Date
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Q.1> Convert 0.75_{10} to binary.

Soln:-

$0.75 \times 2 = 1.5 \quad 1$

$0.5 \times 2 = 1.0 \quad 1$

$0.0 \times 2 = 0.0$

$\therefore \boxed{0.75_{10} = 0.11_2}$

Q.2> Express -73.75 in 12-bit 2's complement form.

Soln:-

$2 | 73$
$2 | 36 - 1$
$2 | 18 - 0$
$2 | 9 - 0$
$2 | 4 - 1$
$2 | 2 - 0$
$1 - 0$

$73_{10} = 01001001_2$

$\therefore -73_{10} = \cancel{0100}\ 1011\ 0110$ (1's complement)

$\therefore -73_{10} = 1011\ 0111$ (2s complement)

$0.75_{10} \times 2 = 1.5 \quad 1$

$0.5 \times 2 = 1.0 \quad 1$

$0.0 \times 2 = 0 \quad 0$

$\therefore 0.75_{10} = 0110_2$ $\quad \therefore -0.75_{10} = 1011$ (2s complement)

~~$\therefore -0.75_{10} = 1001$ (1s complement)~~

~~= 81010~~

~~$\therefore 73.75_{10} = 0100\ 1001 . 0110$~~

$\therefore -73.75_{10} = 1011\ 0111 . 1011$ (2s complement)

Q.3> Apply De Morgans to the following :-

$$\overline{(\bar{A}+B+\bar{C}+D)(0+\bar{A}BC\bar{D})}$$

Solⁿ: Given, $\overline{(\bar{A}+B+\bar{C}+D)(0+\bar{A}BC\bar{D})}$

$= (\bar{A}+B+\bar{C}+D)(0+\bar{A}BC\bar{D})$

$= (\bar{A}B\bar{C}D) + 0'(\bar{A}BC\bar{D})$

$= A\bar{B}C\bar{D} + \bar{0}\cdot(A\bar{B}\bar{C}D)$

$= A\bar{B}C\bar{D} + 1\cdot(A\bar{B}\bar{C}D)$

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

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

Q.4> Prove that :- $(A\bar{B}+A\bar{C})(BC+B\bar{C})(ABC)=0$

Solⁿ: LHS $= (A\bar{B}+A\bar{C})(BC+B\bar{C})(ABC)$

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

$= (A\cdot 0\cdot C + A\cdot 0\cdot\bar{C} + AB\cdot 0 + AB\bar{C})(ABC)$

$= (0+0+0+AB\bar{C})(ABC)$

$= AB\bar{C}ABC$

$= (AA)(BB)(C\bar{C})$

$= A\cdot B\cdot 0$

$= 0$

$=$ RHS //

Q.5> Reduce $ABCBAC$

Solⁿ: $ABC\,BAC$

$= (AA)(BB)(CC)$

$= ABC$ //