Simplify using K-Map $F(A,B,C,D) = \Sigma m(0,2,3,6,7) + d(8,10,11,15)$

Note:-

* don't care (x) term can be used for grouping if possible with 1s
* don't care term alone need not be grouped

$AB \backslash CD$	$\bar{C}\bar{D}$ 00	$\bar{C}D$ 01	CD 11	$C\bar{D}$ 10
$\bar{A}\bar{B}$ 00	1_{0}	$_{1}$	1_{3}	1_{2}
$\bar{A}B$ 01	$_{4}$	$_{5}$	1_{7}	1_{6}
AB 11	$_{12}$	$_{13}$	X_{15}	$_{14}$
$A\bar{B}$ 10	X_{8}	$_{9}$	X_{11}	X_{10}

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

SURPRISE TEST - ANSWER KEY

Simplify the given Boolean expression

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

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

$$= ABC + A\bar{B}C + AB\bar{C} \quad [\because A+A = A]$$

$$= AB(C+\bar{C}) + A\bar{B}C \quad [\because C+\bar{C} = 1]$$

$$= AB + A\bar{B}C = A(B+\bar{B}C) \quad [\because] \; A+\bar{A}B = A+B$$

$$= A(B+C) = AB+AC \quad \boxed{Y = AB+AC}$$

(ii) $AB + A\bar{B}(\overline{\bar{A}\bar{B}})$

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

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

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

$$= AB + AA\bar{B} + \underbrace{AB\bar{B}}_{\to 0} \qquad [\because B\bar{B} = 0]$$

$$= AB + A\bar{B} \qquad [\because AA = A]$$

$$= A(B+\bar{B}) \qquad [\because B+\bar{B} = 1]$$

$$\boxed{Y = A}$$

Simplify using k-map for the given function $Y = \Sigma m(3,5,6,7)$

It is a 3 variable k-map as the number is only till 7

A \ BC	$\bar{B}\bar{C}$ 00	$\bar{B}C$ 01	BC 11	$B\bar{C}$ 10
$\bar{A}$ 0	0 (0)	0 (1)	1 (3)	0 (2)
A 1	0 (4)	1 (5)	1 (7)	1 (6)

$$Y = AC + AB + BC$$

3. Convert

(i) $(434.27)_{10}$ to Octal Number.

$$
\begin{array}{r|l}
8 & 434 \\
\hline
8 & 54 - 2 \\
\hline
 & 6 - 6
\end{array}
$$

$0.27 \times 8 = \boxed{2}.16$

$0.16 \times 8 = \boxed{2}.08$

$0.08 \times 8 = \boxed{0}.64$

$0.64 \times 8 = \boxed{5}.12$

$(434.27)_{10} \Rightarrow (662.2205)_8$

(ii) $(63AB.CD9)_{16}$ to octal Number

6	3	A	B	.	C	D	9
0110	0011	1010	1011	.	1100	1101	1001

0|110|0011|1010|1011 . 110|011|011|001

6 1 6 5 3 . 6 3 3 1

$(63AB.CD9)_{16} \Rightarrow (61653.6331)_8$

ii) 299.123_{10} to Binary Number

$$
\begin{array}{r|ll}
2 & 299 & \\
2 & 149 & -1 \\
2 & 74 & -1 \\
2 & 37 & -0 \\
2 & 18 & -1 \\
2 & 9 & -0 \\
2 & 4 & -1 \\
2 & 2 & -0 \\
 & 1 & -0
\end{array}
$$

$0.123 \times 2 = 0.246$

$0.246 \times 2 = 0.492$

$0.492 \times 2 = 0.984$

$0.984 \times 2 = 1.968$

$0.968 \times 2 = 1.936$

$(299.123)_{10} \Rightarrow (100101011.00011)_2$

4. Perform the following using 2's Complement Arthematic by using 10 bits

(i) 55 - 33 => 55 + (-33)

55 -> 0 0 0 0 1 1 0 1 1 1

-33 -> 1 0 0 0 1 0 0 0 0 1

So in 2s Complement

1s Comp -> 1 1 1 1 0 1 1 1 1 0

+ 1

---

1 1 1 1 0 1 1 1 1 1

Add 55 with 2s Complement 33

```
               1 1 1 1 1 1 1 1 1
55          -> 0 0 0 0 1 1 0 1 1 1

2's Comp 33 -> ~~1 0 0 0 1 0~~
               1 1 1 1 0 1 1 1 1 1
               -------------------
Carry <- 1 |   0 0 0 0 0 1 0 1 1 0
So neglect
```

Since 10^{th} bit is 0 the number is positive

10110 → 22

∴ 55 − 33 = 22

(ii) 27 − 28

```
27          -> 0 0 0 0 0 1 1 0 1 1

(-28)       -> 1 0 0 0 0 1 1 1 0 0
                             1   1
1s comp     -> 1 1 1 1 1 0 0 0 1 1
                                 1
               -------------------
-28, 2s Comp -> 1 1 1 1 1 0 0 1 0 0
```

27 →	0	0	0	0	0	1	1	0	1	1
(−28) →	1	1	1	1	1	0	0	1	0	0
←	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0 ← Is Comp
										1
	0	0	0	0	0	0	0	0	0	1

10th Bit is 1

So it is a −ve number

So the resultant number is −1

is $\boxed{27 - 28 = -1}$

5. Simplify using K. Map

(i) $Y = \Sigma m\,(0, 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 14)$

AB \ CD	$\bar{C}\bar{D}$ 00	$\bar{C}D$ 01	CD 11	$C\bar{D}$ 10
$\bar{A}\bar{B}$ 00	1 (0)	1 (1)	1 (3)	1 (2)
$\bar{A}B$ 01	1 (4)	(5)	(7)	1 (6)
AB 11	1 (12)	(13)	(15)	1 (14)
$A\bar{B}$ 10	1 (8)	1 (9)	1 (11)	1 (10)

$Y = \bar{B} + \bar{D}$

(ii) $Y = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D$

$\bar{A}BCD + AB\bar{C}\bar{D} + AB\bar{C}D + ABCD$

Decode the above Equation in Binary

$Y = 0000 + 0001 + 0011 + 0100 + 0101 + 0111$

$+ 1100 + 1101 + 1111$

$Y = \Sigma m(0, 1, 3, 4, 5, 7, 12, 13, 15)$

AB \ CD	$\bar{C}\bar{D}$ 00	$\bar{C}D$ 01	CD 11	$C\bar{D}$ 10
$\bar{A}\bar{B}$ 00	1_{0}	1_{1}	1_{3}	0_{2}
$\bar{A}B$ 01	1_{4}	1_{5}	1_{7}	0_{6}
AB 11	1_{12}	1_{13}	1_{15}	0_{14}
$A\bar{B}$ 10	0_{8}	0_{9}	0_{11}	0_{10}

$Y = \bar{A}\bar{C} + \bar{A}D + B\bar{C} + BD$