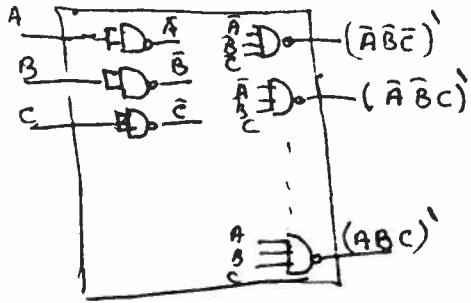
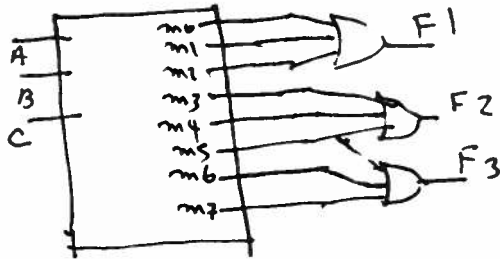


Q1

a)



b

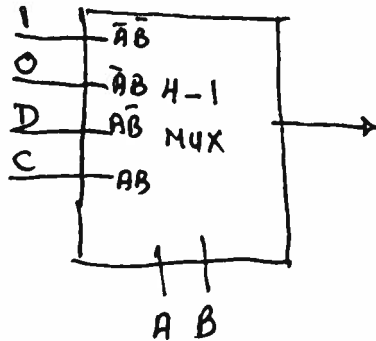


c $F(A, B, C, D) = \bar{A}\bar{B} + A\bar{B}\bar{C} + A\bar{B}D$

Plotting the function on K-map

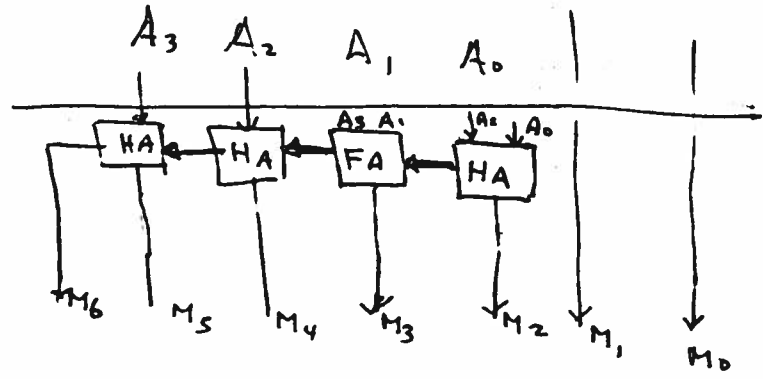
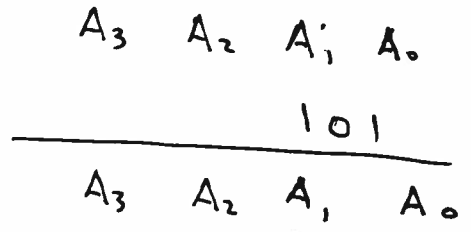
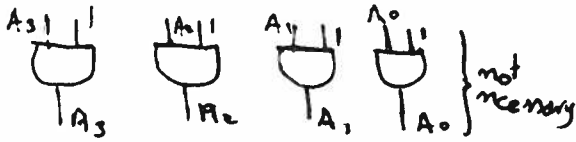
	AB			
CD	00	01	11	10
00	1	0	1	0
01	1	0	0	1
11	1	0	0	1
10	1	0	0	0

Using AB as control signal



Q2

a)



AND gates are not necessary
 It requires $\left\{ \begin{array}{l} 1 \text{ full adder FA} \\ 3 \text{ half adders HA} \end{array} \right.$
 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

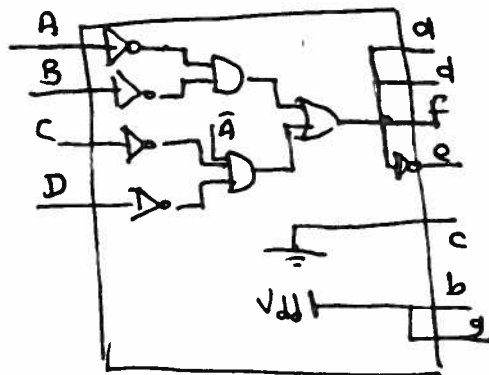
Q3

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								

$a = d = f$
 $c = 0$
 $b = g = 1$
 $e = \bar{a}$

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

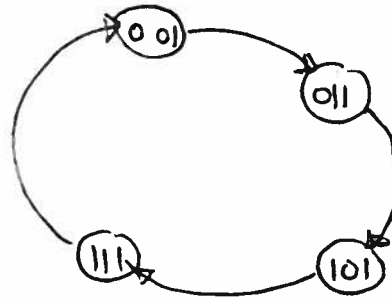
$a = \bar{A}\bar{B} + \bar{A}\bar{C}\bar{D}$



Decoder

Q4

Present state Next state
 001 → 011 → 101 → 111 → 001



m	Present state			Next state		
	y_2	y_1	y_0	y_2^+	y_1^+	y_0^+
m0	0	0	0	X	X	X
m1	0	0	1	0	1	1
m2	0	1	0	X	X	X
m3	0	1	1	1	0	1
m4	1	0	0	X	X	X
m5	1	0	1	1	1	1
m6	1	1	0	X	X	X
m7	1	1	1	0	0	1

y_2, y_1	00	01	11	10
y_0	0 X	2 X	6 X	4 X
1	1	3 1	7	5 1

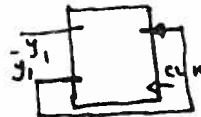
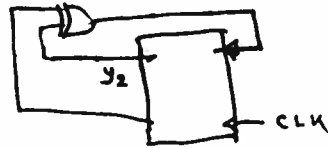
$y_2^+ = y_1 \oplus y_2$

y_2, y_1	00	01	11	10
y_0	X	X	X	X
1	1			1

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

y_2, y_1	00	01	11	10
y_0	X	X	X	X
1	1	1	1	1

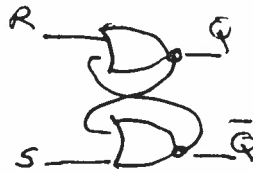
$y_0^+ = 1$



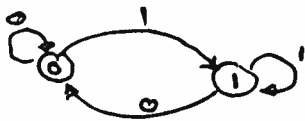
Q5

a)

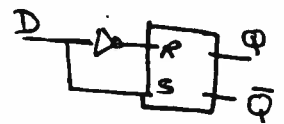
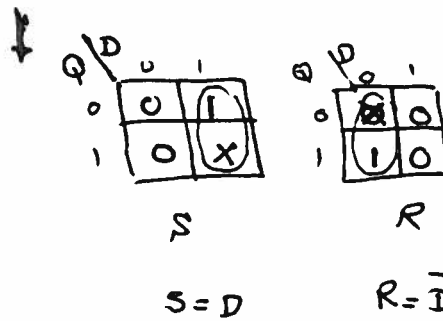
Input		Present state		Next state	
R	S	Q	Q'	Q+	Q'+
0	0	0	1	0	1
0	0	1	0	1	0
0	1	0	1	0	1
0	1	1	0	1	0
1	0	0	1	0	1
1	0	1	0	1	0
1	1	0	1	X	X
1	1	1	0	X	X



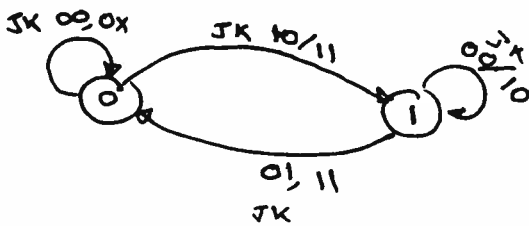
b)



Present State		Next State	
Q	Q'	Q	Q'
0	1	0	1
1	0	1	0

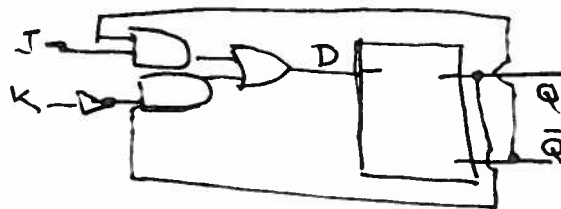


b)



Present state	Next state			
	JK 00	JK 01	JK 11	JK 10
0	0	0	1	1
1	1	0	0	1

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



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 $\bar{K} = \overline{\bar{X}Y_B} = X \text{ or } \bar{Y}_B$

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

For FF B

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

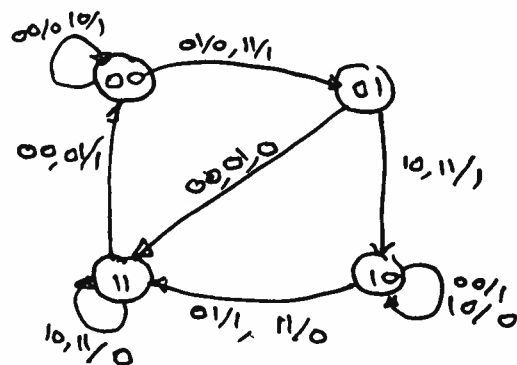
$Q_B^+ = J_B\bar{Y}_B + \bar{K}_B Y_B = Y\bar{Y}_B + (X \oplus Y_A) Y_B$

$Q_B^+ = Y\bar{Y}_B + \bar{Y}_A \bar{Y}_B + Y_A Y_B X$ ----- 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 ⁺				Output			
	xy = 00	01	10	11	xy = 00	01	10	11
0 0	0 0	0 0	0 0	0 1	0	0	1	1
0 1	1 1	1 1	1 0	1 0	0	0	1	1
1 0	1 0	1 1	1 0	1 1	1	1	0	0
1 1	0 0	0 0	1 1	1 1	1	1	0	0



b)

	Present state		Next state		output	
	x ₂ x ₁	x ₀ x ₋₁	x ₂ ⁺ x ₁ ⁺	x ₀ ⁺ x ₋₁ ⁺	z ₂ z ₁	z ₀ z ₋₁
A	0	0	0	0	0	0
B	0	0	1	0	0	0
C	0	1	0	1	0	0
D	0	1	1	0	0	0
E	1	0	0	1	1	0
F	1	0	0	1	0	1
G	1	1	1	1	1	1
H	1	1	1	0	0	1

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

Re-arranging according to o/p

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

Present State	Next State / output
x ₂ x ₁ x ₀ x ₋₁	z ₂ z ₁ z ₀ z ₋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

