

MARTHOMA RESIDENTIAL SCHOOL

Second Terminal Examination- Dec 2017

Class-XII

Computer

Time: 3hr
Marks: 70

Part I [20 marks]

(Answer all questions)

Question 1

- (a) State Absorption Law and prove it with the help of a truth table. [1]
- (b) Draw the truth table to prove propositional logic expressions:
$$p \Rightarrow q = \sim p \vee q$$
 [1]
- (c) Find the dual for the Boolean equation $AB' + BC' + 1 = 1$ [1]
- (d) Convert the Boolean expression $F(X,Y,Z) = X' Y' Z + X' Y Z' + X Y Z$ into its cardinal form. [1]
- (e) Minimize $F = XY + (XZ)' + XY'Z$ using Boolean laws. [1]

Question 2

- (a) Differentiate between stack data structure and queue data structure [2]
- (b) Convert the following infix notation to post fix:
$$A * (B + C) / E + F$$
 [2]
- (c) Define interface with an example. [2]
- (d) Each element of an array $arr[15][20]$ requires 'W' bytes of storage. If address of $arr[6][8]$ is 4440 and base address at $arr[1][1]$ is 4000, find width 'W' of each cell in the array $arr [][]$ when array is stored as column major wise. [2]
- (e) Define Big O Notation. State 1 factor which determines the complexity of an algorithm. [2]

Question 3

What will be the output of the following function `check()` when value of `count= 4`? Show the dry run/ working?

```
void check(int count) [5]
{
if(count==0)
System.out.println(" ");
else
{
```

```

System.out.println("Bye "+ count);
check(--count);
System.out.println(" "+ count);
}

```

Part II [50 marks]

Answer 6 questions in this part, choosing 2 questions from Section A, 2 from Section B and 2 from Section C

Section – A [20 marks]

Answer any two questions:

Question 4

(a) Given $F(A,B,C,D) = \Sigma (0, 2, 3, 6, 8, 10, 11, 14, 15)$

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]

(b) Given $F(P, Q, R, S) = \pi (5, 7, 8, 10, 12, 14, 15)$

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]

Question 5

(a) Draw the logic diagram and truth table for a decimal to binary encoder [5]

(b) Simplify the following Boolean expression and draw the gate for the reduced expression.

$$F = A'B + AB'C + A \quad [2]$$

(c) Define Universal gates. Give one example and show how it work as an OR gate. [3]

Question 6

(a) A school intends to select candidates for the Inter-School Athletic Meet, as per the criteria given below:

- The candidate is from the Senior School and has participated in an Inter-School Athletic Meet earlier.

OR

- The candidate is not from the Senior School, but the height is between 5 ft. and 6 ft. and weight is between 50 kg. and 60 kg.

OR

- The candidate is from the senior school and has height between 5 ft. and 6 ft., but the weight is not between 50 kg. and 60 kg. The inputs are:

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

Output: **X** - Denotes the selection criteria [1 indicates selected and 0 indicates rejected in all cases.]

INPUTS

S : Student is from the Senior School

W : Weight is between 50 kg. and 60 kg.

H : Height is between 5 ft. and 6 ft.

A : Taken part in Inter-School Athletic Meet earlier

(1) Draw the truth table for the inputs and outputs given above and write the SOP expression for **X(S, W, H, A)**. [5]

(2) Reduce **X(S, W, H, A)** using Karnaugh map. [5]

(b) Define Proposition. How does tautology differ from contradiction? [2]

(c) Briefly explain the working of a 4x1 multiplexer. Also draw the logic diagram of 4x1 multiplexer [3]

Section – B [20 marks]

Answer any two questions:

Question 7

Design a class **Palin** which checks whether a given word is palindrome or not. The details of the members of the class are given below:

Class name : **Palin**

Data members / instance variables:

str : stores a word

rev : stores the reverse of the word

len : to store the length of the word

Member functions:

Palin () : default constructor

void readword () : to accept the word **str**

void check() : to reverse a word and store in **rev** and check whether it is palindrome or not.

void display () : display the original word along with the reversed word

Specify the class **Palin** giving details of the **constructor**, **void readword ()**, **void check ()**, and **void display()**. Define the **main ()** function to create an object and call the functions accordingly to enable the task. [10]

Question 8

A Special number is a number in which the sum of the factorial of the digits is equal to the number. Example: 145 ($1! + 4! + 5! = 145$). Thus 145 is a special number. Design a class **Special** to check if the given number is a special number or not. Some of the members of the class are given below:

Class name : **Special**

Data members / instance variables:

n : integer to store the number

Member functions:

Special () : default constructor.

void read () : to accept the number.

int factorial (int x) : return the factorial of a number using **recursion technique**.

boolean isSpecial () : check for the special number by invoking the function factorial() and **returns true if Special, otherwise returns false**.

void display () : to show the result with an appropriate message.

Specify the class **Special**, giving details of the **constructor**, **void read ()**, **int factorial (int)**, **boolean isSpecial ()** and **void display ()**. Define the **main ()** function to create an object and call the member functions accordingly to enable the task.

[10]

Question 9

The sum of angles is calculated as:

Let first angle=**20 Degrees 45 Minutes**

Let second angle=**12 Degrees 40 Minutes**

The sum of angles will be **33 Degrees 25 Minutes**(where **60 Minute= 1 Degree**). Design a class **Angle** with following details:

Class name: **Angle**

Data members / instance variables:

deg , min: integer variables to store degrees and minutes

Member functions:

Angle () : constructor to assign 0 to deg and min

void inputangle () : to input values to deg and min

void dispangle () : to display values of deg and min with proper messages.

Angle sumOfAngle(Angle T1, Angle T2) : to find sum of angles from objects T1 and T2 by using the above method of adding angles and return sum of angles.

Specify the class **Angle**, giving details of the **constructor and all functions**. Write the **main ()** function to input 2 angles and sum of angles.

[10]

Section – C [10 marks]

Answer any two questions:

Question 10

A super class **Account** contains employee details and a sub class **Simple** calculates the employee's simple interest. The details of the two classes are given below:

Class name : **Account**

Data members:

Name : stores the employee name.

Pan : stores the employee PAN number

principal : stores the Principal amount (in decimals).

accno : stores the employee bank account number.

Member functions:

Account (...) : parameterized constructor to assign value to data.

void display () : to display the employee details.

Class name : **Simple**

Data members:

time : stores the time duration.

rate : stores the rate of interest.

Interest : stores the simple interest.

Member functions:

Simple (...) : parameterized constructor to assign value to data members of both the classes.

void calculate () : calculates the simple interest as $(\text{principal} * \text{time} * \text{rate}) / 100$.

void display () : to display the employee details along with the rate, interest and time.

Assume that the super class **Account** has been defined. Using the concept of inheritance, specify the class **Simple** giving details of constructor, void calculate() and void display(). **The super class and the main function need not to be written.**

[5]

Question 11

A book shelf is designed in a **stack with LIFO** (Last in First Out) operation.

Define a class **Book** with the following details.

Class name: **Book**

name[] : stores names of the books.

point: stores index of the topmost book.

max: stores the maximum capacity of the bookshelf.

Book(int cap): parameterized constructor to initialize **max=cap** and **point=-1**

void tell() : 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 add(String v): adds the name of the book (v) to the shelf if possible, otherwise display 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 the **ONLY** the functions **void tell()** and **void add(String)**. Assume that other functions have been defined. **The algorithm and main function need not be written.**

[5]

Question – 12

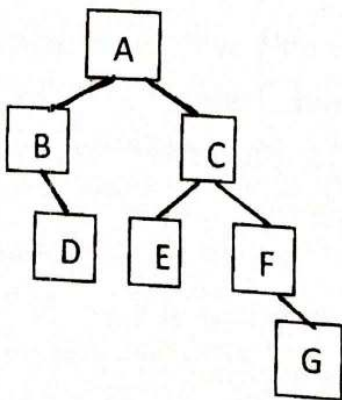
(a) A linked list is formed from objects of the class:

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

Write an **Algorithm OR a Method** to print all the numbers divisible by 7 in an already existing linked list. The method declaration is as follows: **void div_number(Node startPtr)**

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

[2]



i) Name the root and the leaves of the tree

ii) Write the inorder traversal of the tree

iii) Give the internal nodes of the tree

[1]

[1]

[1]