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Number Systems and Binary Codes



Multiple Choice Questions

- Q.1** What are the values respectively, of R_1 and R_2 in the expression $(235)_{R_1} = (565)_{10} = (1065)_{R_2}$?
 (a) 8, 16 (b) 16, 8
 (c) 6, 16 (d) 12, 8
 [ESE-2004(EE)]
- Q.2** $(2)_3 + (3)_4 = (?)_5$
 (a) 4 (b) 11
 (c) None of these (d) Not possible
- Q.3** Convert the octal number 127543 into the hexadecimal form.
 (a) AF63 (b) AF53
 (c) AFD3 (d) BCD3
- Q.4** If $(11x1y)_8 = (12C9)_{16}$ then the values x and y are
 (a) 3 and 1 (b) 5 and 7
 (c) 7 and 5 (d) 1 and 5
 [ESE-2012]
- Q.5** If $(2.3)_{\text{base } 4} + (1.2)_{\text{base } 4} = (y)_{\text{base } 4}$; what is the value of y ?
 (a) 10.1 (b) 10.01
 (c) 10.2 (d) 1.02
 [ESE-2005]
- Q.6** How many 1's are present in the binary representation of $(4 \times 4096) + (9 \times 256) + (7 \times 16) + 5$?
 (a) 8 (b) 9
 (c) 10 (d) 11
 [ESE-2004]
- Q.7** Which of the following represents ' $E3_{16}$ '?
 (a) $(1CE)_{16} + (A2)_{16}$
 (b) $(1BC)_{16} - (DE)_{16}$
 (c) $(2BC)_{16} - (1DE)_{16}$
 (d) $(200)_{16} - (11D)_{16}$
 [ESE-2002]
- Q.8** Which of the following subtraction operations result in F_{16} ?
 1. $(BA)_{16} - (AB)_{16}$
 2. $(BC)_{16} - (CB)_{16}$
 3. $(CB)_{16} - (BC)_{16}$
 Select the correct answer using the code given below:
 (a) Only 1 and 2 (b) Only 1 and 3
 (c) Only 2 and 3 (d) 1, 2 and 3
 [ESE-2006]
- Q.9** The binary equivalent of hexadecimal number 4F2D.
 (a) 0101 1111 0010 1100
 (b) 0100 1111 0010 1100
 (c) 0100 1110 0010 1101
 (d) 0100 1111 0010 1101
 [ESE-2002]
- Q.10** $(FE35)_{16} \text{ XOR } (CB15)_{16}$ is equal to
 (a) $(3320)_{16}$ (b) $(FF35)_{16}$
 (c) $(FF50)_{16}$ (d) $(3520)_{16}$
 [ESE-2000]
- Q.11** F's complement of $(2BFD)_{\text{hex}}$ is
 (a) E304 (b) D403
 (c) D402 (d) C403
 [ESE-2001]
- Q.12** The 2's complement representation of -17 is
 (a) 101110 (b) 101111
 (c) 111110 (d) 110001
 [GATE-2001]

Q.13 The 2's complement representation $(-539)_{10}$ in hexadecimal is
 (a) ABE (b) DBC
 (c) DE5 (d) 9E7 [GATE-2001]

Q.14 In signed magnitude representation, the binary equivalent of 22.5625 is (the bit before comma represents the sign)
 (a) 0, 10110.1011 (b) 0, 10110.1001
 (c) 1, 10101.1001 (d) 1, 10110.1001 [ESE-2002]

Q.15 11001, 1001 and 111001 correspond to the 2's complement representation of which one of the following sets of number?
 (a) 25, 9 and 57 respectively
 (b) -6, -6 and -6 respectively
 (c) -7, -7 and -7 respectively
 (d) -25, -9 and -57 respectively [GATE-2004]

Q.16 The range of signed decimal numbers that can be represented by 6-bit 1's complement number is
 (a) -31 to +31 (b) -63 to +63
 (c) -64 to +63 (d) -32 to +31 [GATE-2004]

Q.17 Which of the following statement is **Incorrect** for the range of n bits binary numbers
 (a) Range of unsigned numbers is 0 to $(2^n - 1)$
 (b) Range of signed magnitude number is $-(2^{n-1} - 1)$ to $(2^{n-1} - 1)$
 (c) Range of signed 1's complement numbers is $(-2^{n-1} + 1)$ to $(2^{n-1} - 1)$
 (d) Range of signed 2's complement numbers is (-2^{n-1}) to $(2^{n-1} - 1)$

Q.18 A number in 4-bit 2's complement representation is $X_3 X_2 X_1 X_0$. This number when stored using 8-bits will be
 (a) 0000 $X_3 X_2 X_1 X_0$
 (b) 1111 $X_3 X_2 X_1 X_0$
 (c) $X_3 X_3 X_3 X_3 X_3 X_2 X_1 X_0$
 (d) $1 X_3 X_3 X_3 X_3 X_2 X_1 X_0$ [GATE-1999]

Q.19 Two 4-bit 2's complement numbers 1011 and 0110 are added. The result expressed in 4-bit 2's complement notation is

(a) 0001
 (b) 0010
 (c) 1101
 (d) cannot be expressed in 4-bit 2's complement [GATE-IN:2003]

Q.20 Which of the following is an invalid state in 8-4-2-1 Binary Coded Decimal counter
 (a) 1 0 0 0 (b) 1 0 0 1
 (c) 0 0 1 1 (d) 1 1 0 0 [GATE-2014]

Q.21 The BCD code for a decimal number $(874)_{10}$ is
 (a) (100001110100)_{BCD}
 (b) (010001111000)_{BCD}
 (c) (100001000111)_{BCD}
 (d) (011110000100)_{BCD} [ESE-2012]

Q.22 A decimal number 6 is written in excess-3 code as
 (a) 0110 (b) 0011
 (c) 1101 (d) 1001

Q.23 Which of the following weighted code will give 9's complement by changing (complementing) each individual bit?
 (a) Excess-3 (b) 5421
 (c) 2421 (d) Both (a) and (c)

Q.24 What is the Gray code word for the binary 101011?
 (a) 101011 (b) 110101
 (c) 011111 (d) 111110 [ESE-2006]

Numerical Data Type Questions

Q.25 The minimum decimal equivalent of the number 11C.0 is _____. [ESE-2000]

Q.26 The decimal equivalent of hexadecimal number of 2A0F is _____. [ESE-2002(EE)]

Q.27 The decimal equivalent of binary number 10110.11 is _____. [ESE-2007]

Q.28 In a particular number system having base B . $(\sqrt{41})_B = 5_{10}$. The value of 'B' is _____. [ESE-2005]

Q.29 $(-64)_{10} + (80)_{16} = (?)_{10}$ [ESE-2007]

Q.30 Given $(135)_{\text{base } x} + (144)_{\text{base } x} = (323)_{\text{base } x}$. The value of base x is _____. [ESE-2005]

Q.31 2's complement representation of a 16-bit number (one sign bit and 15 magnitude bits) is FFFF. Its magnitude in decimal representation is _____. [GATE-1993]

Q.32 A number is expressed in binary two's complement as 10011. Its decimal equivalent value is _____. [ESE-2002]

Q.33 $(X)_8$ is expressed in gray code as $(11110)_2$. The value of X is _____. [ESE-2004]

Q.34 Consider a system which has two eight bit inputs $D_1 = 01010101$, $D_2 = 00000000$, the system produces eight bit output that is bitwise XOR of the inputs. The eight bit output of the system is input to the Gray Code Converter, the decimal equivalent of the output from Gray Code Converter is _____. [ESE-2004]

Q.35 The 16-bit 2's complement representation of an integer is 1111 1111 1111 0101; its decimal representation is _____. [GATE-2016]

Try Yourself

T1. Find the value of x .
 $(135)_x + (144)_8 = (214)_{x+2}$ [Ans: $x = 7$]

T2. Consider the addition of numbers with different bases

$(X)_7 + (Y)_8 + (W)_{10} + (Z)_5 = (K)_9$
 If $X = 36$, $Y = 67$, $W = 98$ and $K = 241$ then find the value of Z . [Ans: 34]

T3. For radix r , decimal value of $(110)_r$ is $4r$ then r is _____ and decimal value of $(010)_r$ is ____.

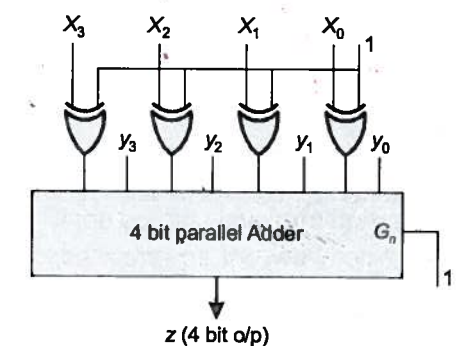
T4. If $(10)_x \times (10)_x = (100)_x$; $(100)_x \times (100)_x = (10000)_x$ then x can take value:
 (a) 2 (b) 5
 (c) 10 (d) All of these

T5. Consider the equation $(123)_5 = (x8)_y$, with x and y as unknown. The number of possible solutions is _____. [GATE-2014, Ans: (3)]

T6. If 73_x (in base- x number system) is equal to 54_y (in base- y number system), the possible values of x and y are
 (a) 8, 16 (b) 10, 12
 (c) 9, 13 (d) 8, 11 [GATE-2004, Ans: (d)]

T7. Consider the following multiplication:
 $(10w1z)_2 \times (15)_{10} = (y01011001)_2$
 Which one of the following gives appropriate values of w , y and z ?
 (a) $w = 0$, $y = 0$, $z = 1$
 (b) $w = 0$, $y = 1$, $z = 1$
 (c) $w = 1$, $y = 1$, $z = 1$
 (d) $w = 1$, $y = 1$, $z = 0$ [ESE-2004(EE)]

T8. Identify the correct statement with respect to following circuit? Numbers are represented in signed magnitude format.



- (a) It outputs $x + y$ (b) It outputs $y - x$
 (c) It outputs $x + 1$ (d) It outputs $y + 1$

T9. An equivalent 2's complement representation of the 2's complement number 1101 is

- (a) 110100 (b) 001101
 (c) 110111 (d) 111101

[GATE-1998, Ans: (d)]

T10. Two's complement format of +127 is

- (a) 01111111 (b) 10000000
 (c) 01101101 (d) 10010010

[Ans: (a)]

T11. The number of 1's in 8-bits representation of -127 in 2's complement form is m and that in 1's complement form is n . What is the value of m / n ?

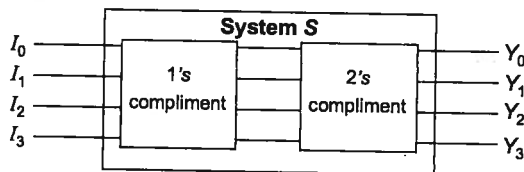
[ESE-2005]

T12. The range of integers that can be represented by an n -bit 2's complement number system is _____.

- (a) -2^{n-1} to $(2^{n-1} - 1)$
 (b) $-(2^{n-1} - 1)$ to $(2^{n-1} - 1)$
 (c) $-(2^{n-1} + 1)$ to 2^{n-1}
 (d) $-(2^{n-1} + 1)$ to $(2^{n-1} - 1)$

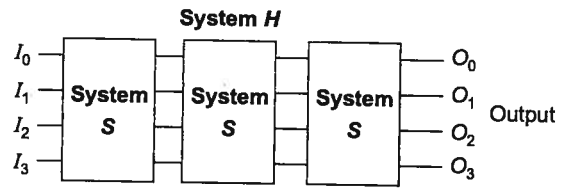
[ISRO-2009, Ans: (a)]

T13. Consider a **System S** as shown in the figure below



System S performs 1's complement of the input and then 2's complement to produce output.

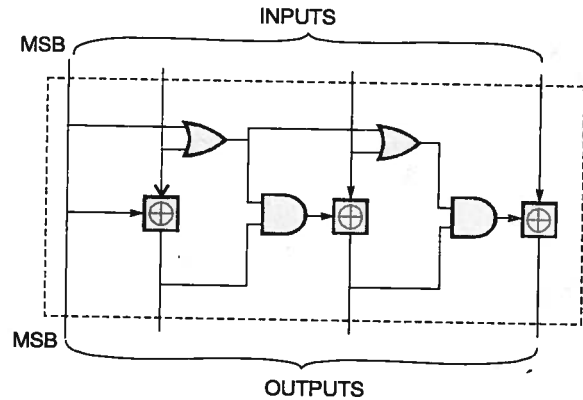
A new **System H** is designed in which 3 **System S** are cascaded.



If the applied input $(I_3 I_2 I_1 I_0)$ is 1010, then what is the output $(O_3 O_2 O_1 O_0)$.

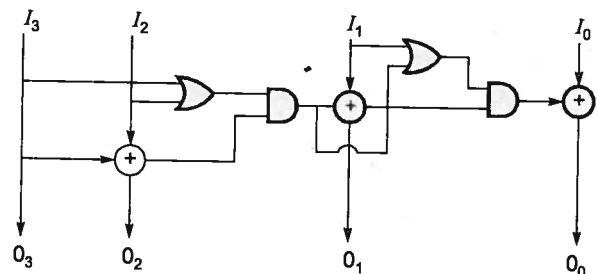
[Ans: 1101]

T14. The circuit shown in the figure converts



- (a) BCD to binary code
 (b) Binary to excess - 3 code
 (c) Excess - 3 to Gray code
 (d) Gray to Binary code

T15. The circuit shown below converts. (here \oplus is XOR)



- (a) Binary to gray
 (b) Binary to Excess 3
 (c) Excess 3 to gray
 (d) Gray to binary

T16. Write gray code for binary numbers from 0000 to 1111.