

Time : 3 hrs.

(Candidates are allowed additional 15 minutes for only reading the paper. They must not start writing during this time)

Answer ALL Questions in Part I (compulsory) and SIX questions from Part II, choosing TWO questions from Sections A, TWO questions from Section B and TWO questions from Section C.

All working, including rough work, should be done on the same sheet as the rest of the answer.

The intended marks for questions or for parts of questions are given in brackets []

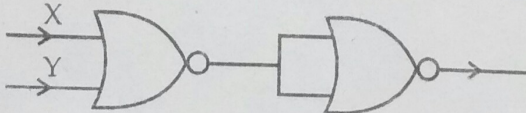
PART - I

Attempt ALL questions.

While answering questions in this part, indicate briefly your working and reasoning, wherever required.

Question 1

- a. State and prove Absorption Law. [1]
- b. Prove that $X + X'$ is a tautology. [1]
- c. Simplify, $F(X, Y, Z) = X \cdot Y + X \cdot Z + X \cdot Y \cdot Z$ using law of Boolean Algebra. [1]
- d. Answer the questions related to the circuit given below :-



- e. Name the basic gate represented by the above diagram. [1]
- f. Find the complement of the following expression. [1]
 $F = X' + X \cdot Y'$

Question 2

- a. Convert the following:-
 - i. $(78.35)_{10} \longrightarrow (?)_2$
 - ii. $(1011101001.1101)_2 \longrightarrow (?)_8$
- b. What is Unicode?
- c. Define converse and inverse.
- d. What is meant by Abstraction?
- e. Write the characteristics of constructor.

Question 3

The following function is a part of some class. Assume that a and b are positive integers :

```
int somefn(int a, int b)
{
    while(a! = b)
    {
        if(a > b)
            a = a - b;
        else
            b = b - a;
    }
    return(a);
}
```

- a. What will be returned by the function somefn(12, 30)? [2]
- b. What value will be returned by the function somefn(35, 3) [2]
- c. State in one line what is being computed by the function somefn(.). [1]

PART - II

Answer SIX questions in this part, choosing TWO questions from Section A, TWO from Section B and TWO Section C.

SECTION - A

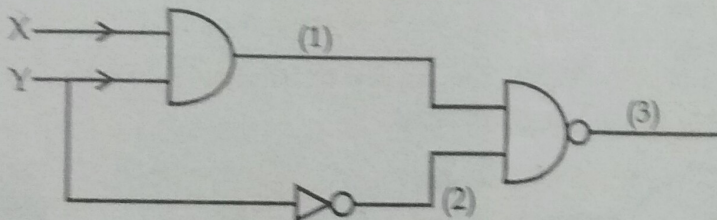
Answer any TWO questions from this section.

Question 4

- a. Define universal gate. Draw logic gate of XOR using NOR gate. [4]
- b. Simplify the following expression by using the boolean laws. At each step state clearly the law used. [3]
 $X'Y'Z' + X'YZ + X'YZ' + XY'Z + XYZ$
- c. Verify: $P \cdot (-P + Q) = (P \Rightarrow Q)'$ [3]

Question 5

- a. What is Adder? Draw the truth table and logic circuit diagram of full adder. [4]
- b. Draw the logic gate circuit diagram of the following expression using only NAND gate. [3]
 $A\bar{B}C + \bar{A}B + B\bar{C}$
- c. From the logic circuit diagram given below, find the outputs (1), (2) and (3). [3]



Question 6

- a. Perform the following:- [6]
- $(1110111)_2 + (1111101)_2$
 - $(101101)_2 * (111)_2$
 - $(11100011)_2 \div (101)_2$
- b. Verify algebraically: [2]
 $X + Y'Z = (X + Y' + Z) \cdot (X + Y' + Z')$
- c. What is the application of boolean algebra in computer science? [2]

SECTION 'B'

Answer any TWO questions from this section.

Each program should be written in such a way that its clearly depicts the logic of the problem. This can be achieved by using mnemonic name and comments in the program. (Flowcharts and Algorithms are not required)

Question 7

Design a class Stringfun to perform various operations on strings. Some of the member functions [10]

/ data members are given below :

Class Stringfun

Data Members / instance variable

Str to store string

Member functions / Methods

void Input() to accept string

void Words() to find and display the number of words, number of vowels and number of uppercase characters in the string.

void frequency() to display frequency of each character within the string.

Specify the class Stringfun giving the details of the functions void Input(), void Words() and void frequency(). You do not need to write the main functions.

Question 8

A class sort contains an array of 50 integers. Some of the member functions/data members are given below :

Class name	sort
Data members / instance variables	
int arr[]	int array
int item	number to be searched in array
Member functions	
void inpdata()	to input numbers in array
void bubblesort()	to sort the array in ascending order using bubblesort technique and to display the sorted list.
void binsearch()	to input time and search for it using the binary search technique, if found to print the item searched and its position in the sorted list, otherwise print an appropriate message.

The main function need not to be written.

Question 9

A disarium number is a number in which the sum of the digits to the power of their respective position is equal to the number itself.

Example : $135 \rightarrow 1^1 + 3^2 + 5^3$
 $= 135$

Hence 135 is a disarium number.

Design a class Disarium to check if a given number is a Disarium number or not. Some of the members of the class are given below :

Class Name	Disarium
Data members/instance variables	
int num	stores the number
int size	stores the size of the number
Members functions	
Disarium (int nn)	parameterized constructor to initialize the data members n = nn and size = 0
void countDigit()	count the total number of digits and assign it to size.
int sumofDigits(int n, int p)	return the sum of the digits of the number n to the power of their respective positions.
void check()	check whether the number is a disarium number and display the result with an appropriate message.

Specify the class Disarium giving the details of the constructor, void countDigit(), int sumofDigit(int, int) and void check(). You do not need to write the main function.

SECTION 'C'

Answer any TWO questions from this section.

Each program should be written in such a way that it clearly depicts the logic of the problem.

This can be achieved by using mnemonic name and comments in the program.

Question 10

Write a program to input any decimal number and print its binary equivalent.

Question 11

Write a program to input two numbers and print the HCF and LCM of the numbers.

Question 12

Write an algorithm or method to sort an array in descending order using insertion sort technique.