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M. Sc. Sem II
Paper - 7, Unit - 4.

PROBLEMS:-

Ex-1: Solve the B. expression $C = A+B$ for the following inputs :- $A=0, B=0$; $A=1, B=0$; $A=1, B=1$

Ans:- When $A=0$, $B=0$, $C = A+B = 0+0 = 0$

When $A=1$, $B=0$; $C = A+B = 1+0 = 1$

When $A=1$, $B=1$; $C = A+B = 1+1 = 1$

Ex-2: Show that:

(i) $AC + ABC = AC$

(ii) $A + AB = A$

(iii) $ABC + A\bar{B}C + AB\bar{C} = A(B+C)$.

Ans:- (i) $AC + ABC = AC(1+B)$ $\because 1+B = 1$ (if $B=0$, $B=1$)

(ii) $A + AB = A(1+B) = A$ where $1+B = 1$ proved

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

$= AC + AB\bar{C}$

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

$= A(C+B)$

$= A(B+C)$ proved

From $\because B+\bar{B} = 1$

$1+0 = 1$

$0+1 = 1$

NOTE:- Each of the identities can also be proved by substituting the two possible values (0 & 1) of the variables A, B, C. Using this process, following identities can also be proved.

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

as, $C = 1, \bar{C} = 0$

$1 + 1 0 = 1$

or $C = 0, \bar{C} = 1$

$B = 1$

$0 + 1 \cdot 1 = 1$

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Ex. 3. Show that

(i) $A + \bar{A} = 1$

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

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

Ans:- (i) putting $A = 0$; $A + \bar{A} = 0 + \bar{0} = 0 + 1 = 1$

putting $A = 1$; $A + \bar{A} = 1 + \bar{1} = 1 + 0 = 1$ proved.

$\therefore A + \bar{A} = 1$ proved.

(ii) This identity can be proved by finding the truth tables for the left and right hand representation (as below).

A	B	C	$\bar{A}$	$A+B$	$\bar{A}+C$	$(A+B)(\bar{A}+C)$	AC	$\bar{A}B$	$AC+\bar{A}B$
0	0	0	1	0	1	0	0	0	0
0	0	1	1	0	1	0	0	0	0
0	1	0	1	1	1	1	0	1	1
0	1	1	1	1	1	1	0	1	1
1	0	0	0	1	0	0	0	0	0
1	0	1	0	1	1	1	1	0	1
1	1	0	0	1	0	0	0	0	0
1	1	1	0	1	1	1	1	0	1

$\therefore (A+B)(\bar{A}+C) = AC + \bar{A}B$.

(iii) Show that, $AB + AC + B\bar{C} = AC + B\bar{C}$.

For this expression truth Table II is given below:-

A	B	C	$\bar{C}$	AB	AC	$B\bar{C}$	$AB+AC+B\bar{C}$	$AC+B\bar{C}$
0	0	0	1	0	0	0	0	0
0	0	1	0	0	0	0	0	0
0	1	0	1	0	0	1	1	1
0	1	1	0	0	0	0	0	0
1	0	0	1	0	0	0	0	0
1	0	1	0	0	1	0	1	1
1	1	0	1	1	0	1	1	1
1	1	1	0	1	1	0	1	1

Hence; $AB + AC + B\bar{C} = AC + B\bar{C}$ proved

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