

Quarterly Examination 2018-2019
Computer Science(Paper-1)

Class : XII

Time : 3 hours+15 mins.

Full Marks : 70

(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 seven questions from Part-II, choosing three questions from Section-A, two from Section-B and two 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 parts of questions are given in brackets [].

PART I

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

Question 1

[1x5=5]

- (a) State Involution law and prove it with the help of a truth table. [1]
- (b) Show that $X \cdot Y + (Y \wedge X)'$ is a tautology, [1]
- (c) Find the dual of : [1]
 $Y \cdot X + X' + 1 = 1$
- d) Write the Maxterm and Minterm. When the inputs are A=0, B=1, C=1 and D=0. [1]
- (e) Draw the logic circuit of a NAND gate using NOR gate only. [1]

{Turn Over}

Methods/Member functions :

- Book(int cap) : constructor to initialise the data members max = cap and point = -1
- : displays the name of the book which was last entered in the shelf. If there is no book left in the shelf, displays the message "SHELF EMPTY"
- void addlString v) : adds the name of the book to the shelf if possible, otherwise displays the message "SHELF FULL"
- void display() : displays all the names of the books available in the shelf

Specify the class Book giving the details of **ONLY** the functions, **void tell()** and **void add(String)**. Assume that the other functions have been defined. **The main function need not be written.**

Question 2.**[10]**

- What is the difference between Stack and Queue ?
- Find the complement of the following: $[(x.y)' . x] [(x.y)'.y]$
- Define Inheritance.
- What is the difference between Base class and Derived class ?
- Minimize using Boolean laws: $x.(x+y).y(z+z')$

Question 3**[5]**

- (a) Give output of the following function where x and y arguments are greater than 0.

Show the dry run/working.

```
void create (int x, int y)
{
    if (x > 1) // base case
    {
        if ( x % y == 0 )
        {
            System.out.print( y + " ");
            create ( x / y, y);
        } // end of inner if
        else
            create ( x , y+1);
    } // end of outer if
}
```

- What will the function create (24 , 2) return ? [2]
- What will the function create (84 , 2) return ? [2]
- In one line, state what the function is doing, apart from recursion. [1]

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

Question 4

[5x2=10]

(a) Given the Boolean function : $F(A,B,C,D) = \sum(3, 4, 6, 7, 11, 12, 13, 14, 15)$

(i) Reduce the above expression by using 4 - variable K-Map, showing the various groups (i.e; octal, quads and pairs).

(ii) Draw the Logic gate diagram of the reduced expression. Assume that the variable and their complements are available as inputs.

(b) A passenger is allotted a window seat in an aircraft, if he/she satisfies the criteria given below: [5]

- The passenger is below 15 years and is accompanied by an adult.

OR

- The passenger is a lady and is not accompanied by an adult.

OR

- The passenger is not below 15 years, but is (travelling for the first time. The inputs are :

INPUTS	
A	The passenger is below 15 years age.
C	The passenger is accompanied by an adult.
L	The passenger is a lady.
F	The passenger is travelling for the first time.

(In all the above cases 1 indicates yes and 0 indicates no).

{Turn Over}

Output : W — Denotes the passenger is allotted a window seat 1 indicates yes and 0 indicates no)

Draw the truth table for the inputs and outputs given above and write the **SOP** expression for **W (A,C,L,F)**.

Question 4

[2x5=10]

- Given: $F(a,b,c) = bc+ca$. Write the function in canonical sum of products form.
- Verify using the truth table, if $(X'.Y).(Y'.X)$ is a tautology, contradiction or contingency.
- What is meant by a logic gate ? State any one application of a logic gate circuit.
- What is the use of keyword super in Java?
- Draw the logic gate diagram for the following three input function $F(a,b,c)$ using NAND gate only. $F(a,b,c) = \pi(0,2,5,6,7)$

Questions

[2x5=10]

- What is a *decoder* ? Draw the logic diagram for a binary to octal (3 to 8) decoder. [3]
- How is a *half adder* different from A *full adder* ? Draw the truth table and derive the SUM and CARRY expression for a full adder. Also, draw the logic diagram for a full adder. [4]
- State whether the following expression is a Tautology. Contradiction or a Contingency, with the help of a truth table : $(X \Rightarrow Z) \vee \sim [(X \Rightarrow Y) \wedge (Y \Rightarrow Z)]$ [3]

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. (Flowcharts and Algorithms are not required.) The Programs must be written in Java.

Question 7

[10]

A class MyArray contains an array of n integers ($n \leq 100$) that are already arranged in ascending order. The subscripts of the array elements vary from 0 to n-1. Some of the member functions of the class are given below :

Class name : MyArray

Data members/instance variables :

arr: an array of n integers.

n: size of the array

Member functions/methods:

MyArray(): constructor to initialize 0 in each memory location of the array arr[]

void readArray(): to read n integers that are arranged in ascending order.

void displayArray(): to display the n integers of the array arr [].

int binarySearch(int v, int l, int u): to search for the value taken as parameter in the array between l (lower limit) and u(upper limit), using the Binary Search Technique. It returns the subscript of the array element if the value is found, otherwise it returns -999. (note: you are expected to use recursive technique)

- (a) Specify the class MyArray giving the details of the methods. You need not write the main function.

Question 8

[10]

Sum = $1 + X/1! + X^3/2! + x^5/3! + \dots + X^{(2n-1)}/n!$

{Turn Over}

A class `SeriesSum` has been defined to calculate sum of the above series. Some of the members of the class are given below:

Class Name	SeriesSum
Data members	X, n(integer), sum(double)
Member Methods	
SeriesSum()	Constructor
int factorial(int n)	Calculates and returns factorial of n. Use recursion.
double term(int p, int q)	Calculates and returns the value of p/q! by making use of factorial(int)
void accept()	Inputs the value of member data x, n
void displaysum()	Displays the value of member data
double calsum()	Calculates the sum of the given series using the appropriate data and other are a functions.

- specify the class `SeriesSum` giving details of the constructor, `int factorial(int)`, `double term(int, int)`, `void displaysum()`. You may assume that other member functions are written for you. You do not need to write the main function.
- What care do you need to take while designing `double term(int, int)`.

Question 9.

A class **Shift** contains a two dimensional integer array of order (m x n) where the maximum values of both n and m is 5. Design the class **Shift** to shuffle the matrix (i.e. the first row becomes the last, the second row becomes the first and so on). The details of the members of the class are given below:

Class name : Shift
Data member/instance variable :
mat [] [] : stores the array element
m : integer to store the number of rows
n : integer to store the number of columns

Member functions/methods:

Shift (int mm, int mm) : parameterized constructor to initialize the data members
m = mm and n = m
void input() :
void cyclic (Shift P) : enables the matrix of the object(P) to shift each row upwards in a cyclic manner and store the resultant matrix in the current object
void displays () : displays the matrix elements

Specify the class **Shift** giving details of the **constructor()**, **void input()**, **void cyclic(Shift)** and **void display()**. Define the main() function to create an object and call the methods accordingly to enable the task of shifting the array elements.

SECTION-C

Answer any two questions.

Each program / Algorithm should be written in such a way that it clearly depicts the logic of the problem step wise. This can also be achieved by using pseudo codes.

Question 10

[5]

Write methods of class Compare:

{Turn Over}

Int arrange(int num): arranges the digits of a number in ascending order.
String arrange (String wrd): arranges the letters in alphabetical order.

Question 11

[5]

A super class **Bank** has been defined to store the details of a customer. Define a sub-class **Account** that enables transactions for the customer with the bank. The details of both the classes are given below:

Class name : **Bank**

Data member/Instance variable :

name : stores the name of the customer
accno : stores the account number
p : stores the principal amount in decimals

Member functions/methods :

Bank(...) : parameterized constructor to assign values to the instance variables
void display() : displays the details of the customer

Class name : **Account**

Data member/Instance variable:

amt : stores the transaction amount in decimals

Member functions methods:

Account(...) : parameterized constructor to assign values to the instance variables of both the classes
void deposit() : accepts the amount and updates the principal as $p=p + amt$

void withdraw() : accepts the amount and updates the principal as $p=p-amt$
 If the withdrawal amount is more than the principal amount, then display the message "INSUFFICIENT BALANCE". If the principal amount after withdrawal is less than 500. then a penalty is imposed by using the formula $p=p-(500-p)/10$

void display() : displays the details of the customer

Assume that the super class **Bank** has been defined. Using the **concept of Inheritance**. specify the class **Account** giving details of the **constructor(...)**. **void deposit()**. **void withdraw()** and **void display()**.

The super class and the main function need not be written.

Question 12 **[5]**

A bookshelf is designed to store the books in a stack with LIFO(Last In First Out) operation. Define a class Book with the following specifications:

Class name : **Book**

Data members/instance variables :

name[] : stores the names of the books
 point : stores the index of the topmost book
 max : stores the maximum capacity of the bookshelf

{Turn Over}