Q.1.
a

If $(214.32)_{10}$ is given as input to the digital system then find what number will be given in coding for microprocessor and to perform actual computation. And get the output by inverse conversion.

→ Considering the input given to the digital system,

i) Decimal to Hexadecimal Conversion :-

a) Integer part

	Quotient	Remainder
214/16	13	6
13/16	0	13

D 6

b) Fractional part

$$\begin{array}{r} 0.32 \\ \times\ 16 \\ \hline 5.16 \end{array}$$

$\therefore (214.32)_{10} = (D6.51)_{16}$

2] Hexadecimal to Binary Conversion

$(D6.51)_{16}$

finding Binary equivalent of each hex digit

$(D6.51)_{16} = (1101\ 0110 . 0101\ 0001)_2$

$= (11010110 . 01010001)_2$

3] Binary to Hexadecimal Conversion

consider,

$(\underbrace{1101}\underbrace{0110} . \underbrace{0101}\underbrace{0001})_2 = (D6.51)_{16}$

4] Hexadecimal to Decimal Conversion

consider,

$(D6.51)_{16}$

$\therefore (D6.51)_{16} = D \times 16^1 + 6 \times 16^0 + 0 \times 16^0 + 5 \times 16^{-1} + 1 \times 16^{-2}$

$= 13 \times 16 + 6 \times 1 + 0 + 5 \times 16^{-1} + 1 \times 16^{-2}$

$= 13 \times 16 + 6 + 5 \times 16^{-1} \times 1 \times 16^{-2}$

$= (214.32)_{10}$

$\therefore (D6.51)_{16} \approx (214.32)_{10}$

Q.1. b) Perform Substraction on given Standard unsigned Hexadecimal number using 15's and 16's compliment of the Substrahend.

⟹ $(BC5)_{16} - (A2BD)_{16}$

i) USING 15's COMPLEMENT METHOD

Consider $(BC5)_{16} - (A2BD)_{16}$

$= (BC5)_{16} + (-A2BD)_{16}$

By 15's Complement method

	15	15	15	15
−	A	2	B	D
	10	2	11	13
	5	13	4	2

$\rightarrow (5D42)_{16}$

∴ Adding $(BC5)_{16}$ and $(5D42)_{16}$

```
   BC5
+ 5D42
 +1 +1
 5 24 16 7
-     16
 6  9  0 7
```

∴ $(BC5)_{16} + (5D42)_{16} = (6907)_{16}$

Taking the 15's Complement of Sum we will get the required answer

$$\begin{array}{cccc} 15 & 15 & 15 & 15 \\ -\,6 & 9 & 0 & 7 \\ \hline \boxed{9} & 6 & 15 & 8 \end{array}$$

$\rightarrow -(96F8)_{16}$

$$\boxed{\therefore\ (BC5)_{16} - (A2BD)_{16} = -(96F8)_{16}}$$

2) By using 16's Complement Method

Consider $(BC5)_{16} - (A2BD)_{16}$

$= (BC5)_{16} + (-A2BD)_{16}$

By 16's Complement method

$$\begin{array}{cccc} 15 & 15 & 15 & 15 \\ -\,A & 2 & B & D \\ \Downarrow & \Downarrow & \Downarrow & \Downarrow \\ 10 & 2 & 11 & 13 \\ \hline 5 & 13 & 4 & 2 \\ + & & & 1 \\ \hline 5 & 13 & 4 & 3 \end{array}$$

$\rightarrow (5D43)_{16}$

$\therefore$ Adding $(BC5)_{16}$ and $(5D43)_{16}$ we get

$$\begin{array}{cccc} & B & C & 5 \\ +\,5 & D & 4 & 3 \\ \hline 5 & 24 & 16 & 8 \\ - & 16 & 16 & \\ \hline (6 & 9 & 0 & 8)_{16} \end{array}$$

Taking 16's Complement of $(6908)_{16}$ we will get required answer

~~∴ 15 15 15 15~~
~~9 6 0 8~~

$$
\begin{array}{rcccc}
\therefore & 15 & 15 & 15 & 15 \\
- & 6 & 9 & 0 & 8 \\
\hline
 & 9 & 6 & 15 & 7 \\
+ & & & & 1 \\
\hline
 & 9 & 6 & 15 & 8
\end{array}
$$

$\rightarrow -(96F8)_{16}$

$$\boxed{\therefore \ (BC5)_{16} - (A2BD)_{16} = -(96F8)_{16}}$$

Q.2:

a) Minimize the following Standard POS expression which gives simplified Boolean expression using K-map.

$$y = \pi M(0,2,3,5,7)$$

⟹

Minimization of given POS equation using K-map is as follows:

A \ BC		$B+C$	$B+\bar{C}$	$\bar{B}+\bar{C}$	$\bar{B}+C$
A	0	0 [0]	1 [1]	0 [3]	0 [2]
$\bar{A}$	1	1 [4]	0 [5]	0 [7]	1 [6]

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

$\therefore$ By solving with the help of K-map we get

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

where y is the required simplified Boolean expression.

Q.2.
b) Discuss the advantages of tabular method over K-map method to obtain the minimal expression and simplify the following Boolean expression by tabular method.

$f(A,B,C,D) = \Sigma M(0,2,3,6,7,8,13)$

⟹

Advantages of tabular method over K-map method:

① Quine-McCluskey method is a tabular method that has an advantage over Karnaugh maps when a large number of inputs are present (more than five variables).
② With more inputs, pattern recognition in Karnaugh maps can be tedious or sometimes even impossible.
③ The Quine-McCluskey method does not require pattern recognition. It consists of two steps:
1) Finding all prime implicants of the function and
2) Selecting a minimal set of prime implicants of the function.
④ In addition, the K-map algorithm is not as straightforward to program the computer with. Therefore, tabulation method called Quine-McCluskey Method that are better suited for programming the computer, and thus can solve any function having any number of variables.

QUINE-MCCLUSKEY METHOD

$f(A,B,C,D) = \Sigma M(0,2,3,6,7,8,13)$

$$F(A,B,C,D) = \Sigma m(0,2,3,6,7,8,13)$$

0	0000
2	0010
3	0011
6	0110
7	0111
8	1000
13	1101

No of 1's	
0	0
1	2,8
2	6,3
3	7,13

Group of 1		Group of 2		Group of 4	
7	0111 ✓	7-3	0-11	7-3-6-2	0-1-
13	1101	7-6	011-		
3	0011 ✓	3-2	001-		
6	0110 ✓	6-2	0-10		
2	0010 ✓	2-0	00-0		
8	1000 ✓	8-0	-000		
0	0000 ✓				

P. I	ESSENTIAL PRIME IMPLECANTS						
	0	2	3	6	7	8	13
7-3-6-2		✓	✓	✓	✓		
0-2	✓	✓					
0-8	✓	✓				✓	
13							✓

∴ The minimal expression of given Boolean Expression is $(\bar{A}C) + (\bar{B}\bar{C}\bar{D}) + (AB\bar{C}D)$

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