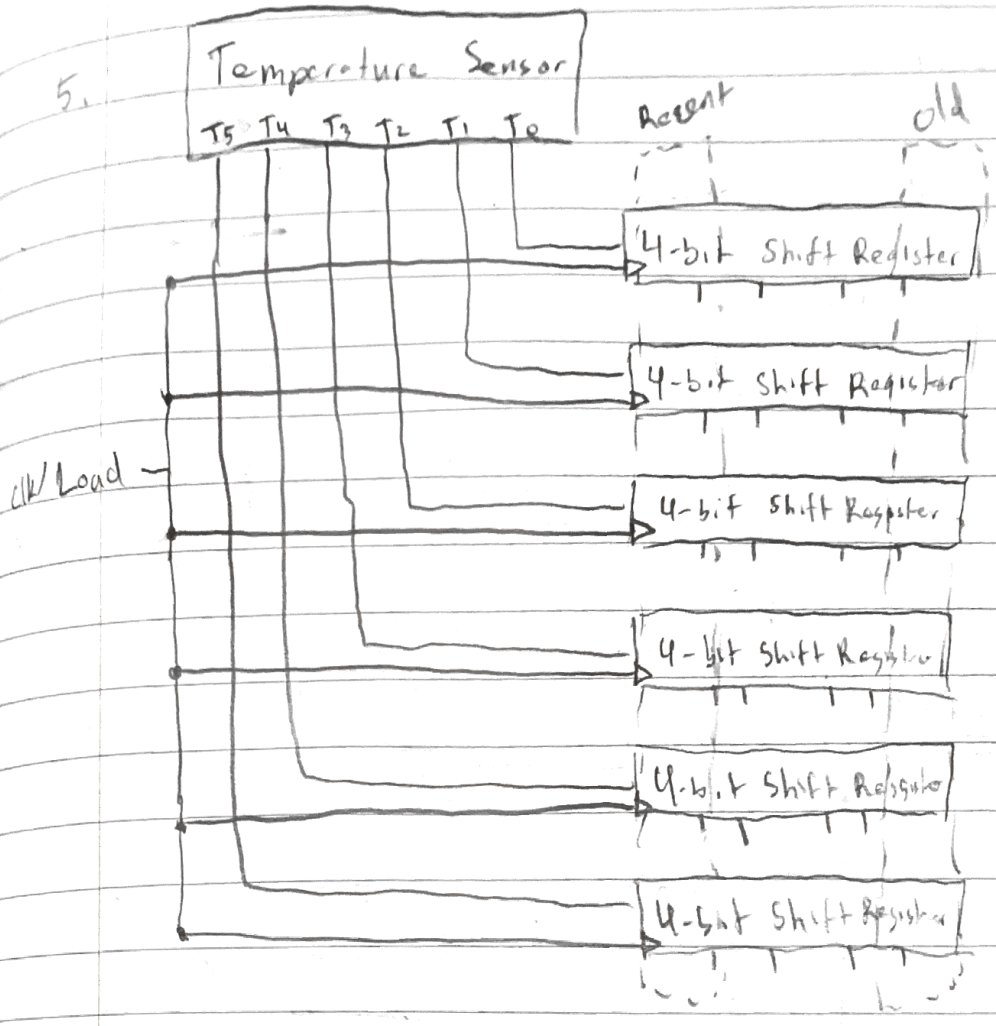
4b. original

parameter [2:1] A = 2'b00, B = 2'b01, C = 2'b10;

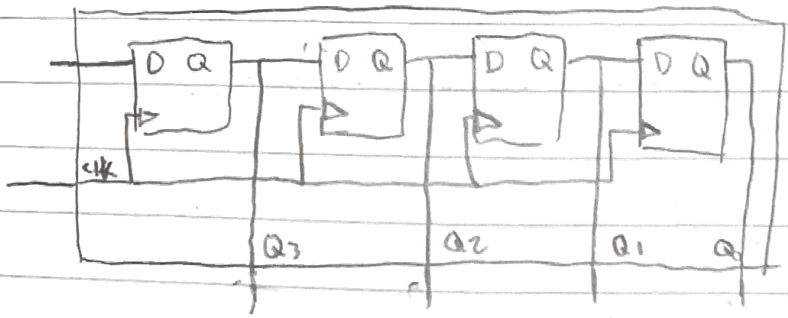
changed

parameter [2:0] A = 2'b001, B = 2'b010, C = 2'b100;

5.



4 bit Shift Register



6a. 1 3-bit counter
2 3 input AND Gates & 1 3 input NOR Gate
1 3 input OR gates