

Practice Paper I For Unit Test 1

Subject: Computer Science

Topic: Number Systems, Boolean Algebra, Logic Gates, Propositional Logic, OOP in Java

Time: 12 Hours

Full Marks: 80 (Maybe)

Section A – Number Systems and Binary Arithmetic (10 Marks)

- 1. Convert the following:** (5 × 1 = 5)
- a) $(101101)_2$ to Decimal
 - b) $(79)_{10}$ to Binary
 - c) $(17)_8$ to Binary
 - d) $(11010110)_2$ to Hexadecimal
 - e) $(2F)_{16}$ to Decimal
- 2. Perform the following binary operations:** (2 × 1.5 = 3)
- a) $1011 + 1101$
 - b) $1101 - 1001$ (using 2's complement)
 - c) 10101×110
- 3. Decode the following 4-bit binary numbers into hexadecimal:** (1 × 2 = 2)
- (0001, 0101, 0111, 1000, 1010, 1100, 1110, 1111)
-

Section B – Boolean Algebra & Logic Gates (24 Marks)

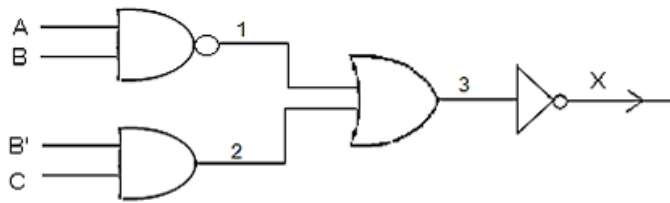
- 4. Find the complement of the Boolean expression: $A' \cdot (B \cdot C' + B' \cdot C)$** [1 mark]
- (a) $A' \cdot (B + C + B' + C)$
 - (b) $A + (B + C') \cdot (B + C')$
 - (c) $A + (B' + C) \cdot (B + C')$
 - (d) $A' \cdot (B' + C' + B' \cdot C)$
- 5. According to the Principle of Duality, the Boolean equation $(A' + B) \cdot (1 + B) = A' + B$ is equivalent to:** [1 mark]
- (a) $(A + B') \cdot (0 + B) = A + B'$
 - (b) $(A' \cdot B) + (0 \cdot B) = A' \cdot B$
 - (c) $(A' \cdot B) + (0 \cdot B) = A' + B$
 - (d) $(A' + B) \cdot (0 + B) = A' + B$
- 6. Distributive law states that:** [1 mark]
- (a) $A + B \cdot C = (A + B) \cdot (A + C)$
 - (b) $A + (A \cdot B) = A$
 - (c) $A \cdot (B + C) = (A \cdot B) + (B \cdot C)$
 - (d) $A + B \cdot C = A \cdot B + A \cdot C$

7. Logic Expression and Circuit:

(3 marks)

i) Write the logic expression:

From the given logic diagram :



- Derive Boolean expression and draw the truth table for the derived expression.
- If $A=1$, $B=0$ and $C=1$ then find the value of X .

ii) $X = (A + B') \cdot (C + D')$

Draw the logic circuit diagram for the above.

iii)

Answer the following questions related to the below image:



- What is the output of the above gate if input $A=0$, $B=1$?
- What are the values of the inputs if output =1?

8. Real-life Logical Expression –

(6 marks)

A shopping mall announces a special discount on all its products as a festival offer only to those who satisfy any one of the following conditions.

- If he/she is an employee of the mall and has a service of more than 10 years.

OR

- A regular customer of the mall whose age is less than 65 years and should not be an employee of the mall.

OR

- If he/she is a senior citizen but not a regular customer of the mall.

(The inputs are : INPUTS **E Employee of the mall**, **R Regular customer of the mall**, **S Service of the employee is more than 10 years**, **C Senior citizen of 65 years or above** (In all the above cases, 1 indicates yes and 0 indicates no.) (i) Draw the truth table for $X(E, R, S, C)$.

(ii) Write the Sum Of Products expression.

(iii) Draw the logic gate diagram for the simplified expression.

9. Verify using a truth table if the proposition is valid:

(4 marks)

$$(X \wedge Y) \Rightarrow Z \equiv (Y \Rightarrow Z) \wedge (X \Rightarrow Y)$$

10. Analyze the given propositions:**(3 marks)**

$p = \text{I am a triangle}$

$q = \text{I am a three-sided polygon}$

$s_1 = p \rightarrow q$

$s_2 = q \rightarrow p$

Assertion: s_2 is converse of s_1

Reason: Three-sided polygon must be a triangle.

Options:

- (a) Both A and R are true, and R is the correct explanation
 - (b) Both A and R are true, but R is not the correct explanation
 - (c) A is true, R is false
 - (d) A is false, R is true
-

Section C – Programming in Java (26 Marks)**11. Assertion-Reason Based Java Question:****(2 marks)**

Assertion: In Java, the String class is used to create and manipulate strings, and it is immutable.

Reason: Immutability ensures that once a String object is created, its value cannot be changed.

- (a) Both A and R are true, and R is the correct explanation
- (b) Both A and R are true, but R is not the correct explanation
- (c) A is true, R is false
- (d) A is false, R is true

12. Java Classes – Array Handling:**(8 marks)**

Define a class `Mixarray` with following:

- Data Members: `arr[]`, `cap`
- Methods:
 - Constructor to initialize `cap`
 - `void input()` //accept array
 - `Mixarray mix(Mixarray P, Mixarray Q)` //create new array with first 3 of P and Q
 - `void display()` // show elements
- Define `main()` // to demonstrate functionality with sample inputs.

13. Java Classes – LCM Calculation:**(8 marks)**

Define a class `LCM` with:

- Data Members: `n1`, `n2`, `large`, `sm`, `l`
- Methods:
 - Constructor to initialize variables
 - `void accept()` – take input
 - `int getLCM()` – return LCM using recursion
 - `void display()` – show values
- Define `main()` to create object and show results.
Hint: Use $\text{LCM}(a, b) = (a \times b) / \text{GCD}(a, b)$ with recursive GCD logic.