Q1 COEN 212 Dec 2016

a)

$F_1 \cdot F_2 = (AB + \bar{C})(\bar{A}\bar{C} + \bar{B}\bar{C}) = A\bar{A}B\bar{C} + AB\bar{B}\bar{C} + \bar{A}\bar{C}\bar{C} + \bar{B}\bar{C} = \bar{A}\bar{C} + \bar{B}\bar{C}$

$F_1 + F_2 = AB + \bar{C} + \bar{A}\bar{C} + \bar{B}\bar{C} = AB + \bar{C}$

2 Marks

b)

$A\bar{B}\bar{C} + B\bar{C}\bar{D} + A\bar{C}D + AB\bar{C} + BC\bar{D} + AC\bar{D}$

$AB + B\bar{D} + A\bar{C}D + AC\bar{D}$ OR $AB + B\bar{D} + \bar{A}(\bar{B}+D)$

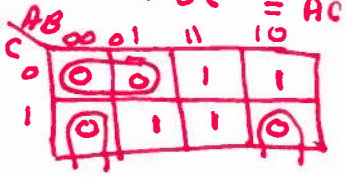
2 Marks

c)

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

NOR - NOR

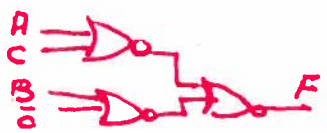
c (i)



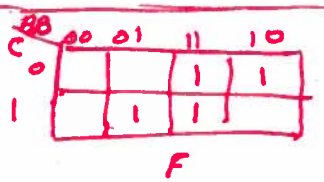
$F = (A+C) \bullet (B+\bar{C})$

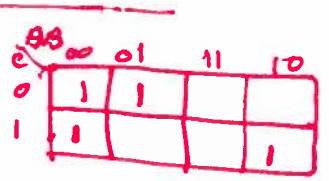
$= \overline{\overline{(A+C)} + \overline{(B+\bar{C})}}$ Using De Morgan's

1.5 Marks



c (ii)

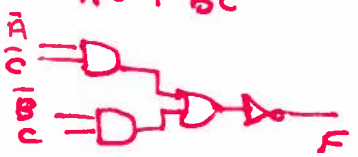




1.5 Marks

$\bar{F} = \bar{A}\bar{C} + \bar{B}C$

$F = \overline{\bar{A}\bar{C} + \bar{B}C}$



Q2 COEN 212 Dec 2016

a)

N	$(N-2)^2$	N_2	N_1	N_0	m	F_4	F_3	F_2	F_1	F_0
0	4	0	0	0	0	0	0	1	0	0
1	1	0	0	1	1	0	0	0	0	1
2	0	0	1	0	2	0	0	0	0	0
3	1	0	1	1	3	0	0	0	0	1
4	4	1	0	0	4	0	0	1	0	0
5	9	1	0	1	5	0	1	0	0	1
6	16	1	1	0	6	1	0	0	0	0
7	X	X	X	X	7	X	X	X	X	X

$F_0 = N_0$ $\quad F_1 = 0$

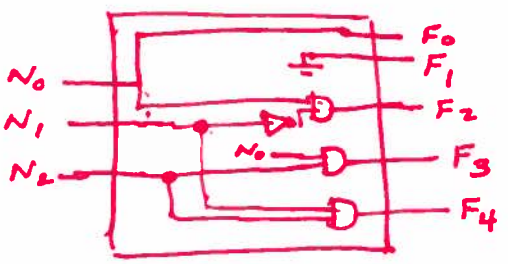
$F_2 =$ 

$F_2 = \bar{N}_1 N_0$

F_3 

$F_3 = N_2 N_0$

$F_4 = N_2 N_1$



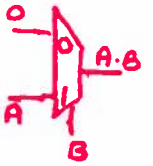
b) ROM SIZE $= 2^3$ of 5 bits $=$ 8 words of 5 bits each

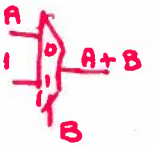
The 8 words are fixed and necessary but the 5 bits can be reduced to 3 due to the fact that $F_1 = 0$ & $F_0 = N_0$

Q3 COEN 212 Dec 2016

a)

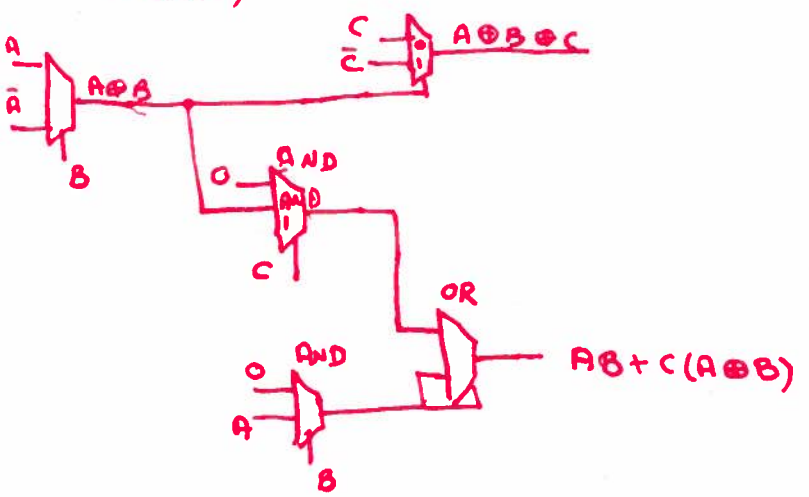
A	B	AND	OR	X-OR
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0



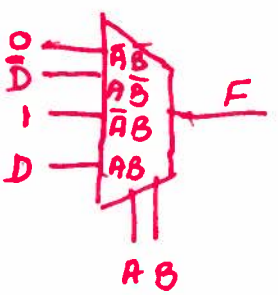


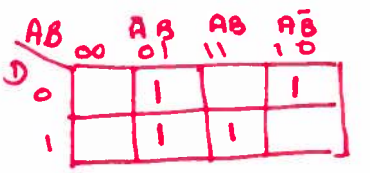
b) $S = A \oplus B \oplus C$

$C_{out} = AB + C(A \oplus B)$



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



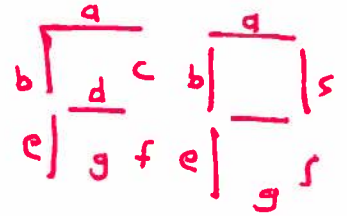


Use AB as control signal gives minimum logic

Q4 COEN 212 Dec 2016

4 inputs & 7 o/ps Truth Table representing the BCD input and the display o/p

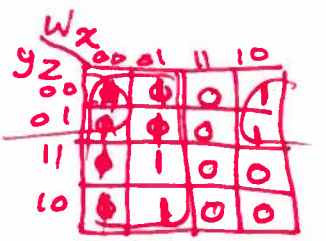
	w	x	y	z	a	b	c	d	e	f	g
BCD	0	0	0	0	↓	↓	↓	↓	↓	↓	0 ↓
	0	0	0	1							
	0	0	1	0							
	0	0	1	1							
	0	1	0	0							
	0	1	0	1							
	0	1	1	0							
	1	0	0	0							
Nor BCD	1	0	0	1							
	1	0	1	0			0	0	0	0	0
	1	0	1	1							
	1	1	0	0							
	1	1	0	1							
	1	1	1	0							
	1	1	1	1							



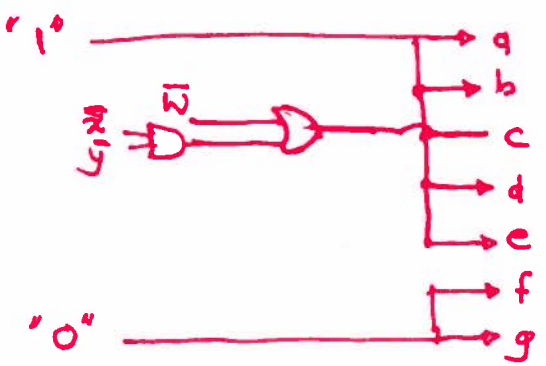
a = b = d = e = '1' } all the time

f = g = '0'

c =



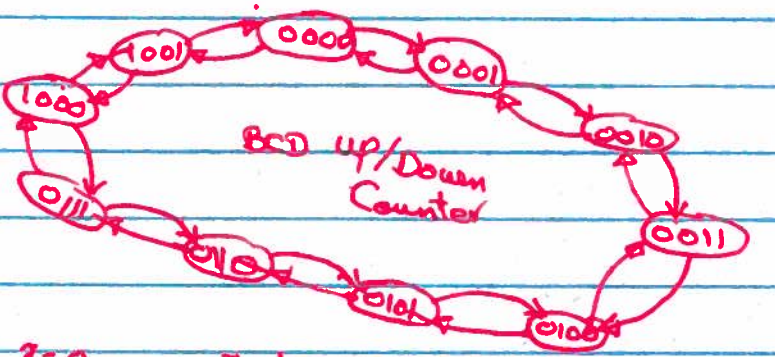
$c = \bar{w} + \bar{y}\bar{x}$



Q5 COEN 212 Dec 2016

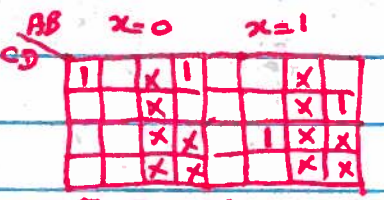
x=0 Down Count

x=1 Up Count



minterm	A B C D	x=0: $A^+ B^+ C^+ D^+$	x=1: $A^+ B^+ C^+ D^+$	x=0: $T_A T_B T_C T_D$	x=1: $T_A T_B T_C T_D$
0	0 0 0 0	1 0 0 1	0 0 0 1	1 0 0 1	0 0 0 1
1	0 0 0 1	0 0 0 0	0 0 1 0	0 0 0 1	0 0 1 1
2	0 0 1 0	0 0 0 1	0 0 1 1	0 0 1 1	0 0 0 1
3	0 0 1 1	0 0 1 0	0 1 0 0	0 0 0 1	0 1 1 1
4	0 1 0 0	0 0 1 1	0 1 0 1	0 1 1 1	0 0 0 1
5	0 1 0 1	0 1 0 0	0 1 1 0	0 0 0 1	0 0 1 1
6	0 1 1 0	0 1 0 1	0 1 1 1	0 0 1 1	0 0 0 1
7	0 1 1 1	0 1 1 0	1 0 0 0	0 0 0 1	1 1 1 1
8	1 0 0 0	0 1 1 1	1 0 0 1	1 1 1 1	0 0 0 1
9	1 0 0 1	1 0 0 0	0 0 0 0	0 0 0 1	1 0 0 1
10					
11					

$T_D = 1$

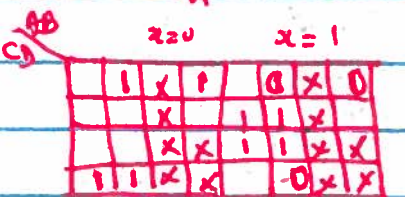


$\bar{B}\bar{C}\bar{D} + BCD + AD$

T_A

$A\bar{D} + B\bar{C}\bar{D} + CD$

T_B



$D(A+B+C) + \bar{A}D$

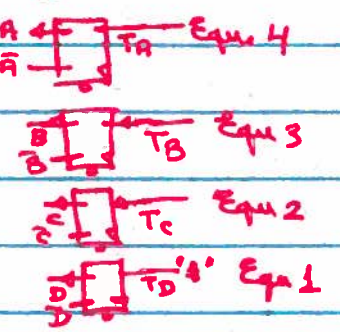
T_C

Equ.1 $T_D = 1$

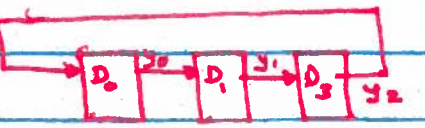
Equ.2 $T_C = \bar{A}D + \bar{D}(A+B+C)$

Equ.3 $T_B = A\bar{D} + B\bar{C}\bar{D} + CD$

Equ.4 $T_A = \bar{B}\bar{C}\bar{D} + BCD + AD$



Q6 COEN 212 Dec 2016



Excitation Equations:

$D_0 = y_2 \quad D_1 = y_0 \quad D_2 = y_1$

Transition Table:

$y_2\ y_1\ y_0$	$y_2^+\ y_1^+\ y_0^+$
0 0 0	0 0 0
0 0 1	0 1 0
0 1 0	1 0 0
0 1 1	1 1 0
1 0 0	0 0 1
1 0 1	0 1 1
1 1 0	1 0 1
1 1 1	1 1 1

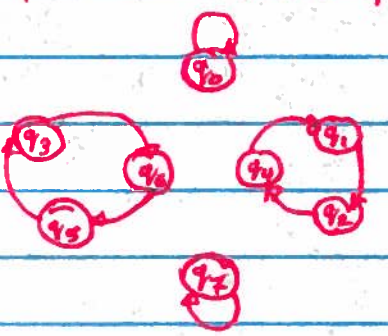
state Assignment

000	q_0
001	q_1
010	q_2
011	q_3
100	q_4
101	q_5
110	q_6
111	q_7

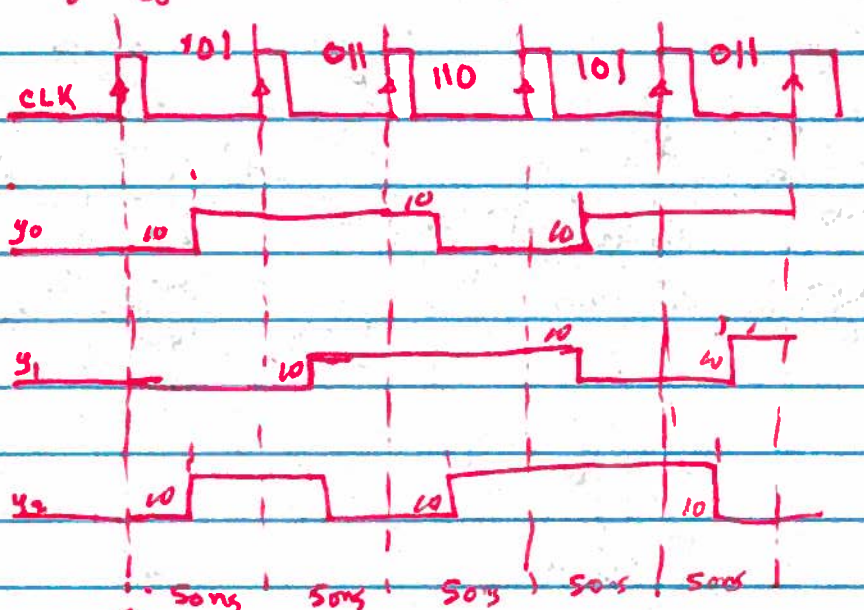
state table

q_0	q_0
q_1	q_2
q_2	q_4
q_3	q_6
q_4	q_1
q_5	q_3
q_6	q_5
q_7	q_7

state diagram



+ve edge trigged FF



the first edge will take the initial values?