Pre - ISC 2017-18

Computer Science Paper-1

Maximum Marks: 70 Time: 3 Hrs+15 mins

Answer all questions in part I (compulsory) and six questions from Part-II, choosing two 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 [].

SECTION A (40 Marks)

PART - I

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

Question 1

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

(b) Using a truth table verify: (~p => q) ^ p = (p ^ ~ q) v (p ^ 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'YZ' + XYZ into its cardinal form. [1]

(e) Minimize the expression using Boolean laws: F =(A+ B'). (B + C.D). [1]

Question 2

(a) Differentiate between Stack data structure and Queue data structure. [2]

(b) Convert the following infix notation to postfix: A/ (B * C) / E + F [2]

(c) What is the use of keyword implements. How is it different from keyword extends? [2]

(d) Each element of an array arr[15][20] requires 'W' bytes of storage. If the address of arr[6][8] is 4440 and the Base Address at arr[1][1] is 4000, find the width 'W' of each cell in the array arr[ ][ ] when the array is stored as Column Major Wise. [2]

(e) Define Big 'O' notation. State the two factors which determine the complexity of an algorithm. [2]

Question 3

The following is a function of some class. What will be the output of the function test ( ) when the value of count is equal to 4? [5]

Show the dry run / working.

```
void test (int count )
{
if ( count== 0)
        System.out.println(" ");

else
{
        System.out.println( "Bye" + count); test( - -count );
        System.out.println(" " + count);

}
}
```

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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

(a) Given F(A,B,C,D) = Σ(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. [1]

(b) Given F(P,Q,R,S) = 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. [1]

Question 5

(a) Draw the logic diagram and truth table for Decimal to Binary encoder and briefly explain its working. [5]

(b) Simplify the following Boolean expression and draw the gate for the reduced expression. F= A'B + AB'C + A [2]

(c) Draw the truth table and a logic gate diagram for a 2 to 4 Decoder and briefly explain its working. [3]

Question 6

(a) Draw a truth table with a 3 input combination which outputs 1 if there are odd number of 0's. Also derive an SOP expression for the output. Reduce the expression using Karnaugh Map. [5]

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

(c) Draw the logic diagram of the multiplexer for the given function f(a,b,c)=∑ (1, 3, 4, 5, 7). [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.

[10]

Question 7

A class Composite contains a two dimensional array of order [m x n]. The maximum values possible for both 'm' and 'n' is 20. Design a class Composite to fill the array with the first (m x n) composite numbers in column wise. The details of the members of the class are given below:

Class name: Perfect

Data members /instance variables:

arr[ ][ ] : stores the perfect numbers column wise

m: integer to store the number of rows

n: integer to store the number of columns

Member functions:

Perfect (int mm, int nn) : to initialize the size of the matrix m=mm and n=nn

int isPerfect(int p) : returns 1 if number is perfect otherwise returns 0.

void fill ( ) : to fill the elements of the array with the first (m × n) perfect numbers in column wise

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void display( ) : displays the array in a matrix form.

Specify the class Perfect giving details of the constructor(int,int), int isPerfect(int), void fill( ) and void display( ). Define a main( ) function to create an object and call the functions accordingly to enable the task.

Question 8 [10]

Design a class Sort which enables a word to be arranged in alphabetical order. The details of the members of the class are given below :

Class name : Sort

Data members /instance variables:

Str : stores a word

len : to store the length of the word

Member functions :

Sort( ) : default constructor

void readword( ) : to accept the word

void arrange ( ) : to arrange the word in alphabetical order using any selection sorting technique.

void display( ) : displays the original word along with the sorted word

Specify the class Sort giving details of the constructor, void readword( ), void arrange( ), and void display( ). Define the main( ) function to create an object and call the functions accordingly to enable the task.

Question 9 [10]

Design a class Exchange to accept a sentence and interchange the first alphabet with the last alphabet for each word in the sentence, with single letter word remaining unchanged. The words in the input sentence are separated by a single blank space and terminated by a full stop. Example: Input: It is a warm day. Output: tI si a marw yad. Some of the data members and member functions are given below:

Class name: Exchange

Data members/instance variables: sent(stores the sentence), **rev**, size(stores the length of the sentence)

Member functions:

Exchange():default constructor to initialize data members.

void readsentence( ): to accept the sentence and store the length of the sentence in size.

void exFirstLast( ): extract each word and interchange the first and last alphabet of the word and form a new sentence **rev** using the changed words.

void display( ): display the original sentence along with the new changed sentence.

Specify the class Exchange giving details of the constructor( ), void readsentence( ), void exfirstlast( ) and void display( ). Define the main( ) function to create an object and call the functions accordingly to enable the task.

SECTION – C

Answer any two questions

Each Program 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 comments in the program and mnemonic names or pseudo codes 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 10 [5]

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:

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Class name: Account
Data Members:
Name: stores the employee name
Pan: stores the employee PAN number
Principal: stores the Principal amount (in decimals)
acc_no : stores the employee bank account number
Member functions: Account (....) : parameterized constructor to assign value to data members
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 (Principal × time × rate) / 100
void display( ) : displays the employee details along with the rate, time and interest.
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 be written.

[5]

Question 11
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
Data Members:
ele[ ] : array to hold the integer elements.
cap : stores the maximum capacity of the array.
front : to point the index of the front.
rear : to point the index of the rear.
Member functions:
DeQueue(int max) : constructor to initialize the data member cap = max, front = rear = 0 and create the integer array.
void pushfront(int v) : to add integers from the front index if possible else display the message("full from front").
int popfront( ) : to remove the return elements from front. If array is empty then return-999.
void pushrear(int v) : to add integers from the front index if possible else display the message("full from rear").
int poprear( ) : to remove and return elements from rear. If the array is empty then return-999.
Specify the class DeQueue giving the details of ONLY the constructor(int), void pushfront(int) and int poprear ( ). Assume that the other functions have been defined. The main( ) function need not be written.

[2]

Question 12

A linked list is formed from the objects of the class:

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

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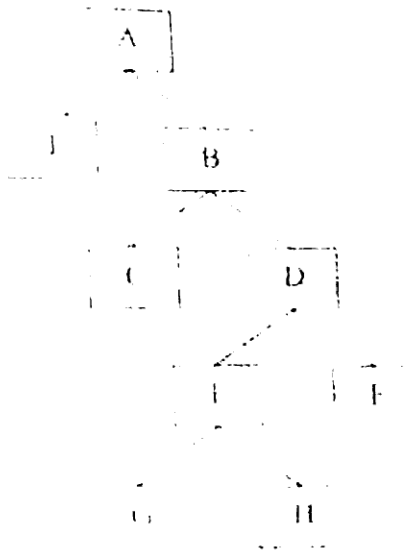
Write an Algorithm OR a Method to insert a node at the beginning of an existing linked list. The method declaration is as follows: void InsertNode(Nodes starPtr, int n)

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

(i) Preorder Transversal of tree. (ii) Right subtree of node D. (iii) Height of the tree (3)



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