

POSTAL Book Package

2023

GATE • PSUs

Instrumentation Engineering

Objective Practice Sets

Digital Electronics

Contents

Sl.	Topic	Page No.
1.	Number Systems and Codes	2 - 8
2.	Boolean Algebra and Minimization Techniques	9 - 17
3.	Logic Gates	18 - 28
4.	Arithmetic Operations and Combinational Circuits	29 - 41
5.	Sequential Circuits	42 - 52
6.	Shift Registers	53 - 55
7.	Counters	56 - 66
8.	Logic Families	67 - 75
9.	ADCs and DACs	76 - 82
10.	Semiconductor Memories	83 - 85
11.	Basics of Distributed Control Systems & Programmable Logic Controllers	86 - 86



MADE EASY
Publications

Note: This book contains copyright subject matter to MADE EASY Publications, New Delhi. No part of this book may be reproduced, stored in a retrieval system or transmitted in any form or by any means. Violators are liable to be legally prosecuted.

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.
 $11110100_2 = -12_{10}$
 (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.26 If a particular number system having base B , such that

$$(\sqrt{21})_B = 3_{10}$$

Then the value of ' B ' is _____ .

Q.27 4-bit 2's complement representation of a decimal number is 1000. The number will be _____?

Q.28 If $(11 \times 1Y)_8 = (12C9)_{16}$, then the value of $X - Y$ will be _____.

Q.29 The number 1's present in the binary representation of $15 \times 256 + 5 \times 16 + 3$ are _____.

Q.30 The number of bytes required to represent the decimal number 1856357 in packed BCD (Binary Coded Decimal) form is _____.

Q.31 In a particular number system the cubic equation $x^3 + bx^2 + Cx - 190 = 0$ has roots $x = 5$, $x = 8$ and $x = 9$. Then the base of the number system is _____.

Multiple Select Questions (MSQs)

Q.32 $(1010.011)_2$ is equal to

- (a) $(10.75)_{10}$ (b) $(22.12)_4$
(c) $(12.3)_8$ (d) $(A.C)_{16}$

Q.33 If $(23)_x = (47)_y$, then the possible values of radix x and y could be

- (a) $x = 2, y = 1$ (b) $x = 3, y = 1$
(c) $x = 4, y = 1$ (d) $x = 6, y = 2$

Q.34 $(-64)_{10} + (80)_{16}$ is equal to

- (a) 0100 0000 in binary number system.
(b) 0110 0100 in BCD code.
(c) 80 in octal number system.
(d) 64 in hexadecimal number system.

Q.35 Which of the following are the self-complementing codes?

- (a) BCD codes
(b) Excess-3 code
(c) 2-4-2-1 binary weighted code
(d) 4-2-2-1 binary weighted code

Q.36 Consider the signed binary number $A = 0100\ 0110$ and $B = 1101\ 0011$, where B is in 2's complement and MSB is the sign bit. Which of the below statement(s) is/are correct?

- (a) $A + B = 1000\ 1001$
(b) $A - B = 0111\ 0011$
(c) $B - A = 0100\ 1101$
(d) $-A - B = 1110\ 0111$

Q.37 Which of the following represents $(AB)_{16}$?

- (a) $(0110\ 0010)_2 + (0100\ 0001)_2$
(b) $(1100\ 0011)_2 - (0001\ 1000)_2$
(c) $(96)_{16} + (15)_{16}$
(d) $(D3)_{16} - (28)_{16}$

Q.38 If in a particular number system, the cubic equation $x^3 - ax^2 + bx - 190 = 0$ has roots $x = 5$, $x = 8$ and $x = 9$, then

- (a) The base of the number system is 13.
(b) $a = 19$ in the given number system.
(c) $b = A7$ in the given number system.
(d) The equivalent equation in the hexadecimal system is $x^3 - 16x^2 + 9Dx - 168 = 0$.



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)

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

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)

$$\begin{aligned}(211)_x &= (152)_8 \\ \text{Converting to decimal} \\ 2x^2 + x + 1 &= 8^2 \times 1 + 8 \times 5 + 2 = 106 \\ \text{on solving, } x &= 7, -15/2\end{aligned}$$

5. (c)

Binary: 0001 0000 0000 0001
 $2^{12} + 2^0 = 4097$

BCD: $\begin{array}{cccc} \underline{0100} & \underline{0000} & \underline{1001} & \underline{0111} \\ \downarrow & \downarrow & \downarrow & \downarrow \\ 4 & 0 & 9 & 7 \end{array}$

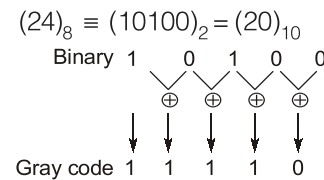
Octal: 0000 0000 0001 0001
 $\rightarrow 1 \times 8^4 + 1 \times 8^0$
 $\rightarrow 4097$

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)



8. (b)

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

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

$$\begin{array}{r} \text{1's complement of } (17)_{10} = 1011110 \\ + 1 \\ \hline \text{2's complement} 1011111 \end{array}$$

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
 $\therefore 0 \rightarrow 2^8 - 1$
 $= 0 - 255$
for 2's complement $-(2^{n-1})$ to $(2^{n-1} - 1)$