

Number Systems

ONE-MARK QUESTIONS

2.1 01110

+ 11001

100111 But, carry is discarded in 2's complement addition.

So, final answer is 00111 which is option 'c'.

2.2 Dividing $(43)_d$ by 16 to obtain hexadecimal number, the quotient is 2 and remainder is 13 which B in hex notation. Further, BCD number use a nibble to represent each decimal digit in binary format. Therefore, 4 in BCD = 0100 and 3 in BCD = 0011. It means $(43)_d = (2B)_h$ and in BCD it is 0100 0011 which is option 'b'.

2.3 The range of number represented by 1's complement number is $= \pm(2^{n-1} - 1)$, where n = number of bits. In this example $n = 6$. Thus, correct answer is -31 to $+31$ which is option 'a'.

2.4 When sign bit of both numbers is same but it is opposite in the result, it is treated as overflow condition in two 2's complement number system. Here, it is represented as x and y are true but z isn't and vice versa. Hence, 'c' is the correct option.

2.5 Given Boolean expression is:

$$(X + Y)(X + \bar{Y}) + \overline{(\bar{X}\bar{Y})} + \bar{X}$$

$$= X + XY + X\bar{Y} + \overline{(\bar{X}\bar{Y})}. X$$

$$= X(1 + Y + \bar{Y}) + (X + Y)X = X + XY = X \text{ and it is option 'a'.$$

TWO MARK QUESTIONS

2.1 It is given that both numbers P and Q are in 2's complement form. This entails they are negative numbers. Further, it is expected to subtract Q from P. It is nothing but $-P - (-Q)$ operation which is nothing but $Q - P$. Therefore, we have to take Q as it is and P in 2's complement form. So, adding $P = 0001\ 0011$ in $Q = 1110\ 0110$.

$$\begin{array}{r} 1110\ 0110 \\ +\ 0001\ 0011 \\ \hline 1111\ 1001 \end{array}$$

Since no carry is generated in this operation, the answer is negative and in 2's complement form. Therefore, the correct answer is $= 0000\ 0111$ i.e. option 'b'.

2.2 Since $X = 1$ is given, the first term $[X + Z\{\bar{Y} + (\bar{Z} + X\bar{Y})\}] = 1$. For output to be equal to 1, $\bar{Z}(X + Y)$ in the second term must be 1. This is possible only when $Z = 0$ which is option 'd'.

2.3 $Y = \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D}$

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

$$\therefore Y = \bar{B}\bar{C}D + \bar{A}B\bar{C}\bar{D} + A\bar{B}C\bar{D} \text{ i.e. option 'd'.$$

2.4 The Boolean expression for the truth table given is

$$f = \bar{A}BC + AB\bar{C} = B(\bar{A}C + A\bar{C}) = B(A + C)(\bar{A} + \bar{C}) \text{ i.e. option 'a'.$$

2.5 The given Boolean expression is $AC + B\bar{C}$.

We can expand it using identity $x + \bar{x} = 1$.

$$\therefore AC(B + \bar{B}) + (A + \bar{A})B\bar{C} = ABC + A\bar{B}C + AB\bar{C} + \bar{A}B\bar{C} \text{ i.e. option 'd'.$$