MADE EASY PUBLICATIONS

# POSTAL BOOK PACKAGE 2025

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# ELECTRONICS ENGINEERING

**Objective Practice Sets**

## Digital Circuits


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# 1 CHAPTER
# Number Systems and Codes

## MCQ and NAT Questions

**Q.1** "BAD" is the hexadecimal representation of a binary number. If the number represents only the magnitude, its decimal equivalent is
(a) 2749 (b) 2989
(c) 1213 (d) 111013

**Q.2** Which of the following is a self-complementary code?
(a) 8421 code (b) Excess 3 code
(c) Pure binary code (d) Gray code

**Q.3** A Gray code is a/an:
(a) Binary weight code
(b) Arithmetic code
(c) Code which exhibits a single bit change between two successive codes
(d) Alphanumeric code

**Q.4** If $(211)_x = (152)_8$, then the value of base '$x$' is
(a) 3 (b) 5
(c) 7 (d) 9

**Q.5** The decimal number 4097 is represented in four forms as shown below. Match **List-I (Type of Representation)** with **List-II (Number)** and select the correct answer:

| | List I | | List II |
|---|---|---|---|
| A. | Binary | 1. | 0000 0000 0000 1001 |
| B. | BCD | 2. | 0000 0000 0001 0001 |
| C. | Octal | 3. | 0001 0000 0000 0001 |
| D. | Hexadecimal | 4. | 0100 0000 1001 0111 |

**Codes:**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | 3 | 1 | 2 | 4 |
| (b) | 2 | 4 | 3 | 1 |
| (c) | 3 | 4 | 2 | 1 |
| (d) | 2 | 1 | 3 | 4 |

**Q.6** The range of numbers that can be represented in two's complement mode with four binary digits is
(a) – 15 to +15 (b) – 8 to +8
(c) – 8 to +7 (d) – 7 to +7

**Q.7** $(24)_8$ is expressed in Gray code as which one of the following?
(a) 11000 (b) 10100
(c) 11110 (d) 11111

**Q.8** The 2's complement representation of –17 is
(a) 101110 (b) 101111
(c) 111110 (d) 110001

**Q.9** A number is expressed as 1023 with radix $x$. Given that the number uses all the symbols of the number system, which of the following is correct?
(a) $x$ = 3 and its decimal value is 37
(b) $x$ = 2 and its decimal value is 14
(c) $x$ = 4 and its decimal value is 15
(d) $x$ = 4 and its decimal value is 75

**Q.10** **Statement 1:** The range of unsigned decimal values that can be represented (using binary system) in a byte is 256.
**Statement 2:** The range of signed decimal values that can be represented (by signed binary using 2's complement) in a byte is 256.
(a) Statement 1 is TRUE
(b) Statement 2 is TRUE
(c) Statement 1 and Statement 2 both are TRUE
(d) Both are FALSE

**Q.11** **Statement 1:** 256 different signed decimal values can be represented in a byte.
**Statement 2:** In 2's complement system.
$1\,1\,1\,1\,0\,1\,0\,0_2 = -12_{10}$
(a) statement 1 is TRUE
(b) statement 2 is TRUE
(c) both statements are TRUE
(d) both statements are FALSE

**Q.12** For the given Grey code 10110 what will be the binary equivalent code?
(a) 10110 (b) 11101
(c) 11011 (d) None of these

**Q.13** Which of the following represents seven bit code?
1. ASCII
2. BCD
3. EBCDIC
4. Selectric

Select the correct answer using the codes given below :
(a) 1 and 4 (b) 1 and 2
(c) 1 and 3 (d) 2 and 3

**Q.14** With 2's complement representation, the range of values that can be represented on the data bus of an 8 bit microprocessor is given by
(a) –128 to +127 (b) –128 to +128
(c) –127 to +128 (d) –256 to +256

**Q.15** The binary number 00001011 when represented in BCD format, is given by
(a) 00001011 (b) 10111011
(c) 00010001 (d) 10001000

**Q.16** Hamming codes are used for error detection and correction. If the minimum Hamming distance is m, then the number of errors correctable is
(a) equal to m (b) less than m/2
(c) equal to 2 m (d) greater than m

**Q.17** 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

**Q.18** **Assertion (A):** A 16-bit data contained in a certain location of a computer memory can be expressed in terms of four hexadecimal digits only.
**Reason (R):** The hexadecimal number system has a base that is four times the base of binary number system.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not a correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

**Q.19** What will be the excess-3 code representation of the number $(64)_{10}$?
(a) 01000011 (b) 01110011
(c) 01000000 (d) 10010111

**Q.20** The addition of two number $(-64)_{10}$ and $(80)_{16}$ is
(a) $(-16)_{10}$ (b) $(16)_{10}$
(c) $(1100000)_2$ (d) $(01000000)_2$

**Q.21** Given that the largest $n$-bit binary number requires d digits in decimal representation. Which one of the following relations between n and d is approximately correct?
(a) $d = 2^n$ (b) $n = 2^d$
(c) $d < n \log_{10}2$ (d) $d > n \log_{10}2$

**Q.22** A signed integer has been stored in a byte using the 2's complement format. We wish to store the same integer in a 16 bit word. We should
(a) copy the original byte to the less significant byte of the word and fill the more significant byte with zeros.
(b) copy the original byte to the more significant byte of the word and fill the less significant byte with zeros.
(c) copy the original byte to the less significant byte of the word and make each bit of the more significant byte equal to the most significant bit of the original byte.
(d) copy the original byte to the less significant bytes well as the more significant byte of the word.

**Q.23** Consider the following operation
$$(23)_x + (21)_x = (y)_x$$
What is the minimum value of '$y$' that is possible?
(a) $(17)_{10}$ (b) $(20)_{10}$
(c) $(44)_{10}$ (d) $(110)_{10}$

**Q.24** Consider the following statements:
1. When two unsigned numbers are added, an overflow is detected from the carry into the most significant position.
2. An overflow does not occur if the two numbers added are both negative.
3. If the carry into the sign bit position and carry out of the sign bit position are not equal, an overflow condition is produced.

Which of the above statement(s) is/are correct?
(a) 1, 2 and 3 (b) 1 only
(c) 2 only (d) 3 only

**Q.25** 2's complement representation of a 16-bit signed number is FFFFH. Its magnitude in decimal representation is
(a) 0 (b) 1
(c) 32767 (d) 65535

## Answers Number Systems and Codes

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | (b) | 2. | (b) | 3. | (c) | 4. | (c) | 5. | (c) | 6. | (c) | 7. | (c) |
| 8. | (b) | 9. | (d) | 10. | (c) | 11. | (c) | 12. | (c) | 13. | (a) | 14. | (a) |
| 15. | (c) | 16. | (b) | 17. | (b) | 18. | (c) | 19. | (d) | 20. | (d) | 21. | (d) |
| 22. | (c) | 23. | (b) | 24. | (d) | 25. | (b) | 26. | (4) | 27. | (–8) | 28. | (2) |
| 29. | (8) | 30. | (4) | 31. | (15) | 32. | (b, c) | 33. | (c, d) | 34. | (a, b, c) | 35. | (b, c, d) |
| 36. | (b, d) | 37. | (b, c, d) | 38. | (c, d) | | | | | | | | |

## Explanations Number Systems and Codes

**1. (b)**

$$(BAD)_{16} = B \times 16^2 + A \times 16^1 + D \times 16^0$$
$$= 11 \times 256 + 10 \times 16 + 13$$
$$= (2989)_{10}$$

**2. (b)**

Self complementing code:
Excess – 3 code, 2421, 3221, 4311, 5211
It is one that 9's complement in decimal is the 1's complement in binary.

**3. (c)**

A Gray code is a code which exhibits a single bit change between two successive codes.

**4. (c)**

$$(211)_x = (152)_8$$

Converting to decimal

$$2x^2 + x + 1 = 8^2 \times 1 + 8 \times 5 + 2 = 106$$

on solving, $x = 7, -15/2$

**5. (c)**

Binary: 0001 0000 0000 0001

$$2^{12} + 2^0 = 4097$$

BCD: $\underset{\downarrow 4}{0100}\ \underset{\downarrow 0}{0000}\ \underset{\downarrow 9}{1001}\ \underset{\downarrow 7}{0111}$

Octal: 0000 0000 0001 0001

$\rightarrow 1 \times 8^4 + 1 \times 8^0$

$\rightarrow 4097$

Hexadecimal: 0000 0000 0000 1001

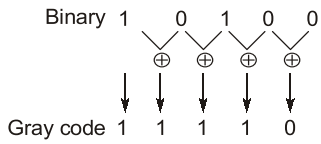
$$= 1 \times 16^3 + 1 \times 16^0$$
$$= 4097$$

**6. (c)**

Range of signed magnitude and 1's complement representation for n-bit is $= -(2^{n-1} - 1)$ to $(2^{n-1} - 1)$
for 2's complement : $-2^{n-1}$ to $(2^{n-1} - 1)$

**7. (c)**

$(24)_8 \equiv (10100)_2 = (20)_{10}$




**8. (b)**

2's complement of a number = 1's complement + 1

$$(17)_{10} = 010001$$

$$\begin{array}{rl} \text{1's complement of } (17)_{10} = & 1\,0\,1\,1\,1\,0 \\ \text{2's complement} & +\quad\quad 1 \\ \hline & 1\,0\,1\,1\,1\,1 \end{array}$$

**9. (d)**

Given $(1023)_x$

We know that radix $x$ is always greater than any number inside it.

Hence, $x \geq 4$

Now by options check $x = 4$

So, $(1023)_4 = 1 \times 4^3 + 0 \times 4^2 + 2 \times 4^1 + 3 \times 4^0$
$= 64 + 0 + 8 + 3 = (75)_{10}$

**10. (c)**

In unsigned, range with n bit is 0 to $2^n - 1$

Here, 1 byte = 8 bit

$\therefore \quad 0 \rightarrow 2^8 - 1$
$= 0 - 255$

for 2's complement $-(2^{n-1})$ to $(2^{n-1} - 1)$

**11. (c)**

2's complement of $(11110100)_2$

$$= \begin{array}{r} 00001011 \\ \quad\quad\quad 1 \\ \hline 00001100 \end{array} = 12$$

But in 2's complement representation, MSB is '1' i.e. number is negative.

**12. (c)**

Given Gray code 1 0 1 1 0

Binary code will be 1 1 0 1 1

**13. (a)**

Seven bit code : ASCII, selectric

EBCDIC : 8-bit code

BCD : 4-bit code

**14. (a)**

For 8-bit 2's complement : – 128 to 127

**15. (c)**

Convert binary into decimal

$00001011 \rightarrow 2^3 \cdot 1 + 2^1 \cdot 1 + 2^0 \cdot 1 = 11$

$(11)_{10} = (0\,0\,0\,1 \quad 0\,0\,0\,1)_2$

**16. (b)**

No. of errors correctable in hamming code for m hamming distance < $m/2$.

**17. (b)**

$\because$ + 22.5625

\+ $\rightarrow$ 0

– $\rightarrow$ 1

| | | |
|---|---|---|
| 2 | 22 | |
| 2 | 11 | 0 |
| 2 | 5 | 1 |
| 2 | 2 | 1 |
| | 1 | 0 |

$\therefore \quad 22 = (10110)_2$

$0.5625 \times 2 = 1.1250 \rightarrow 1$

$0.1250 \times 2 = 0.2500 \rightarrow 0$

$0.2500 \times 2 = 0.5 \rightarrow 0$

$0.5 \times 2 = 1 \rightarrow 1$

$\therefore (1001)_2$

$\therefore \quad (22.5625) = (10110.1001)_2$

**18. (c)**

Hexadecimal, decimal, binary number system has a base 16, 10, 2 respectively.

**19. (d)**

Given, $(64)_{10} = (01000000)_2$

To convert into excess 3, first convert into BCD code.

$$(64)_{10} \xrightarrow{BCD} \begin{array}{cc} 6 & 4 \\ 0110 & 0100 \end{array}$$

Now add $(3)_{10} = 0011$ into each Nibble.

So, $(64)_{10} \xrightarrow{\text{Excess 3}} \begin{array}{r} 0110\ 0100 \\ +\ 0011\ 0011 \\ \hline 1001\ 0111 \end{array}$

**20. (d)**

$(80)_{16} = (128)_{10}$

$(128)_{10} + (-64)_{10} = (64)_{10}$

$(64)_{10} = (01000\,000)_2$

**21. (d)**

For $n$-bit number

$$d > n \log_{10} 2$$

For $n = 1, 2, 3 \quad d = 1$

For $n = 4, 5, 6 \quad d = 2$

For $n = 7, 8, 9 \quad d = 3$

For $n = 10, 11, 12, 13 \quad d = 4$

For any $n$, $d > n \log_{10} 2$ is correct.

**22. (c)**

The MSB of the integer in 8 bit format should be repeated to expand the representation of 2's complement form to 16 bit.

**23. (b)**

For minimum value of '$y$' the value of '$x$' should be minimum

$\therefore$ minimum value of $x = 4$

$\therefore \quad (23)_4 + (21)_4 = (110)_4 = (4^2 + 4 + 0)_{10} = (20)_{10}$

**24. (d)**

1. When two unsigned numbers are added, an overflow is detected from the carry out of most significant bit. (not into most significant bit)
2. Overflow does not occur if the numbers are of opposite sign otherwise it may occur.
3. In signed operation, if carry into sign bit and carryout of the sign bit are not equal, overflow occurs else overflow does not occur.