INDRAPRASTHA INSTITUTE OF INFORMATION TECHNOLOGY, DELHI

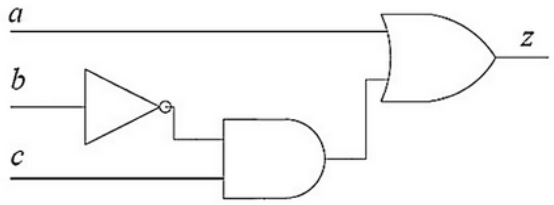
ECE111 DC

TUTORIAL 4 **(10 marks)**

1) **Find the (r-1)'s complement for the given numbers:** **(2 marks)**

   a) $(723)_8$
   b) $(467)_{10}$
   c) $(10110)_2$
   d) $(467)_{12}$

2) **(a) Consider the Boolean function z(a,b,c)** **(2 marks)**



Express the Boolean function in Canonical SOP and POS form.

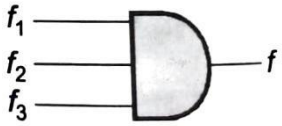
(b) Design a logic circuit that has input A, B and C whose output 'F' will be high only when a majority of the inputs is high.

3) **Consider the logical functions given below.**

$f_1(A, B, C) = \sum(2, 3, 4)$

$f_2(A, B, C) = \prod(0, 1, 3, 6, 7)$ **(2 marks)**

If 'f' is logic zero, then find the maximum number of possible minterms in function f_3.



4) **Two 4-bit 2's complement numbers 1011 and 0110 are added. Find the result and express it in 4-bit 2's complement notation.** **(2 marks)**

5) **Find the result of $(45)_{10}$ - $(45)_{16}$ and express it in 6-bit 2's complement representation.** **(2 marks)**

****

DC

TWT -4

Q1 a) 7th complement of $(738)_8$

$= -(044)_8 + (777)_8$

$\Rightarrow$ 7th complement $= (044)_8$

b) 9th complement of $(467)_{10}$

$= (999)_{10} - (532)_{10}$

$\Rightarrow$ 9th complement of $= (532)_{10}$

c) $(10110)_2 = (11111)_2 - (01001)_2$

$\Rightarrow$ 1's complement $= (01001)_2$

d) $(467)_{12} =$ ~~(CCC)~~ $(BBB)_{12} -$ ~~(BBB)~~ $(754)_{12}$

$\Rightarrow$ 11th complement $= (754)_{12}$

Q2 a) $Z = a + \bar{b} \cdot c$

Canonical SOP

$Z = a(b+\bar{b})(c+\bar{c}) + \bar{b} \cdot c(a+\bar{a})$

$Z = abc + ab\bar{c} + a\bar{b}c + a\bar{b}\bar{c} +$ ~~$\bar{a}\bar{b}c$~~ $+ \bar{a} \cdot \bar{b} \cdot c$

~~Canonical POS~~

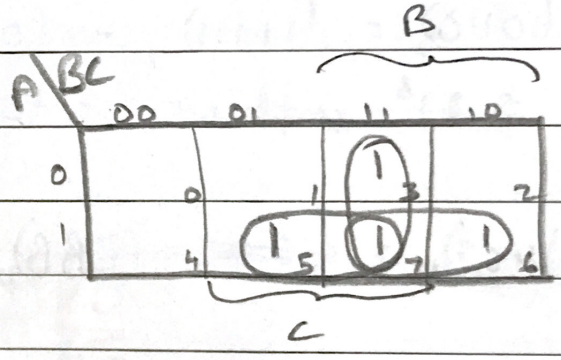
~~$Z = a + (b \cdot \bar{b}) + (c \cdot \bar{c}) + \bar{b} \cdot c$~~

~~$= (a+b+c) \cdot (a+\bar{b}+c) \cdot (a+b+\bar{c}) \cdot (a+\bar{b}+\bar{c}) + \bar{b} \cdot c$~~

Canonical POS

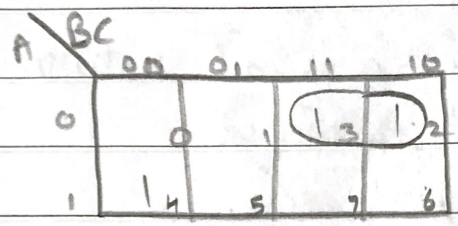
$$Z = a + \bar{b} \cdot c$$
$$= (a+\bar{b}) \cdot (a+c)$$
$$= [a+\bar{b}+c\cdot\bar{c}] \cdot [a+c+b\cdot\bar{b}]$$
$$Z = (a+\bar{b}+c)\cdot(a+\bar{b}+\bar{c}) \cdot (a+c+b)\cdot(a+c+\bar{b})$$

	A	B	C	F
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1



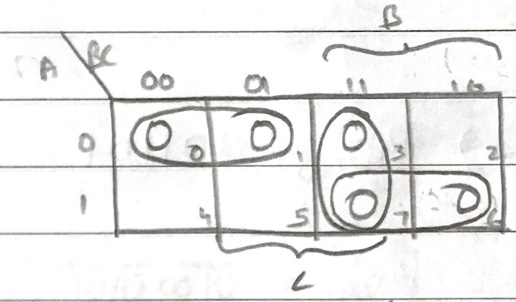
$$\Rightarrow F = BC + AB + AC$$

Q3 $f_1(A,B,C) = \Sigma(2,3,4) = \Pi(0,1,5,6,7)$



$f_1 = \bar{A}B + A\bar{B}\bar{C}$

$f_2(A,B,C) = \Pi(0,1,3,6,7)$



$\Rightarrow f_2 = (A+B)\cdot(\bar{B}+\bar{C})\cdot(\bar{A}+\bar{B})$

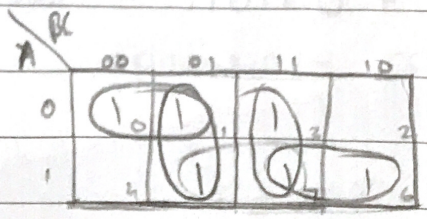
$\Rightarrow$ For $f = 0$

either f_1, f_2, or f_3 is zero

$\Rightarrow f_1 = \Pi(0,1,5,6,7)$

$f_2 = \Pi(0,1,3,6,7)$

$\Rightarrow f_3 = \Pi(2,4) = \Sigma(0,1,3,5,6,7)$



$f_3 = \bar{A}\bar{B} + \bar{B}C + BC + AB$

$= \bar{A}\bar{B}C + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC + \bar{A}BC + AB\bar{C}$

$\Rightarrow$ Max no of minterms in $f_2 = 6$

Q4 1011
+ 0110
10001 → in ~~2's~~ 2's complement notation
taking 2's complement of the sol^n
⇒ 1111 is the required sol^n.
~~Verify~~ Taking 2's complements of the original numbers to get the original no.

0101
+ 1010
1111

Q5

2	$(45)_{10}$	
2	22	1
2	11	0
2	5	1
2	2	0
	1	

⇒ $(45)_{10} = 00101101$

$\therefore (45)_{16} = \overline{0100}\ \overline{0101}$
(4 5)

⇒ $(45)_{10} - (45)_{16}$

$= 00101101 - 1000101$
$= 00101101 + 0111011 - 10000000$
$= 1101000 - 10000000$
∵ No carry
⇒ Sol^n is -(2's complement of ans)
-0011000
⇒ 6 bit ans = -011000