GATEFREAKS

GATE/NET/PSU

COMPUTER SCIENCE

Digital Electronics

Sachin Michu
Alumnus IIT DELHI

Neha Michu
Alumna IIT DELHI

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1. An example of a binary number which is equal to its 2's complement is:
(A) 1100
(B) 1001
(C) 1000
(D) 1111
UGCNET2004-II(dec.)

2. Suppose x and y are two Integer Variables having values 0x5AB6 and 0x61CD respectively. The result (in hex) of applying bitwise operator AND to x and y will be:
(A) 0x5089
(B) 0x4084
(C) 0x78A4
(D) 0x3AD1
UGCNET2004-II(dec.)

3. Which of the following is divisible by 4?
(A) 100101100
(B) 1110001110001
(C) 11110011
(D) 10101010101010
UGCNET2005-II(june)

4. $(101011)_2 = (53)_b$, then b is equal to:
(A) 4
(B) 8
(C) 10
(D) 16
UGCNET2005-II(dec.)

5. Which of the following binary number is the same as its 2s complement:
(A) 1010
(B) 0101
(C) 1000
(D) 1001
UGCNET2005-II(dec.)

6. The number of 1's present in the binary representation of $(3 \times 512 + 7 \times 64 + 5 \times 8 + 3)_{10}$ is:
(A) 8
(B) 9
(C) 10
(D) 11
UGCNET2006-II(june)

7. In a weighted code with weight 6, 4, 2 ,-3 the decimal 5 is represented by:
(A) 0101
(B) 0111
(C) 1011
(D) 1000
UGCNET2006-II(june)

8. The hexadecimal equivalent of $(10111)_2 \times (1110)_2$ is:
(A) 150
(B) 241
(C) 142
(D) 101011110
UGCNET2006-II(dec.)

9. An example of a self complementing code is:
(A) 8421 code
(B) Gray code
(C) Excess-3 code
(D) 7421 code
UGCNET2006-II(dec.)

10. 2's complement of -100 is:
(A) 00011100
(B) 10011101
(C) 10011100
(D) 11100100
UGCNET2007-II(jun.)

11. How many 1's are present in the binary representation of $15 \times 256 + 5 \times 16 + 3$:
(A) 8
(B) 9
(C) 10
(D) 11
UGCNET2007-II(jun.)

12. The octal equivalent of the hexadecimal number FF is:
(A) 100
(B) 150
(C) 377
(D) 737
UGCNET2008-II(jun.)

13. The octal equivalent of hexadecimal $(A.B)_{16}$ is :
(A) 47.21
(B) 12.74
(C) 12.71
(D) 17.21
UGCNET2009-II(jun.)

14. The answer of the operation $(10111)_2 * (1110)_2$ in hex equivalence is
(A) 150
(B) 241
(C) 142
(D) 101011110
UGCNET2009-II(dec.)

15. How many 1's are present in the binary representation of $3 \times 512 + 7 \times 64 + 5 \times 8 + 3$
(A) 8
(B) 9
(C) 10
(D) 11
UGCNET2009-II(dec.)

16. What is decimal equivalent of BCD 11011.1100 ?
(A) 22.0
(B) 22.2
(C) 20.2
(D) 21.2
UGCNET2010-II(Jun)

17. The decimal number equivalent of $(4057.06)_8$ is
(A) 2095.75

(B) 2095.075
(C) 2095.937
(D) 2095.0937

UGCNET2010-II(dec.)

18. 12-bit 2's complement of -73.75 is
(A) 01001001.1100
(B) 11001001.1100
(C) 10110110.0100
(D) 10110110.1100

UGCNET2010-II(dec.)

19. If an integer needs two bytes of storage, then the maximum value of unsigned integer is
(A) 2^{16} - 1
(B) 2^{15} - 1
(C) 2^{16}
(D) 2^{15}

UGCNET2011-II(Dec.)

20. Negative numbers cannot be represented in
(A) signed magnitude form
(B) 1s complement form
(C) 2s complement form
(D) none of the above

UGCNET2011-II(Dec.)

21. If an integer needs two bytes of storage, then the maximum value of a signed integer is
$(A)2^{16} - 1$
$(B)2^{15} - 1$
$(C)2^{16}$
$(D)2^{15}$

UGCNET2012-II(JUN)

22. Which one of the following is decimal value of a signed binary number 1101010, if it is in 2s complement form ?
(A) - 42
(B) - 22
(C) - 21
(D) - 106

UGCNET2013-II(JUN)

23. Given that $(292)_{10} = (1204)_x$ in some number system x. The base x of that number system is
(A) 2
(B) 8
(C) 10
(D) None of the above

UGCNET2013-II(Dec.)

24. Which of the following statement(s) is (are) not correct ?
i. The 2s complement of 0 is 0.
ii. In 2s complement, the left most bit cannot be used to express a quantity.
iii. For an n-bit word (2s complement) which includes the sign bit, there are 2^{n-1} positive integers, 2^{n+1} negative integers and one 0 for a total of 2^n unique states.
iv. In 2s complement the significant information is contained in the 1s of positive numbers and 0s of the negative numbers.
(A) *i* & *iv*
(B) *i* & *ii*
(C) *iii*
(D) *iv*

UGCNET2014-II(Jun)

25. The Excess-3 decimal code is a self-complementing code because
(A) The binary sum of a code and its 9s complement is equal to 9.
(B) It is a weighted code.
(C) Complement can be generated by inverting each bit pattern.
(D) The binary sum of a code and its 10s complement is equal to 9.

UGCNET2014-II(DEC)

26. The range of representable normalized numbers in the floating point binary fractional representation in a 32-bit word with 1-bit sign, 8-bit excess 128 biased exponent and 23-bit mantissa is
(A) 2^{-128} to $(1 - 2^{-23}) \times 2^{127}$
(B) $(1 - 2^{-23}) \times 2^{-127}$ to 2^{128}
(C) $(1 - 2^{-23}) \times 2^{-127}$ to 2^{23}
(D) 2^{-129} to $(1 - 2^{-23}) \times 2^{127}$

UGCNET2014-II(DEC)

27. The equivalent hexadecimal notation for octal number 2550276 is :
(A)FADED (B)AEOBE (C)ADOBE (D)ACABE

UGCNET2015-III(jun)

28. The octal number 326.4 is equivalent to
(A) $(214.2)_{10}$ and $(D6.8)_{16}$
(B) $(212.5)_{10}$ and $(D6.8)_{16}$
(C) $(214.5)_{10}$ and $(D6.8)_{16}$
(D) $(214.5)_{10}$ and $(D6.4)_{16}$

UGCNET2016-II(aug.)

29. Which of the following is the most efficient to perform arithmetic operations on the numbers ?
(A) Sign-magnitude

(B) $1's$ complement
(C) $2's$ complement
(D) $9's$ complement

UGCNET2016-II(aug.)

30. The IEEE-754 double-precision format to represent floating point numbers, has a length of .... bits.
(A) 16
(B) 32
(C) 48
(D) 64

UGCNET2016-II(jun.)

31. Convert the octal number 0.4051 into its equivalent decimal number.
(A) 0.5100098
(B) 0.2096
(C) 0.52
(D) 0.4192

UGCNET2016-II(dec.)

32. The hexadecimal equivalent of the octal number 2357 is :
(A) 2EE
(B) 2FF
(C) 4EF
(D) 4FE

UGCNET2016-II(dec.)

33. If X is a binary number which is power of 2, then the value of
X & (X - 1) is :
(A) 11......11
(B) 00....00
(C) 100.....0
(D) 000.....1

UGCNET2016-II(dec.)

34. Let $m = (313)_4$ and $n = (322)_4$. Find the base 4 expansion of $m + n$.
(A) $(635)_4$ (B) $(32312)_4$ (C) $(21323)_4$ (D) $(1301)_4$

UGCNET2017-II(Nov.)

35. The Octal equivalent of the binary number 1011101011 is :
(A) 7353
(B) 1353
(C) 5651
(D) 5657

UGCNET2017-II(Nov.)

36. When two numbers are added in excess-3 code and the sum is less than 9, then in order to get the correct answer it is necessary to
(A) subtract 0011 from the sum
(B) add 0011 to the sum
(C) subtract 0110 from the sum
(D) add 0110 to the sum

ISRO 2007

37. The number of digit 1 present in the binary representation of $3 \times 512 + 7 \times 64 + 5 \times 8 + 3$ is
(A) 8
(B) 9
(C) 10
(D) 12

ISRO 2007

38. 0.75 decimal system is equivalent to ..... in octal system
(A) 0.60
(B) 0.52
(C) 0.54
(D) 0.50

ISRO 2007

39. Consider a computer system that stores a floating-point numbers with 16-bit mantissa and an 8-bit exponent, each in twos complement. The smallest and largest positive values which can be stored are
(A) 1×10^{-128} and $2^{15} \times 10^{128}$
(B) 1×10^{-256} and $2^{15} \times 10^{255}$
(C) 1×10^{-128} and $2^{15} \times 10^{127}$
(D) 1×10^{-128} and $2^{15} - 1 \times 10^{127}$

ISRO 2007

40. The Hexadecimal equivalent of 01111100110111100011 is
(A) CD73E
(B) ABD3F
(C) 7CDE3
(D) FA4CD

ISRO 2007

41. If $N^2 = (7601)_8$ where N is a positive integer, then the value of N is
(A) $(241)_5$
(B) $(143)_6$
(C) $(165)_7$
(D) $(39)_{16}$

ISRO 2008

42. If $(12x)_3 = (123)_x$, then the value of x is
(A) 3
(B) 3 or 4
(C) 2
(D) None of these

ISRO 2008

43. A computer uses 8 digit mantissa and 2 digit exponent. If a=0.052 and b=28E+11 then b+a-b will
(A) result in an overflow error
(B) result in an underflow error
(C) be 0
(D) be 5.28E+1
ISRO 2008

44. Which of the following is termed as minimum error code
(A) Binary code
(B) Gray code
(C) Excess 3 code
(D) Octal code
ISRO 2008

45. The range of integers that can be represented by an n bit 2s 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} to 2^{n-1}
(D) $-(2^{n-1}+1)$ to $(2^{n-1}-1)$
ISRO 2009

46. The two numbers given below are multiplied using the Booth's algorithm
Multiplicand: 0101 1010 1110 1110
Multiplier: 0111 0111 1011 1101
How many additions/subtractions are required for the multiplication of the above two numbers?
(A) 6
(B) 8
(C) 10
(D) 12
ISRO 2009

47. The addition of 4-bit, two's complement, binary numbers 1101 and 0100 results in
(A) 0001 and an overflow
(B) 1001 and no overflow
(C) 0001 and no overflow
(D) 1001 and an overflow
ISRO 2009

48. What is the decimal value of the floating-point number C1D00000 (hexadecimal notation)? (Assume 32-bit, single precision floating point IEEE representation)
(A) 28
(B) -15
(C) -26
(D) -28
ISRO 2011

49. Which logic gate is used to detect overflow in 2's compliment arithmetic?
(A) OR gate
(B) AND gate
(C) NAND gate
(D) XOR gate
ISRO 2013

50. When two BCD numbers $0x14$ and $0x08$ are added what is the binary representation of the resultant number?
(A) $0x22$
(B) $0x1c$
(C) $0x16$
(D) Results in overflow.
ISRO 2013

51. The number 1102 in base 3 is equivalent to 123 in which base system?
(A) 4
(B) 5
(C) 6
(D) 8
ISRO 2013

52. The binary equivalent of the decimal number 42.75 is
(A) 101010.110
(B) 100110.101
(C) 101010.101
(D) 100110.110
ISRO 2013

53. In the standard IEEE 754 single precision floating point representation, there is 1 bit for sign, 23 bits for fraction and 8 bits for exponent. What is the precision in terms of the number of decimal digits?
(A) 5
(B) 6
(C) 7
(D) 8
ISRO 2014

54. Which of the given number has its IEEE-754 32-bit floating point representation as (0 10000000 110 0000 0000 0000 0000 0000)
(A) 2.5
(B) 3.0
(C) 3.5
(D) 4.5
ISRO 2015

55. The range of integers that can be represented by an n bit 2s 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} to 2^{n-1}
(D) $-(2^{n-1}+1)$ to $(2^{n-1}-1)$

ISRO 2015

56. The number of 1's in the binary representation of (3*4096 + 15*256 + 5*16 + 3) are:
(A) 8
(B) 9
(C) 10
(D) 12

ISRO 2015

57. The decimal number has 64 digits. The number of bits needed for its equivalent binary representation is?
(A) 200
(B) 213
(C) 246
(D) 277

ISRO 2015

58. If $12A7C_{16} = X_8$ then the value of X is
(A) 224174
(B) 425174
(C) 6173
(D) 225174

ISRO 2016

59. The Excess-3 code is also called
(A) Cyclic Redundancy Code
(B) Weighted Code
(C) Self-Complementing Code
(D) Algebraic Code

ISRO 2016

60. Which of the following binary number is the same as its 2's complement ?
(A) 1010
(B) 0101
(C) 1000
(D) 1001

ISRO 2016

61. $(1217)_8$ is equivalent to
(A) $(1217)_{16}$
(B) $(028F)_{16}$
(C) $(2297)_{10}$
(D) $(0B17)_{16}$

ISRO 2017

62. The number of 1's in the binary representation of (3*4096 + 15*256 + 5*16 + 3) are:
(A)8
(B)9
(C)10
(D)12

GATE 1995,2 MARKS

63. Booths algorithm for integer multiplication gives worst performance when the multiplier pattern is
(A)101010 1010
(B)100000..... 0001
(C)111111..... 1111
(D)011111..... 1110

GATE 1996,2 MARKS

64. Given $\sqrt{(224)_r} = (13)_r$.
The value of the radix r is:
(A) 10
(B) 8
(C) 5
(D) 6

GATE 1997,2 MARKS

65. The octal representation of an integer is $(342)_8$. If this were to be treated as an eight-bit integer is an 8085 based computer, its decimal equivalent is
(A) 226
(B) -98
(C) 76
(D) -30

GATE 1998,1 MARK

66. Suppose the domain set of an attribute consists of signed four digit numbers. What is the percentage of reduction in storage space of this attribute if it is stored as an integer rather than in character form?
(A) 80%
(B) 20%
(C) 60%
(d) 40%

GATE 1998,2 MARKS

67. Booths coding in 8 bits for the decimal number -57 is
(A) 0 - 100 + 1000
(B) 0 - 100 + 100 -1
(C) 0 - 1 + 100 - 10 + 1
(D) 0 0 - 10 + 100 - 1

GATE 1999,1 MARK

68. Zero has two representations in
(A) Sign magnitude
(B) 1's complement
(C) 2's complement
(D) None of the above

GATE 1999,2 MARKS

69. The number 43 in 2s complement representation is
(A) 01010101 (B) 11010101 (C) 00101011 (D) 10101011
GATE 2000,1 MARK

70. Consider the values of A = 2.0 x 10^{30}, B = -2.0 x 10^{30}, C = 1.0, and the sequence
X:= A + B   Y:= A + C
X:= X + C   Y:= Y + B
executed on a computer where floating point numbers are represented with 32 bits. The values for X and Y will be
(A) X = 1.0, Y = 1.0
(B) X = 1.0, Y = 0.0
(C) X = 0.0, Y = 1.0
(D) X = 0.0, Y = 0.0
GATE 2000,2 MARKS

71. The 2's complement representation of $(-539)_{10}$ is hexadecimal is
(A) ABE (B) DBC (C) DE5 (D) 9E7
GATE 2001,2 MARKS

72. The decimal value 0.25
(A) is equivalent to the binary value 0.1
(B) is equivalent to the binary value 0.01
(C) is equivalent to the binary value 0.00111...
(D) cannot be represented precisely in binary
GATE 2002,1 MARK

73. The 2's complement representation of the decimal value -15 is
(A) 1111
(B) 11111
(C) 111111
(D) 10001
GATE 2002,1 MARK

74. In 2's complement addition, overflow
(A) is flagged whenever there is carry from sign bit addition
(B) cannot occur when a positive value is added to a negative value
(C) is flagged when the carries from sign bit and previous bit match
(D) None of the above
GATE 2002,1 MARK

75. 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 2004,1 MARK

76. What is the result of evaluating the following two expressions using three-digit floating point arithmetic with rounding?
(113.+ -111.)+7.51
113.+(-111.+7.51)
(A) 9.51 and 10.0 respectively
(B) 10.0 and 9.51 respectively
(C) 9.51 and 9.51 respectively
(D) 10.0 and 10.0 respectively
GATE 2004,1 MARK

77. Let A = 1111 1010 and B = 0000 1010 be two 8-bit 2's complement numbers. Their product in 2's complement is
(A) 1100 0100
(B) 1001 1100
(C) 1010 0101
(D) 1101 0101

GATE 2004,2 MARKS

78. 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} to 2^{n-1}
(D) $-(2^{n-1})$ to $(2^{n-1}-1)$
GATE 2005,1 MARK

79. The hexadecimal representation of $(657)_8$ is:
(A) 1AF
(B) D78
(C) D71
(D) 32F
GATE 2005,1 MARK

80. Consider the following floating-point format.

15	14........8	7.......0
sign	*Exponent*	*Mantissa*

Mantissa is a pure fraction in sign-magnitude form.

(A) The decimal number 0.239×2^{13} has the following hexadecimal representation (without normalization and rounding off):
(A) 0D 24
(B) 0D 4D
(C) 4D 0D
(D) 4D 3D
GATE 2005,2 MARK
(B) The normalized representation for the above format is specified as follows.
The mantissa has an implicit 1 preceding the binary (radix) point. Assume that only $0's$ are padded in while shifting a field.
The normalized representation of the above number $0.239 \times 2^{13}$is:

(A) 0A 20
(B) 11 34
(C) 49 D0
(D) 4A E8 GATE 2005,2 MARK

81. In the IEEE floating point representation the hexadecimal value 0x00000000 corresponds to
(A) The normalized value 2^{-127}
(B) The normalized value 2^{-126}
(C) The normalized value +0
(D) The special value +0
GATE 2008,1 MARK

82. Let r denote number system radix. The only value(s) of r that satisfy the equation $\sqrt{121} = 11$, is / are
(A) decimal 10
(B) decimal 11
(C) decimal 10 and 11
(D) any value >2
GATE 2008,1 MARK

83. $(1217)_8$ is equivalent to
(A) $(1217)_{16}$
(B) $(028F)_{16}$
(C) $(2297)_{10}$
(D) $(0B17)_{16}$
GATE 2009,1 MARK

84. P is a 16-bit signed integer. The $2's$ complement representation of P is $(F87B)_{16}$. The 2's complement representation of 8*P is
(A) $(C3D8)_{16}$
(B) $(187B)_{16}$
(C) $(F878)_{16}$
(D) $(987B)_{16}$
GATE 2010,1 MARK

85. The decimal value 0.5 in IEEE single precision floating point representation has
(A)fraction bits of 000...000 and exponent value of 0
(B)fraction bits of 000...000 and exponent value of -1
(C)fraction bits of 100...000 and exponent value of 0
(D)no exact representation
GATE 2012,1 MARK

86. The base (or radix) of the number system such that the following equation holds is............

$$\frac{312}{20}=13.1$$

GATE 2014-I,1 MARK

87. Consider the equation $(123)_5 = (x8)_y$ with x and y as unknown. The number of possible solutions is -------
GATE 2014-II,1 MARK

88. The value of a float type variable is represented using the single-precision 32-bit floating point format of IEEE-754 standard that uses 1 bit for sign, 8 bits for biased exponent and 23 bits for mantissa. A float type variable X is assigned the decimal value of -14.25. The representation of X in hexadecimal notation is
(A) C1640000H
(B) 416C0000H
(C) 41640000H
(D) C16C0000H
GATE 2014-II,2 MARKS

89. Consider the equation $(43)_x= (y3)_8 =$ where x and y are unknown. The number of possible solution is -----
GATE 2015-III,2 MARKS

90. The 16-bit 2's complement representation of an integer is 1111 1111 1111 0101; its decimal representation is ______.
GATE 2016-I,1 MARKS

91. Let X be the number of distinct 16-bit integers in 2's complement representation. Let Y be the number of distinct 16-bit integers in sign magnitude representation.
Then X − Y is______________.
GATE 2016-II,1 MARKS

92. The n-bit fixed-point representation of an unsigned real number X uses f bits for the fraction part. Let $i = n - f$, the range of decimal values for X in this representation is
(A) 2^{-f} to 2^i
(B) 2^{-f} to $(2^i - 2^{-f})$
(C) 0 to 2^i
(D) 0 to $(2^i - 2^{-f})$
GATE 2017-I,1 MARK

93. The representation of the value of a 16-bit unsigned integer X in hexadecimal number system is BCA9. The representation of the value of X in octal number system is
(A)571244
(B)736251
(C)571247
(D)136251
GATE 2017-II,1 MARK

94. Given the following binary number in 32-bit (single precision) $IEEE-754$ format :

00111110011011010000000000000000

The decimal value closest to this floating-point number is :
(A)$1.45 * 10^1$
(B)$1.45 * 10^{-1}$
(C)$2.27 * 10^{-1}$
(D)$2.27 * 10^1$

GATE 2017-II,1 MARK

95. Consider the unsigned 8-bit fixed point binary number representation, below,

$$b_7 \ b_6 \ b_5 \ b_3 \ b_3 \ \cdot b_2 \ b_1 \ b_0$$

where the position of the primary point is between b_3 and b_2 . Assume b_7 is the most significant bit. Some of the decimal numbers listed below cannot be represented exactly in the above representation:
i. 31.500
ii. 0.875
iii. 12.100
iv. 3.001
Which one of the following statements is true?
(A) None of i, ii, iii, iv can be exactly represented
(B) Only ii cannot be exactly represented
(C) Only iii and iv cannot be exactly represented
(D) Only i and ii cannot be exactly represented

GATE 2018,2 MARKS

Solutions

1. Ans:c
Although binary number corresponding to positive integers have same representation in 2's complement representation . But here we don't need to represent number in 2's complement form but we have to find 2's complement of given number.
A: 1100 $\rightarrow$ 0100
B: 1001 $\rightarrow$ 0111 C: 1000 $\rightarrow$ 1000
D: 1111 $\rightarrow$ 0001.

2. Ans:b
$x = (5AB6)_{16} = (0101\ 1010\ 1011\ 0110)_2$
$y = (61CD)_{16} = (0110\ 0001\ 1100\ 1101)_2$
Bitwise ANDing between x and y is
0101 1010 1011 0110
<u>0110 0001 1100 1101</u>
0100 0000 1000 0100
=$(4084)_{16}$.

3. Ans:a
If LSB bit is 1 then number is odd and if LSB bit is 0 then number is even. If number is divisible by 4 then it should be even . So option b and c are ruled out.
A:$(100101100)_2 = (512 + 32 + 8 + 4) = 556$, which is divisible by 4.

4. Ans:b
$(101\ 011)_2 = (53)_8$, So b=8
Alternatively:
$(101\ 011)_2 = (53)_b$
$1 * 2^5 + 1 * 2^3 + 1 * 2^1 + 1 * 2^0 = 5 * b^1 + 3 * b^0$
$43 = 5b + 3$
$b = 8$.

5. Ans:c
Although binary number corresponding to positive integers have same representation in 2's complement representation . But here we don't need to represent number in 2's complement form but we have to find 2's complement of given number.
A: 1010 $\rightarrow$ 0110
B: 0101 $\rightarrow$ 1011
C: 1000 $\rightarrow$ 1000
D: 1001 $\rightarrow$ 0111.

6. Ans:b
$3 * 512 + 7 * 64 + 5 * 8 + 3$
$= 3 * 8^3 + 7 * 8^2 + 5 * 8^1 + 3 * 8^0$
$= (3753)_8$
$= (011111101011)$
Therefore number of ones are 9.

7. Ans:c
C:1011=1*6+0*4+1*2+1*(-3)=5.

8. Ans:c
$(10111)_2 = 23$
$(1110)_2 = 14$
$(10111)_2 \times (1110)_2 = 23 \times 14 = (322)_{10}$
$(322)_{10} = (101000010)_2 = (142)_{16}$.

9. Ans:c
Excess-3 code are self complementing i.e. 1's complement of an Excess- 3 number is the Excess- 3 code for the 9's complement of the corresponding decimal number. For example: Binary of 1 :0001
Excess-3 of 1: 0100
1's complement of excess-3 of 1=1011
9's complement of 1 : 9-1=8
Excess-3 of 8 : 1011.

10. Ans:c
Algorithm to convert 2's complement binary number to equivalent binary:
Start scanning from LSB, keep all bits un-altered until first 1, after that complement each bit.
$-(100)_{10} = -(01100100)_2 = (10011100)_2$.

11. Ans:a
$15 * 256 + 5 * 16 + 3 = 15 * 16^2 + 5 * 16^1 + 3 * 16^0$
$= (F53)_{16}$
$= 1111\ 0101\ 0011$
$= 8$.

12. Ans:c
$(FF)_{16} = (1111\ 1111)_2 = (011\ 111\ 111)_2 = (377)_8$.

13. Ans:
$(A.B)_{16} = (1010.1011)_2 = (001\ 010\ .101\ 100)_2 = (12.54)_8$.

14. Ans:c
$(10111)_2 = 23$
$(1110)_2 = 14$
$(10111)_2 \times (1110)_2 = 23 \times 14 = (322)_{10}$
$(322)_{10} = (101000010)_2 = (142)_{16}$.

15. Ans:b
$3*512+7*64+5*8+3$
$=3*8^3+7*8^2+5*8^1+3*8^0$
$=(3753)_8$
$=(011111101011)$
Therefore number of ones are 9.

16. Ans:b
0001 1011.1100
<u>0000 0110.0110</u>
0010 0010.0010
Make pair of 4
=22.2

17. Ans:d
$(4057.06)_8=4*8^3+5*8^1+7*8^0+6*8^{-2}$
2095.09375 .

18. Ans:c
$-73.75 = -\frac{73.75*4}{4} = -\frac{295}{4} = -\frac{000100100111}{4} = \frac{111011011001}{4} = \frac{11101101100.1}{2} = 1110110110.01 =$ 10110110.0100.

19. Ans:b
In any signed representation (sign magnitude, 1's complement , 2's complement) maximum integer that can be represented with n bits are $2^{n-1}-1$, Here $n=16$, So maximum number that can represented in 16 bits is $2^{15}-1$.

20. Ans:d
All three number system (Sign magnitude, 1's complement, 2's complement) are used for representing negative numbers, hence d is correct answer.

21. Ans:b
In any signed representation (sign magnitude, 1's complement , 2's complement) maximum integer that can be represented with n bits are $2^{n-1}-1$, Here $n=16$, So maximum number that can represented in 16 bits is $2^{15}-1$.

22. Ans:b
Algorithm to convert 2's complement binary number to equivalent binary:
Start scanning from LSB, keep all bits un-altered until first 1, after that complement each bit.
In the given number, leading MSB bit is 1 , hence number is negative.
$(1101010)_2 \to (0010110)_2 = -22$.

23. Ans:d
$(292)_{10}=(1204)_x$
$292=1*x^3+2*x^2+4*x^0$
$x^3+2*x^2=288$
$x=6$.

24. Ans:c
The range of numbers that can be represented by an n bit 2's complement number system is
-2^{n-1} to $2^{n-1}-1$
There are -2^{n-1} negative numbers and $2^{n-1}-1$ positive number and one representation of 0. There are total 2^n numbers . Hence statement iii is incorrect.

25. Ans:a
Excess-3 code are self complementing i.e. 1's complement of an Excess- 3 number is the Excess- 3 code for the 9's complement of the corresponding decimal number. For example: Binary of 1 :0001
Excess-3 of 1: 0100
1's complement of excess-3 of 1=1011
9's complement of 1 : 9-1=8
Excess-3 of 8 : 1011.

26. Ans:a
Bais = 128
Minimum mantissa in normalized form = 1.000....23 times
Minimum stored exponent =000..00=0
Actual exponent= 0-128=128
Number in normalized form 1.0×2^{-128}
Maximum Mantissa: 1.1111111..22 times = 0.111111...23 times = $(1-2^{-23})$
Maximum Exponent(stored)=111..11=255
Actual exponent=255-128=127
Number in normalized form= $(1-2^{-23})\times 2^{127}$

27. Ans:c
$(2550276)_8=(010\ 101\ 101\ 000\ 010\ 111\ 110)_2$
$=(0000\ 1010\ 1101\ 0000\ 1011\ 1110)_2$
$=(0AD0BE)_{16}$.

28. Ans:c
$(326.4)_8=8^2\times 3+8^1\times 2+8^0\times 6.8^{-1}\times 4=(214.5)_{10}$
$(326.4)_8=(011010110.100)_2=(D6.8)_{16}$.

29. Ans:c
In 1's complement and sign magnitude , there are 2 representation for zero -0 (11111111) and +0 (00000000), while 2's complement has only one representation for 0 (00000000). Also complexity of performing arithmetic operation is less in 2's complement.

30. Ans:d
.

31. Ans:a
$(0.4051)_8=4\times 8^{-1}+0\times 8^{-2}+5\times 8^{-3}+1\times 8^{-4}=$ 0.5100097.

32. Ans:c
$2357_8=(010\ 011\ 101\ 111)_2$
$=(0100\ 1110\ 1111)_2$
$=(4EF)_{16}$.

33. Ans:b
X
$2^1=2=10$
$2^2=4=100$
$2^3=8=1000$
$2^4=16=10000$

$X-1$
$1=01$
$3=011$
$5=0111$
$7=01111$
$X\&(X-1)$ is 00...00 therefore option b is correct.

34. Ans:d
$m=(313)_4=3*4^2+1*4^1+3*4^0=(55)_{10}$
$n=(322)_4=3*4^2+2*4^1+2*4^0=(58)_{10}$
$55+58=(113)_{10}=(01\ 11\ 00\ 01)_2=(1301)_4$
Alternatively:
313
322
1301
$\because (3+2)_4=(11)_4$.

35. Ans:b
$(001\ 011\ 101\ 011)_2=(1353)_8$

36. Ans:a
Excess-3 code is less than 9 imply there is no carry , hence subtraction 3 (0011) will give the actual value .

37. Ans:b
$3*512+7*64+5*8+3$
$=3*8^3+7*8^2+5*8^1+3*8^0$
$=(3753)_8$
$=(011111101011)$
Therefore number of ones are 9.

38. Ans:a
Given Number is 0.75_{10}
$0.75\times 8=6.0\rightarrow 6$
$0.00\times 8=0.0\rightarrow 0$
$0.75_{10}=(0.60)_8$.

39. Ans:d
.

40. Ans:c
$(0111\ 1100\ 1101\ 1110\ 0011)\equiv(7CDE3)_{16}$.

41. Ans:b
$N^2=(7601)_8$
$N^2=7*8^3+6*8^2+0*8^1+1*8^0$
$N^2=3969$
$N=63$
B. $(143)_6=1*6^2+4*6^1+3*6^0=63$.

42. Ans:d
Given equation is invalid and no such x exist.
LHS:
$(12x)_3$ Value of x should be less than radix 3, hence possible values of x are 2,1,0
RHS:
$(123)_x$, x is radix so its value should be greater than digits hence possible value of x are 4,5,6...
Hence no real value of x exist .

43. Ans:c
a=0.052 $=0.52\times 10^{-1}$
b=28E+11, =0.28 $\times 10^{13}$.
To add 2 numbers , exponent value should be equal, hence
a= 0.52×10^{-1}
b=0.28 $\times 10^{13}=28000000000000\times 10^{-1}$.
a+b=28000000000000.52 $\times 10^{-1}$ = 0.2800000000000052 $\times 10^{13}$
a+b in 8 digit : 0.28000000 $\times 10^{13}$=b
(a+b)-b= b-b=0.

44. Ans:b
Gray codes are minimum error codes.

45. Ans:a
The range of numbers that can be represented by an n bit 2's complement number system is
-2^{n-1} to $2^{n-1}-1$.

46. Ans:b
In booth multiplication,(starting from LSB)
I:when consecutive bits are 00,11 then perform arithmetic shift by 1 bit.
II:when consecutive bits are 10 , perform subtraction and arithmetic shift by 1 bit.
III:when consecutive bits are 01 , perform addition and arithmetic shift by 1 bit.
To check number of addition/subtraction, append 0 to LSB of Multiplier and then check number of 01/10 pair. There are 8 such pairs .
$011101111011110 10\rightarrow +100-1+1000-1+1000-1+1-1$.

47. Ans:c
2's complement overflow may occur when 2 values of same sign are added. If positive and negative values are added then overflow never occur. $(1101)_2\rightarrow -(0011)_2=-3$
$(0100)_2\rightarrow +(0100)_2=4$
$-3+4=1\rightarrow +(0001)_2$ no overflow.

48. Ans:c
C1D00000 = 1 10000011 1010000......0000 Stored exponent(E') = Actual Exponent(E) + biasing(B)
Actual Exponent(E)=Stored exponent(E') - bias(B)
Stored Exponent(E')= $(10000011)_2=131$ Bias =127
E=131-127=4
Mantissa (M)= $(10100000000000000000000)_2=(0.625)_{10}$
Sign bit is 1 so number is negative
In IEEE format is in normalized form, hence given number is:
$-1.625*2^4=-26$.

49. Ans:d
Condition for overflow in 2's complement addition:
$V=C_{\text{in}}$ XOR C_{out} , where C_{in} is carry-in to the MSB and C_{out} is carry-out to MSB.

50. Ans:a
14: 0001 0100
08: 0000 1000
0001 1100
which is not a valid BCD number , hence to get correct result (0110) is added to the result
0001 1100
0000 0110
0010 0010
=22.

51. Ans:b
$(1102)_3 = 1 \times 3^3 + 1 \times 3^2 + 2 = 38$
$(123)_x = 1 \times x^2 + 2 \times x + 3$
$1 \times x^2 + 2 \times x + 3 = 38$
$x = 5$.

52. Ans:a
.

53. Ans:c
23 bits are used for mantissa , hence these bits are used for precision. Lets x be the number of digital required to represent mantissa.
So, $2^{23} = 10^x$.
taking log on both sides,
$\log_2 2^{23} = \log_2 10^x$
$23 = x \log_2 10$
$x = 6.92$
7 is correct answer.

54. Ans:c
Given number is :
(0 10000000 1100000 00000000 00000000)
Stored Exponent=$(10000000)_2 = (128)_{10}$
Actual Exponent = Stored exponent - bias
=128-127=1
Mantissa=$(0.110000...00)_2 = (0.75)_{10}$
In the normalized form $= 1.75 \times 2^1 = 3.50$.

55. Ans:a
The range of numbers that can be represented by an n bit 2's complement number system is
-2^{n-1} to $2^{n-1} - 1$.

56. Ans:c
$3 * 4096 + 15 * 256 + 5 * 16 + 3$
$= (3F53)_{16}$
$= 0011111101010011$
$= 10$
Alternatively:
$3 * 4096 + 15 * 256 + 5 * 16 + 3$
$= 16211_{10} = 11111101010011_2$
=10.

57. Ans:b
$10^{64} - 1 = 2^x - 1$
$10^{64} = 2^x$
$x = 64. \log_2 10$
$x = 64 \times 3.32 = 213$.

58. Ans:d
$(12A7C)_{16} = (0001\ 0010\ 1010\ 0111\ 1100)_2 = (00\ 010\ 010\ 101\ 001\ 111\ 100)_2 = (225174)_8$.

59. Ans:c
Excess-3 code are self complementing i.e. 1's complement of an Excess- 3 number is the Excess- 3 code for the 9's complement of the corresponding decimal number. For example: Binary of 1 :0001
Excess-3 of 1: 0100
1's complement of excess-3 of 1=1011
9's complement of 1 : 9-1=8
Excess-3 of 8 : 1011.

60. Ans:c
Although binary number corresponding to positive integers have same representation in 2's complement representation . But here we don't need to represent number in 2's complement form but we have to find 2's complement of given number.
A: 1010 → 0110
B: 0101 → 1011
C: 1000 → 1000
D: 1001 → 0111.

61. Ans:b
$(1217)_8$
$=(001010001111)_2$
= 0010 1000 1111
$=(028F)_{16}$.

62. Ans:c
$3 * 4096 + 15 * 256 + 5 * 16 + 3$
$= (3F53)_{16}$
$= 0011111101010011$
$= 10$
Alternatively:
$3 * 4096 + 15 * 256 + 5 * 16 + 3$
$= 16211_{10} = 11111101010011_2$
=10.

63. Ans:a
In booth multiplication,(starting from LSB)
I:when consecutive bits are 00,11 then perform arithmetic shift by 1 bit.
II:when consecutive bits are 10 , perform subtraction and arithmetic shift by 1 bit.
III:when consecutive bits are 01 , perform addition and arithmetic shift by 1 bit.

64. Ans:c
$\sqrt{224_r} = (13)_r$
$2r^2 + 2r + 4 = (r + 3)^2$
$2r^2 + 2r + 4 = r^2 + 9 + 6r$
$r^2 - 4r - 5 = 0$
$r^2 - 5r - r - 5 = 0$
$r = 5, r = -1$.

65. Ans:d
$(3\ 4\ 2)_8 = (011\ 100\ 010)_2 = (11100010)_2$.
As leading bit is 1 , hence number is negative and is

in 2's complement representation. Binary equivalent of given number is $-(00011110)_2 = -30$.

66. Ans:c
We have four digits and sign bit. All digits and sign is represented in character form, Size of character is 1 Byte , hence 5 bytes(40 bits) of space is used.
If we use integer, the largest number needed to represent is 9999 and smallest number is -9999, hence 14 bits are used to represent unsigned value and 1 bit is used for sign . Total space used is 15 bits.
Reduction in the storage requirement= $\frac{(40-15)}{40} = \frac{5}{8} \approx 60\%$.

67. Ans:b
$-(57)_{10} = (11000111)_2$ (in 2's complement form.
Attach 0 to the right : 110001110. In booth multiplication,(starting from LSB)
I:when consecutive bits are 00,11 then perform arithmetic shift by 1 bit.
II:when consecutive bits are 10 , perform subtraction and arithmetic shift by 1 bit.
III:when consecutive bits are 01 , perform addition and arithmetic shift by 1 bit.
$110001110 \to 0 - 100 + 100 - 1$.

68. Ans:a,b
1's complement
+0 = 0000
-0 = 1111
Sign Magnitude
+0 = 0000
-0 = 1000.

69. Ans:c
2's complement representation is used for negative numbers only. 2's complement of a positive numbers is same as binary equivalent of that number .
43 is positive number , hence 2's complement of 43 =the number 43 in 2s complement representation is 00010101.

70. Ans:B
.

71. Ans:c
Range of 2's complement numbers having with n bits $= -2^{n-1}$ to $2^{n-1} - 1$.
To represent $(-539)_{10}$ in 2's complement, 11 bits are required.
$539 = (01000011011)_2$
$-539 = (10111100101)_2$
-539 can be represented in 12 bits as:$(110111100101)_2 = (DE5)_{16}$ $\{\because$ In 2's complement representation , 1 is added to MSB to increase number of bits.$\}$.

72. Ans:b
$= 0.25 * 2 = 0.50 \to 0$
$= 0.50 * 2 = 1.00 \to 1$
=0.01.

73. Ans:d
Range of 2's complement numbers having with n bits $= -2^{n-1}$ to $2^{n-1} - 1$.
To represent $(-15)_{10}$ in 2's complement, 5 bits are required.
$(15)_{10} = (01111)_2$
2's complement $(10001)_2$.

74. Ans:b
2's complement overflow may occur when 2 values of same sign are added. If positive and negative values are added then overflow never occur. Hence B is correct answer.

75. Ans:d
$73_x = 54_y$
$x * 7 + 3 = 5 * y + 4$
$7x = 5y + 1$
$x = 8, y = 11$.

76. Ans:a
.

77. Ans:a
Leading MSB bit in A is 1 and for B it is 0 , hence A is negative and B is positive.
A= $11111010 \to -(00000110)_2 = -6$
B= $00001010 \to (00001010)_2 = 10$ As number is positive.
A× B = -60
$-(60)_{10} = -(00111100)_2 = (11000100)_2$ 2's complement representation.

78. Ans:a
The range of numbers that can be represented by an n bit 2's complement number system is
-2^{n-1} to $2^{n-1} - 1$.

79. Ans:a
657_8=$(110\ 101\ 111)_2$
=$(0001\ 1010\ 1111)_2$
=$(1AF)_{16}$.

80. AnsA:d,AnsB:d
A: With-out Normalization Stored exponent(E') = actual(E) + biasing(B)
=13 + 64 = 77
$(77)_{10} = (1001101)_2$
$0.239 = (0.00111101)_2$
$(0\ 1001101\ 00111101)_2 = (4D3D)_{16}$
B: With normalized
$0.239 \times 2^{13} = 0.239 \times 2^3 \times 2^{10}$
1.912×2^{10}
$(0.912)_{10} = (0.11101)_2$
E' = 10+64=74
$(74))_{10} = (1001010)_2$
$(0\ 1001010\ 11101000)_2 =)4AE8)_{16}$.

81. Ans:d
Zeros in mantissa and stored exponent corresponds to special value 0.

82. Ans:d
$\sqrt{121} = 11$
$\sqrt{1*r^0 + 2*r^1 + 1*r^2} = 1*r^0 + 1*r^1$
$1 + 2r + r^2 = (1+r)^2$
$1 + r = 1 + r$
For any value of r, above equation satisfies , As r is radix value , hence it should be greater than its digits , here maximum digit value is 2, So radix$>$ 2.

83. Ans:b
$(1217)_8$
$= (001010001111)_2$
$=$ 0010 1000 1111
$=(028F)_{16}$.

84. Ans:a
$P = (F87B)_{16} = (1111\ 1000\ 0111\ 1011)_2 = (001\ 111\ 100\ 001\ 111\ 011)_2 = (174173)_8$
$8*P = 8*(174173)_8 = 8*(1*8^5 + 7*8^4 + 4*8^3 + 1*8^2 + 7*8^1 + 3*8^0)_{10}$
$= (1*8^6+7*8^5+4*8^4+1*8^3+7*8^2+3*8^1+0*8^0)_{10}$
$= (1741730)_8$
$= (001\ 111\ 100\ 001\ 111\ 011\ 000)_2$
$= (0111\ 1100\ 0011\ 1101\ 1000)_2$
$= (7C3D8)_{16}$
16 bits representation is $(C3D8)_{16}$.

85. Ans:b
0.5 in the normalized form : 1.0×2^{-1}. Here Actual exponent value is -1 and mantissa is 0000...0000.

86. Ans:5
$\frac{(312)_r}{(20)_r} = (13.1)_r$
$\frac{3*r^2+1*r^1+2*r^0}{2*r^1+0*r^0} = r + 3 + \frac{1}{r}$
$\frac{3*r^2+r+2}{2r} = \frac{r^2+3r+1}{r}$
$3*r^2 + r + 2 = 2*r^2 + 6r + 2$
$r^2 - 5r = 0$
r*(r-5)=0
r=0, 5.

87. Ans:3
$(123)_5 = (x8)_y$
$2*5^2 + 1*5^1 + 3*5^0 = xy + 8$
$38 = xy + 8$
$xy = 30$ possible solutions are
$(1,30), (2,15), (3,10)$.

88. Ans:a
14.25 can be represented in normalized from as $=1.78125 \times 2^3$
Actual Exponent(E)=3
Mantissa(M)=$(0.78125)_{10} = (0.11001)_2$
Bias(S)= $2^{8-1} - 1 = 127$
Stored exponent = actual exponent + bias = $3 + 127 = (10000010)_2$
Therefore, number represented as = $(1\ 10000010\ 11001000000000000000000)_2$
Hexadecimal value = $(C1640000)_{16}$.

89. Ans:5
$(43)_x = (y3)_8$
$4*x^1 + 3*x^0 = y*8^1 + 3*8^0$
$3 + 4x = 3 + 8y$
$x = 2y$
$(6,3), (8,4), (10,5), (14,7), (12,6)$= 5

90. Ans:-11
Algorithm to convert 2's complement binary number to equivalent binary:
Start scanning from LSB, keep all bits un-altered until first 1, after that complement each bit.
In the given number, leading MSB bit is 1 , hence number is negative.
$(1111\ 1111\ 1111\ 0101)_2 \rightarrow -(0000\ 0000\ 0000\ 1011)_2 = -11$.

91. Ans:1
2's Complement:
The range of numbers that can be represented by an 16 bits 2's complement number system is
-2^{16-1} to $2^{16-1} - 1$
Number of distinct integers(X) =2^{16}
Sign Magnitude:
The range of numbers that can be represented by an 16 bits sign magnitude number system is
$-2^{16-1} - 1$ to $2^{16-1} - 1$
Number of distinct integers(Y) =$2^{16} - 1$
X-Y=1 .

92. Ans:d
.

93. Ans:d
$(BCA9)_{16} = (1011\ 1100\ 1010\ 1001)_2$
$=(001\ 011\ 110\ 010\ 101\ 001)_2 = (136251)_8$.

94. Ans:c
Stored exponent(E') = Actual Exponent(E) + biasing(B)
Actual Exponent(E)=Stored exponent(E') - bias(B)
Stored Exponent(E')= $(01111100)_2 = 124$ Bias =127
E= 124 - 127 = -3 Mantissa bits = $(11011010000000000000000)_2 = (0.8515625)_{10}$
Number in normalized form $= 1.85 * 2^{-3} \approx 0.227 = 2.27 \times 10^{-1}$.

95. Ans:c
.