Pre-Board Examinations 2020 – 21

Computer Science – XII

Paper 1 – Theory

Time : Three hours | Marks : 70

Instructions

1. Answer all questions in Part I (compulsory) and six questions from Part-II, choosing two questions from Section-A, two questions from Section-B and two questions from Section-C.
2. All working, including rough work, should be done on the same sheet as the rest of the answer.
3. The intended marks for questions or parts of question are given in brackets [ ].

PART I

Answer all questions

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

1.

(a) State Absorption law and prove it with the help of a truth table. [1]

(b) What are maxterms? Convert the following as a product of max terms:
F(A,B,C) = (A + B) . (A' + C') [2]

(c) Minimize F = XY + (XZ)' + XY'Z using Boolean laws. [2]

2.

(a) From the class declaration given below, state the nature of the identifiers P,Q,R and S.
class P extends Q implements R,S. [2]

(b) What is dynamic binding? [2]

(c) Define the term 'fall through' with reference to switch case. [2]

(d) Explain abstract class and interface. [2]

(e) State one advantage and disadvantage of using recursion over iteration. [2]

3. The following function process( ) is part of a class. What will the function process(12, 8) return? Show the dry run / working. [5]

```
public int process(int n, int p)
{
    if(n == 0)
    {
        return p ;
    }
    else
    {
        return process(p%n, n);
    }
}
```

PART – II

Answer six questions in this part, choosing two questions from Section A, two from Section B and two from Section C.

Section – A

Answer any two questions

4.

(a) Given the Boolean function: F(P, Q, R, S) = ∑ (0,2,4 8,9,10,12,13)

i. Reduce the above expression by using 4 variable Karnaugh map, showing the various groups (i.e., octal, quads and pairs). [4]

ii. Draw the logic gate diagram for he reduced expression. Assume that the variables and their complements are available as inputs. [1]

(b) Given the Boolean function: F(A, B, C, D) = π (5,7,8,10,12,14,15)

i. Reduce the above expression by using 4 variable Karnaugh map, showing the various groups(i.e., octal, quads and pairs). [4]

ii. Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs. [1]

5.

(a) Draw the logic diagram and truth table to encode the decimal numbers (2,3,5,7,8) and briefly explain its working. [5]

(b) Simplify the following expression, using Boolean laws and draw the gate for the reduced expression. F = A'B + AB'C + A [3]

(c) Define Universal gates. Give one example and show how it works as an OR gate. [2]

6.

(a) What is an encoder? Draw the encoder circuit to convert A-F hexadecimal number to binary. [5]

(b) Using only NAND gates, draw the logic circuit diagram for A' + B. [3]

(c) Define proposition. How does tautology differ from contradiction? [2]

Section – B

Answer any two questions

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 names and comments in the program.

(Flow charts and Algorithms are not required.)

7. A class MatrixSort contains a two-dimensional array of order [m x n]. The details of the members of the class are given below.

Class name : MatrixSort

Data Members

arr[ ][ ] : two dimensional array

m : integer to store the number of rows

n : integer to store the number of columns

Member Methods

MatrixSort(int mm, int nn) : constructor to initialize the size of the matrix.

void init( ) : to initialize the elements of the array.

void sort( ) : to arrange the numbers of each row in ascending order.

void display( ) : to display the array in matrix form.

Define a main( ) function to create an object and call the functions to enable the task. [10]

8. A class Capital has been defined to check whether a sentence has words beginning with a capital letter or not. Some of the members of the class are given below.

Class name : Capital

Data Members

str : to store a sentence

freq : stores the frequency of words beginning with a capital letter.

Member methods

Capital( ) : default constructor

void accept( ) : to input the sentence to str.

Boolean isCap(String w) : checks and returns true if word begins with a capital letter.

void count( ) : to count the frequency of words beginning with capital letter.

void display( ) : displays the sentence along with the frequency.

Define the main( ) function to create an object and call the functions to complete the task. [10]

9. Design a class Perfect to check if a given number is perfect number or not. A number is said to be perfect if sum of the factors of the number excluding itself is equal to the original number.

Example : 6 = 1 + 2 + 3

Some of the members of the class are given below.

Class name : Perfect

<u>Data Members</u>

Num : to store the number

<u>Member Methods</u>

Perfect( ) : default constructor

void init( ) : to initialize the number

int sumOfFactors( ) : returns the sum of the factors of the number

Boolean check( ) : checks whether the number is perfect and if yes, returns true

void display( ) : displays whether the number is perfect or not.

Define a main( ) function to create an object and call the methods to display the result. [10]

Section – C

Answer any two questions

Each program should be written in such a way that it clearly depicts the logic of the problem stepwise. This can be achieved by using comments in the program and mnemonic names.

10. A dequeue enables the user to add and remove integers from both the ends. i.e., front and rear. Define a class DeQueue with the following details.

Class name : DeQueue

<u>Data Members</u>

arrQ[ ] : array to hold the integer elements.

size : stores the maximum capacity of the array.

front : to point the index of the front.

rear : to point the index of the rear.

<u>Member methods</u>

DeQueue(int max) : constructor to initialize the data member size = max, front = rear = 0

void pushF (int n) : to add elements to the front.

void pushR(int n) : to add elements to the rear.

int popF( ) : to remove an element from the front.

int popR( ) : to remove an element from the rear. [5]

11. A linked list is formed from the objects of the class Node. The class structure of the Node is given below.

```
class Node
{
    int n;
    Node link;
}
```

Write the method to search for a number from an existing linked list. The method declaration is as follows. void findNode(Node start, int n) [5]

12. Answer the following questions from the diagram of a Binary Tree given below. [5]

(a) What is the height of the tree?

(b) List the leaf nodes of the tree.

(c) Write the preorder traversal of the tree structure.