POSSESION OF MOBILES IN EXAM IS UFM PRACTICE.

Name _____ _____ **Enrollment No.**_____ _____

Jaypee Institute of Information Technology, Noida

T1 Examination, 2023

B. Tech IV Semester

Course Title: Digital Systems **Maximum Time: 1 Hr**

Course Code: 18B11EC213 **Maximum Marks: 20**

CO1: Familiarize with the fundamentals of number system, Boolean algebra and Boolean function minimization techniques.
CO2: Analyze and design combinational circuits using logic gates.
CO3: Analyze state diagram and design sequential logic circuits using flip flops.
CO4: Understand the classification of signals & systems and learn basic signal operations & Fourier analysis.
CO5: Understand various steps involved in digitization and transmission of a signal.

Note: Attempt all questions. All questions are compulsory.

Q. 1 **(a) Subtract using 10's Compliment method: 20 – 100.** **[CO1, 1+1+2]**

(b) Subtract using 2's Compliment method: $(11010)_2 - (1101)_2$.

(c) Simply the Boolean expression using Boolean laws: $Y = AB + \overline{AC} + A\bar{B}C(AB + C)$

Q.2. Find out minimized POS form of the following function: **[CO1, 4]**

$F(A, B, C, D) = \sum m(0, 2, 8, 10, 14) + \sum d(5, 15)$ using k-map and also find out EPI's and PI's.

Q.3. Implement the function $F(A, B, C, D) = \sum m(0, 1, 3, 4, 8, 9, 15)$ using 8:1 Mux. **[CO2, 4]**

Q. 4 Simplify the function $F(A, B, C) = \sum m(0, 1, 4, 5)$ using QM Techniques **[CO1, 4]**

Q.5. How many decoders are required to construct 6: 64 decoder using 3:8 decoders. Implement the full subtractor using 3: 8 decoders. **[CO2, 4]**

Ques 1 (a) Subtract using 10's compliment

$$\begin{array}{r} 20 \\ -100 \\ \hline \end{array}$$

Solution :- First of all make no. of digits equal in both

$$\therefore \begin{array}{r} 020 \\ -100 \\ \hline \end{array} \xrightarrow{\text{10's Compliment}} r^n - N = 10^3 - 100 = 900$$

Now,

$$\begin{array}{r} 020 \\ +900 \\ \hline 920 \end{array}$$

→ No carry is generated. (0.5)

Therefore answer is negative. as 10's compliment of 920.

$$r^n - N = 10^3 - 920 = -80 \quad \text{—— (0.5)}$$

(b) Subtract using 2's compliment : $(11010)_2 - (1101)_2$

Solu^n Let suppose $X = (11010)_2$

$Y = (01101)_2$

2's compliment of Y is $r^n - N$

$$= (2^5) - 01101$$

$$= \begin{array}{r} 100000 \\ -1101 \\ \hline 10011 \\ \hline \end{array} \quad \text{—— (0.5)}$$

2's Compliment of Y → 10011

Now add →

$$\begin{array}{r} 11010 \\ +10011 \\ \hline \boxed{1}01101 \end{array}$$

→ Here carry is generated. (0.5)

So discard the carry and answer is positive as.

$+(01101)_2$

(c) Simply the Boolean expression using boolean laws

$$Y = AB + A\bar{C} + A\bar{B}C(AB+C)$$

$$= AB + A\bar{C} + A\bar{B}CAB + A\bar{B}CC \quad \text{(Distributive)}$$

$$= AB + A\bar{C} + 0 + A\bar{B}C \quad \text{—— (0.5)}$$

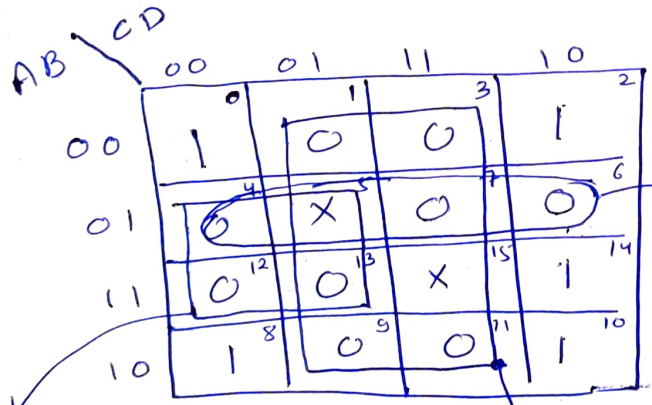
$$= A[B + \bar{B}C] + A\bar{C} \quad \text{—— (0.5)}$$

$$= A(B+C) + A\bar{C} \quad \leftarrow \text{(Absorption Law)} \quad \text{—— (0.5)}$$

$$= AB + (AC + A\bar{C})$$

$$= AB \quad \text{—— (0.5)}$$

Ques 2 $F(A,B,C,D) = \Sigma m(0,2,8,10,14) + \Sigma d(5,15)$ using K-map and find EPI & PI's.



(2) Marks for filling K-map & grouping.

$(A + \bar{B})$ — PI (0.5)

$(\bar{B} + C)$ — (0.5) EPI

$\bar{D}$ — (0.5) EPI

$$F = (A+\bar{B})(\bar{B}+C)\bar{D} \quad \text{— (0.5)}$$

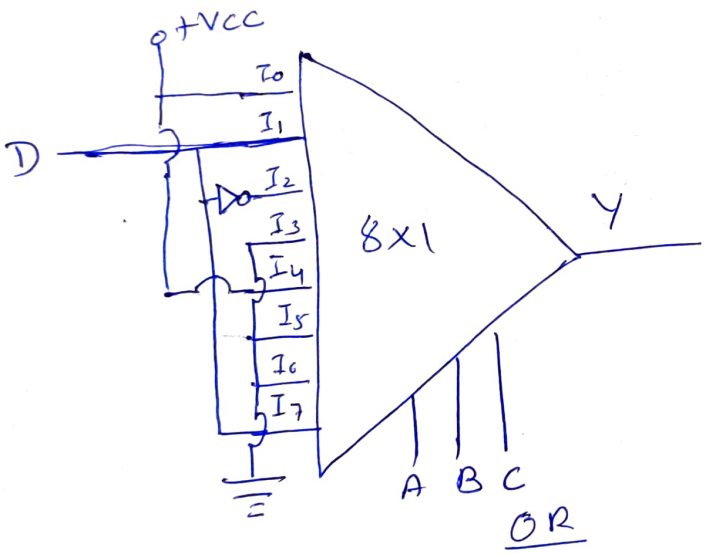
Ques 3 Implimenk $F(A,B,C,D) = \Sigma m(0,1,3,4,8,9,15)$ using 8x1 MUX.

Solution (3)

If S_2, S_1, S_0 are A, B, C then

	$\bar{A}\bar{B}\bar{C}$ I_0	$\bar{A}\bar{B}C$ I_1	$\bar{A}B\bar{C}$ I_2	$\bar{A}BC$ I_3	$A\bar{B}\bar{C}$ I_4	$A\bar{B}C$ I_5	$AB\bar{C}$ I_6	ABC I_7
$\bar{D}$	(0)	2	(4)	6	(8)	10	12	14
D	(1)	(3)	5	7	(9)	11	13	(15)
	1	D	$\bar{D}$	0	1	0	0	D

(2) Marks



(2) Marks

OR

If S_2 S_1 S_0 are B, C, D then

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
$\bar{A}$	(0)	(1)	2	(3)	(4)	5	6	7
A	(8)	(9)	10	11	12	13	14	(15)
	1	1	0	$\bar{A}$	$\bar{A}$	0	0	A

OR

	$\bar{A}\bar{C}\bar{D}$ I_0	$\bar{A}\bar{C}D$ I_1	$\bar{A}C\bar{D}$ I_2	$\bar{A}CD$ I_3	$A\bar{C}\bar{D}$ I_4	$AC\bar{D}$ I_6	$AC\bar{D}$ I_6	ACD I_7
$\bar{B}$	(0)	(1)	2	(3)	(8)	(9)	10	11
B	(4)	5	6	7	12	13	14	(15)
	1	$\bar{B}$	0	$\bar{B}$	$\bar{B}$	$\bar{B}$	0	B

OR

	$\bar{A}\bar{B}\bar{D}$ I_0	$\bar{A}\bar{B}D$ I_1	$\bar{A}B\bar{D}$ I_2	$\bar{A}BD$ I_3	$AB\bar{D}$ I_4	$A\bar{B}D$ I_5	$AB\bar{D}$ I_6	ABD I_7
$\bar{C}$	(0)	(1)	(4)	5	(8)	(9)	12	13
C	2	(3)	6	7	10	11	14	(15)
	$\bar{C}$	1	$\bar{C}$	0	$\bar{C}$	$\bar{C}$	0	C

Ques 4 :-

Simplify following function using QM Technique

$F(A,B,C) = \Sigma m(0, 1, 4, 5)$

Soln

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

$\Rightarrow$

First Coulmn

		A B C
Group 0	0	0 0 0
Group 1	1	0 0 1
	4	1 0 0
Group 2	5	1 0 1

$\Rightarrow$

Second Column

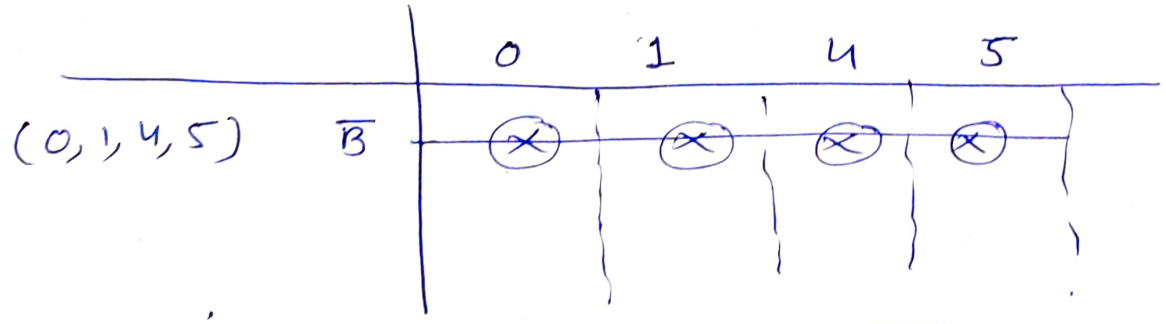
	A B C
(0, 1)	0 0 –
(0, 4)	– 0 0
(1, 5)	– 0 1
(4, 5)	1 0 –

$\Downarrow$

Third Column

	A B C
(0, 1, 4, 5)	– 0 –
(0, 4, 15)	– 0 –

So the prime implicants are:-



$\therefore$ $\boxed{F(A, B, C) = \overline{B}}$

(1)

Ques 5 (i) How many decoders are required to construct 6x64 decoder using 3x8 decoder

Ans $8+1 = 9$

(3)

(ii) Implement full substracter using 3x8 decoder.

Sol We know that

$$D = \Sigma m (1, 2, 4, 7)$$

$$B_{out} = \Sigma m (1, 2, 3, 7)$$