

MARTHOMA RESIDENTIAL SCHOOL
First Terminal Examination - 2019

Class-XII

Computer Science

Time: 3 hrs
Marks: 80

Answer all questions from Part-I and Part-II

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 (20 Marks)

Answer all questions.

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

Question 1

- (a) State duality principle and find the dual of $(p+q').r.1=p.r+q'.r$ [1]
(b) Verify if the following proposition is valid using truth table [1]

$$(x \Rightarrow y) \wedge (x \Rightarrow z) = x \Rightarrow (y \wedge z)$$

- (c) Find F' for following expression, where $F = p+p'q'$ [1]
(d) If $A=1, B=0, C=0, D=1$ find its (i) minterm (ii) maxterm [1]
(e) State Demorgan's law. Verify anyone of them using truth table [1]

Question 2

- (a) What do you mean by inheritance? Name any 4 types of inheritance in Java.? [2]
(b) What is a linked list? What is the purpose of *super* keyword? [2]
(c) Convert the following *infix notation* to *postfix* form: [2]
 $P + (Q * R - S \wedge T) / A$
(d) What do you mean by base case in a recursive function? Define Big O Complexity. [2]
(e) Each element of an array $A[-15 \dots 10, 15 \dots 40]$ requires two bytes of storage. If the array is stored in Row Major Order with the beginning location 1000, determine the location of $A[5, 20]$. [2]

Question 3

- (a) The following functions `show()` and `calling()` are a part of some class. Assume that the parameter n is greater than 1 when the function is invoked. It returns the value 1 when true otherwise it returns 0. Answer the following questions with dry run / working. [5]

```
void calling( int i)
{
int f = 2;
int c=show(n,f);
}
int show (int n , int f)
{
if (n==f)
return 1;
if(n%f == 0 || n ==1)
return 0;
```

```
return show( n,f+1 );  
}
```

- i) What will the function show(...) returns when the value of n is 11 ?
- ii) What will the function show(...) returns when the value of n is 27 ?
- iii) State in one line that what the function show(...) do apart from recursion?

PART - II (60 Marks)

SECTION - A

Answer all questions.

Question 4

(a) Given the Boolean function $F(A, B, C, D) = \sum(0, 2, 5, 7, 8, 10, 11, 13, 14, 15)$

- (i) Reduce the above expression by using 4-variable Karnaugh map, showing the various groups (octal, quads and pairs).
- (ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.

(b) Given the Boolean function $P(A, B, C, D) = \Pi(0, 1, 2, 3, 5, 6, 7, 10, 13, 14, 15)$

- (i) Reduce the above expression by using 4-variable Karnaugh map, showing the various groups (octal, quads and pairs).
- (ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.

Question 5

(a) A government institution intends to award a medal to a person who qualifies any one of the following criteria:

The person should have been an Indian citizen and had lost his/her life in a war but has not completed 25 years of service.

OR

The person must be an Indian citizen and has served the nation for a continuous period of 25 years but has not lost his/her life in a war.

OR

The person is not an Indian citizen but has taken active part in activities for the upliftment of the nation.

The inputs are:

INPUTS

I: The person is/was an Indian citizen

S: Has a continuous service of more than 25 years

L: Lost his/her life in a war

U: Taken part in activities for upliftment of the nation

Output **M** Denotes eligible for medal [1 indicates YES and 0 indicates NO in all cases] a) Draw the truth table for the inputs and outputs given above and write the **SOP** expression for **M(I,S,L,U)**

b) Derive a POS expression for SUM and CARRY in half adder and draw its logic circuit.

c) Draw the truth table and logic gate diagram of a 3 x 8 decoder.

SECTION - B

Answer all 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 6

Class **Extract** has been defined to express digits of an integer in words. The details of the class are given below:

Class name : **Extract**

Data members

n : integer whose digits are to be expressed in words.

Member functions

Extract () : constructor to assign 0 to n.

void innumber() : to accept the value of n.

void extractdigit(int) : to extract the digits of n using **recursive technique**.

void num_to_words(int) : to display the digits of an integer in words.

Specify the class **Extract** giving details of the constructor and function **void innumber()**, **void extractdigit(int)** and **void num_to_words(int)**. **The main function need not be written**

[10]

Question 7

A class **employee** contains the unique id of 100 employees. Some of the data members / member functions are given below:

Class name :

Data member/instance variable:

eno[] : integer array to store unique id

Member functions/methods:

employee () : constructor to initialize the array elements

void fillArray() : to accept the elements of the array in ascending order

int binSearch(int l, int u, int v) : to search for a particular unique id (v) using **binary search** and **recursive technique** and returns 1 if found otherwise returns -1

Specify the class **employee** giving details of the **constructor**, **void fillArray()** and **int binSearch(int, int, int)**. Define the **main()** function to create an object and call the functions accordingly to enable the task.

[10]

Question 8

a) The following is a function of some class which checks if a positive integer is an Armstrong number by returning true or false. (A number is said to be Armstrong if the sum of the cubes of all its digits is equal to the original number.) The function does not use modulus (%) operator to extract digit. There are some places in the code marked by ?1?, ?2?, ?3?, ?4?, ?5? which may be replaced by a statement/expression so that the function works properly.

```
boolean ArmstrongNum( int N )
```

```
{  
int sum= ?1?;  
int num=N;
```

```

while( num>0)
{
int f= num/10;
int s = ??;
int digit = num- s;
sum+= ?3?;
num = ?4?;
}
if(?5? )
return true;
else
return false;
}

```

- (i) What is the statement or expression at ?1?
- (ii) What is the statement or expression at ?2?
- (iii) What is the statement or expression at ?3?
- (iv) What is the statement or expression at ?4?
- (v) What is the statement or expression at ?5?

b) A line on a plane can be represented by coordinates of the two-end points p1 and p2 as p1(x1,y1) and p2(x2, y2). A super class **Plane** is defined to represent a line and a sub class **Circle** to find the length of radius and the area of circle by using the required data members of super class.

Some of the members of both the classes are given below:

Class name : Plane

Data members/instance variables:

x1 : to store the x-coordinate of the first end point

y1 : to store the y-coordinate of the first end point

Member functions/methods:

Plane(int nx, int ny) : parameterized constructor to assign the data members x1= nx and y1= ny

void display() : to display the coordinates

Class name : Circle

Data members/instance variables:

x2 : to store the x-coordinate of the second end point

y2 : to store the y-coordinate of the second end point

radius : double variable to store the radius of the circle

area : double variable to store the area of the circle

Member functions / methods

Circle(...) : parameterized constructor to assign values to data members of both the classes

void findRadius() : to calculate the length of radius using the formula:

$$\frac{\sqrt{(x2 - x1)^2 + (y2 - y1)^2}}{2}$$

assuming that x1, x2, y1, y2 are the coordinates of the two ends of the diameter of a circle.

void findArea() : to find the area of circle using formula: πr^2 . The value of pie (π) is 22/7 or 3.14

void display() : to display both the coordinates along with the length of the radius and area of the circle.

Assume that the super class **Plane** has been defined. Using the concept of **Inheritance**, specify the **Circle** giving details of the constructor, void findRadius(), void findArea() and void display(). The super class and the main function need not be written.

SECTION - C

Answer all questions.

Each Program should be written in such a way that it clearly depicts the logic of the problem stepwise. This can also be achieved by using comments in the program and mnemonic names or pseudocodes for algorithms. The program must be written in Java and the algorithms must be written in general / standard form, wherever required / specified.
(Flowcharts are not required.)

Question 9

A super class `Retail_Stock` has been defined to store the details of the stock of a retail store. Define a subclass `Purchase` to store the details of the items purchased with the new rate and updates the stock. Some of the members of the classes are given below:

Class name : `Retail_Stock`

Data members/instance variables:

- `item` : to store the name of the item
- `qty` : to store the quantity of an item in stock
- `rate` : to store the unit price of an item
- `amt` : to store the net value of the item in stock

Member functions:

- `Retail_Stock (...)` : parameterized constructor to assign values to the data members
- `void display()` : to display the stock details

Class name : `Purchase`

Data members/instance variables:

- `pqty` : to store the purchased quantity
- `prate` : to store the unit price of the purchased item

Member functions / methods

- `Purchase(...)` : parameterized constructor to assign values to the data members of both classes

- `void update()` : to update stock by adding the previous quantity by the purchased quantity and replace the rate of the item if there is a difference in the purchase rate. Also update the current stock value as:
(quantity * unit price)

- `void display()` : to display the stock details before and after updating.

Assume that the super class `Retail_Stock` has been defined. Using the concept of Inheritance, specify class `Purchase` giving details of the constructor(...), `void update()` and `void display()`. The super class and the main function need not be written.

Question 10

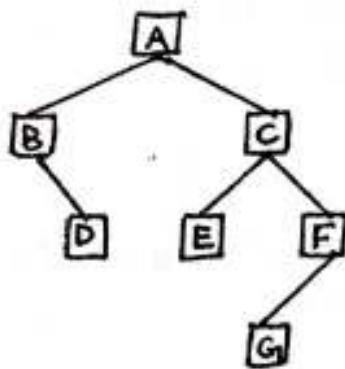
- (a) A linked list is formed from the objects of the class `Node`. The class structure of the `Node` is given below:

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

Write an *Algorithm* OR a *Method* to search for a number from an existing linked list
The method declaration is as follows:

void FindNode(Node Start, int b)

(b) Answer the following questions from the diagram of a Binary Tree given below:



- (a) Write the post order traversal of the tree.
- (b) State the root and the height of the tree
- (c) Separate the Internal nodes and the External nodes of the tree.
