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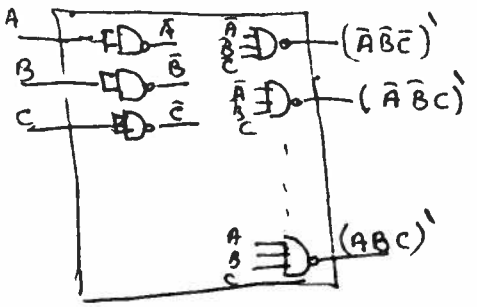
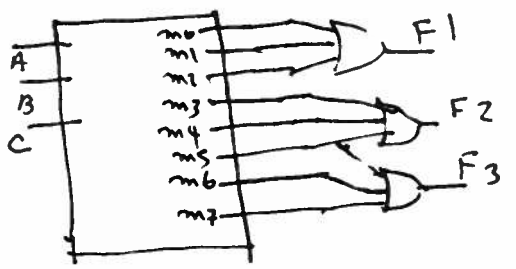
Q1

a)



b

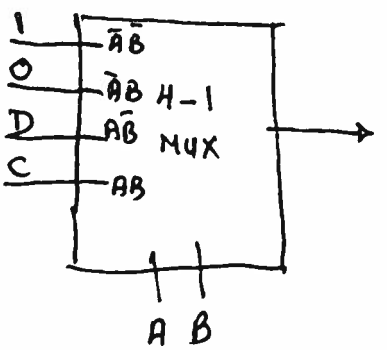


c $F(A, B, C, D) = \bar{A}\bar{B} + AB\bar{C} + A\bar{B}D$

Plotting the function on K-map

CD \ AB	00	01	11	10
00	1	0	1	0
01	1	0	1	1
11	1	0	0	1
10	1	0	0	0

Using AB as control signal



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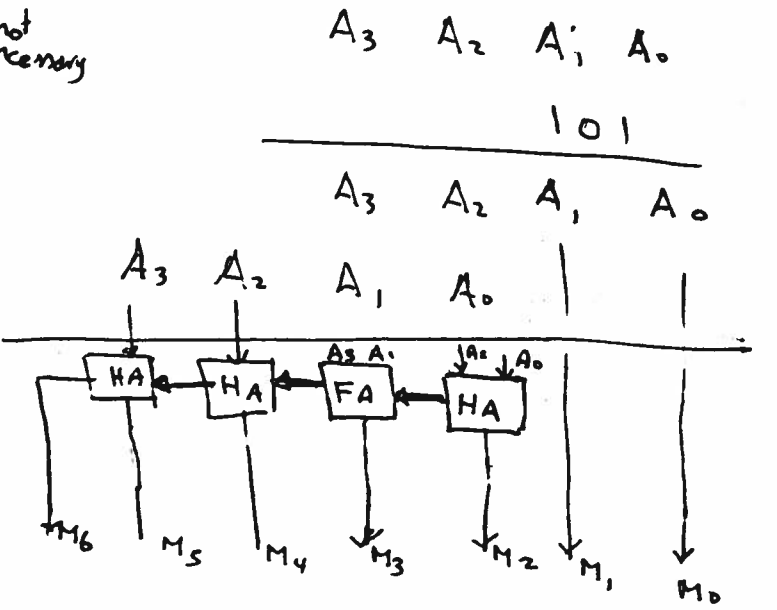
Q2

a)



AND gates are not necessary

It requires { 1 full add FA
3 half adders HA

Delay = delay of FA + delay of 3 HA

b) Memory ROM requirement is 2^7 words of 7 bits. However since the multiplier is constant, then 2^4 words of 7 bits is sufficient

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Q3

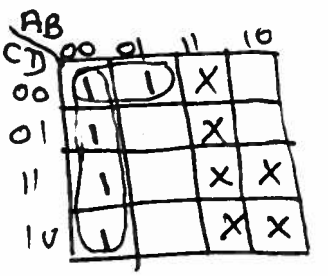
A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	1	1	0	1	0	1	1
0	0	0	1	1	1	0	1	0	1	1
0	0	1	0	1	1	0	1	0	1	1
0	0	1	1	1	1	0	1	0	1	1
0	1	0	0	1	1	0	1	0	1	1
0	1	0	1	0	1	0	0	1	0	1
0	1	1	0	0	1	0	0	1	0	1
0	1	1	1	0	1	0	0	1	0	1
1	0	0	0	0	1	0	0	1	0	1
1	0	0	1	0	1	0	0	1	0	1
		X								

$a = d = f$

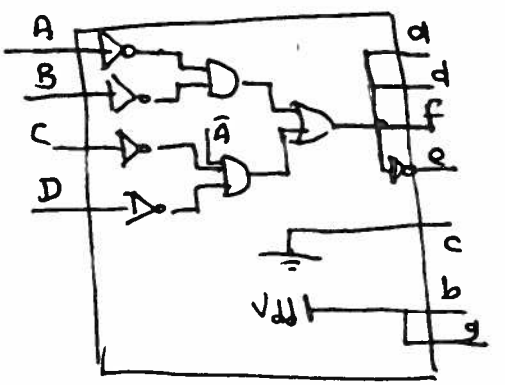
$c = 0$

$b = g = 1$

$e = \bar{a}$



$a = \bar{A}\bar{B} + \bar{A}\bar{C}\bar{D}$



Decoder

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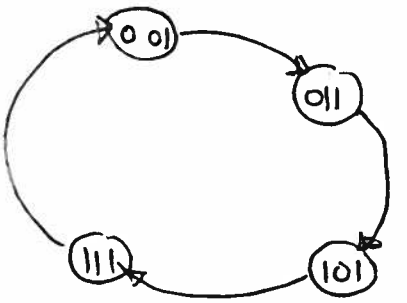
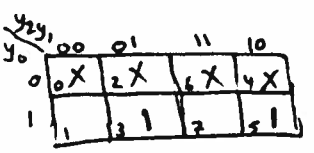
Q4

Present State → Next State

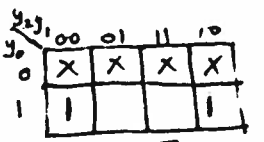
001 → 011 → 101 → 111 → 001



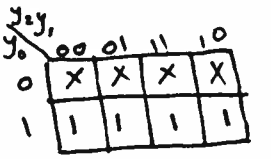
	Present State $y_2\ y_1\ y_0$	Next State $y_2^+\ y_1^+\ y_0^+$
m_0	0 0 0	X X X
m_1	0 0 1	0 1 1
m_2	0 1 0	X X X
m_3	0 1 1	1 0 1
m_4	1 0 0	X X X
m_5	1 0 1	1 1 1
m_6	1 1 0	X X X
m_7	1 1 1	0 0 1



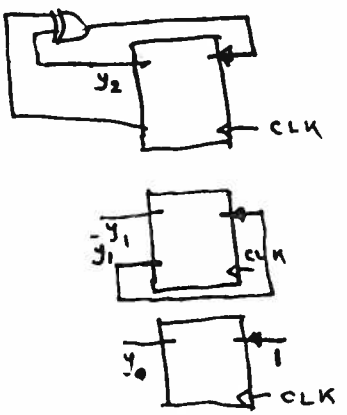
$y_2^+ = y_1 \oplus y_2$



$y_1^+ = \bar{y}_1$



$y_0^+ = 1$



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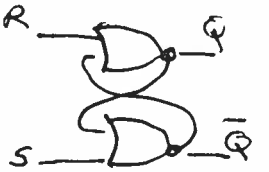
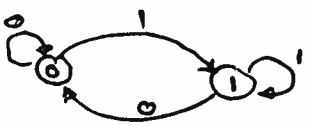
Q5

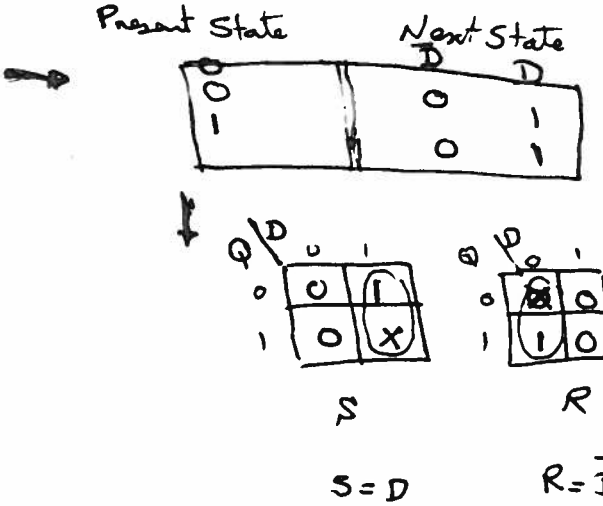
a)

Input R	Input S	Present state Q	next state Q^+
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	X
1	1	1	X

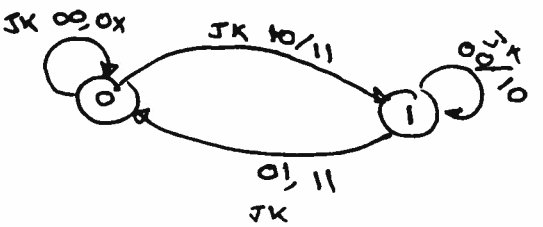


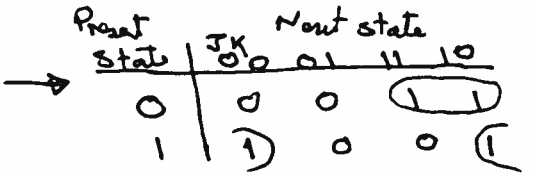
b)



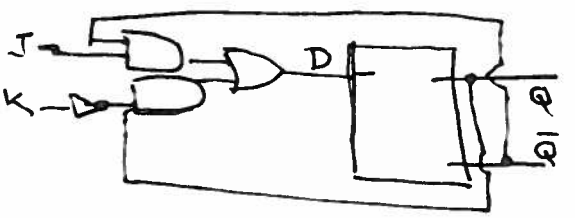


b)





$Q+ = D = J\bar{Q} + \bar{K}Q$



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Q6

a)

For JK, $Q+ = J\bar{Q} + \bar{K}Q$

For FF A

$Q_A^+ = J_A\bar{Y}_A + \bar{K}_A Y_A =$

$J_A = Y_B$, $K_A = \bar{X}Y_B$ and $\bar{K} = \overline{\bar{X}Y_B} = X$ or $\bar{Y}_B$

$Q_A^+ = Y_B\bar{Y}_A + \bar{Y}_B Y_A + \bar{X}Y_A = (Y_B \oplus Y_A) + XY_A$ ---- Equ. 1

For FF B

$J_B = Y \quad K_B = X \oplus Y_A$

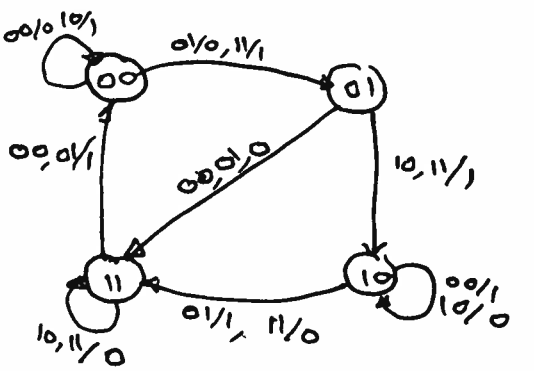
$Q+_B = J_B\bar{Y}_B + \bar{K}_B Y_B = Y\bar{Y}_B + (X \odot Y_A)Y_B$

$Q+_B = Y\bar{Y}_B + \bar{Y}_A\bar{X}Y_B + Y_A Y_B X$ ---------- Equ 2

for output $Z = K_B$, $Z = X\bar{Y}_A + \bar{X}Y_A$

Transition Table

Present state Y_A Y_B	Next state Y_A^+ Y_B^+ xy = 00	01	10	11	Output xy = 00	01	10	11
0 0	0 0	0	00	01	0	0	1	1
0 1	1 1	1	10	10	0	0	1	1
1 0	1 0	11	10	11	1	1	0	0
1 1	0 0	0	0	11	1	1	0	0



b)

Present state	Next state $x=0$	Next state $x=1$	output $x=0$	output $x=1$
A 0 0 0	1 0 1	0 0 1	0	0
B 0 0 1	0 1 1	0 1 0	0	0
C 0 1 0	1 0 1	1 0 0	0	0
D 0 1 1	1 1 0	0 0 0	1	0
E 1 0 0	0 1 1	0 1 0	0	0
F 1 0 1	1 0 1	0 0 1	1	1
G 1 1 0	1 1 0	1 1 1	0	1
H 1 1 1	1 1 0	0 0 0	1	0

E = B, H = D, then C = A

Re-arranging according to o/p

A	F B	00
B	D C	
C	F E	
E	D C	
D	G A	10
H	G A	
F	F B	11
G	G H	01

Present State	Next state / output $x=0$	$x=1$
A	F/00	B/00
B	D/00	A/00
D	G/10	A/10
F	F/11	B/11
G	G/01	D/01