

Class-12th
Computer Science
I Pre Board Exam (2023-24)

Time: 3 Hrs

M.M: 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 **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 [].

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 the properties of zero in Boolean algebra [1]
- b) Find the complement of the following Boolean expression using De Morgan's law:
 - a. $F(P, Q, R) = P + (Q' \cdot R)$ [1]
- c) Find the dual of: $(A' + 0) \cdot (B' + 1) = A'$ [1]
- d) State whether the following proposition is a tautology, contradiction or a contingency:
 $F = (P \Rightarrow Q) \vee (Q \Rightarrow \sim P)$ [1]
- e) What do you mean by abstraction [1]
- f) What is the relevance of the keyword *static* for a data member of a class. [1]
- g) State any one purpose of using *interfaces* in Java programming. [1]
- h) Define difference between link list and stack. [1]
- i) State *any one* application each of *half adder* and *full adder*. [1]
- j) What do you mean by inheritance [1]

Question 2

- (i) Convert the following *infix notation* to *prefix form*:

$$(X + Y) / (Z * W / V) \quad [2]$$

- (ii) A matrix B[10][20] is stored in the memory with each element requiring 2 bytes of storage. If the base address at B[2][1] is 2140, find the address of B[5][4] when the matrix is stored in Column Major Wise. [2]

- (iii) The following function **check()** is a part of some class. What will the function **check()** return when the value of (i) **n=25** and (ii) **n=10**. Show the dry run/ working.

```
int check(int n)
{
    if(n<=1)
        return 1;
    if( n%2==0)
        return 1 + check(n/2);
    else
        return 1 + check(n/2 + 1);
}
```

- (a) What will the value of return when n=25 and n=10? [2]
- (b) What function does **check()** perform. apart from recursion? [1]
- (iv) The following function is a part of some class which computes and check the number is palindrome or not. There are some places in the code marked by **?1?** , **?2?** , **?3?** which must be replaced by an expression / a statement so that the function works correctly.

```
void palin(int n)
{
    int d, num, rev=0;
```

```

num = ?1?;
while( ?2?)
{
d = n%10;
rev = ?3?;
n=n/10 ;
}
if (rev==num)
System.out.println(num+" is a Palindrome no") ;
else
System.out.println(num+" is not a Palindrome no") ;
}

```

- (a) What is the expression or statement at ?1? [1]
 (b) What is the expression or statement at ?2? [1]
 (c) What is the expression or statement at ?3? [1]

PART – II (50 Marks)

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 3

(a) Given the Boolean function: $F(A,B,C,D) = \Sigma (0, 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14)$.

- (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) (a) Given the Boolean function: $F(A, B, C, D) = \pi (3, 4, 6, 9, 11, 12, 13, 14, 15)$.

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

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

Question 4

- (i) (a) Draw a logic diagram for the given expression. [4]

$$AB(A + B) + ABC$$

- (b) What do you mean by logic gate? [1]

- (ii) (a) Draw the logic circuit encode the following Octal number(3) to its binary equivalents of given numbers [5]

Question 5

- (a) A company intends to develop a device to show the high status power load for a house hold invertors depending on the criteria given below: [5]

If Air conditioner and Geyser are on

OR

If Air conditioner is off, but Geyser and Refrigerator are on

OR

If Geyser is off, but Air conditioner and Water purifier are on

OR

When all are on

The inputs are:

INPUTS	
A	Air conditioner is on

G	Geyser is on
R	Refrigerator is on
W	Water purifier is on

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

Output : **X** [1 indicates high power, 0 indicates low power for all cases]

Draw the truth table for the inputs and outputs given above and write the **SOP** expression for **X(A,G,R,W)**.

(b) Draw the truth table and derive an SOP expression for *sum* and *carry* for a full adder. Also, draw the logic circuit for the *carry* of a full adder. [3]

(c) Simplify the following expression using Boolean laws: [2]

$$F = [(X' + Y) \cdot (Y' + Z)]' + (X' + Z)$$

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 6

A class Palindrome has been defined to check whether a positive number is palindrome number or not. The number 'N' is palindrome if the original number and its reverse are same. Some of details of the class are given below. [10]

Class name : **Palindrome**

Data members/ Instance Variables

num : integer to store the number
 revnum : integer to store the reverse number.

Methods/Member functions

palindrome() : constructor to initialize the data members with legal initial values.
 void accept : to accept number.
 int reverse(int n) : reverse the parameterized argument 'n' and store the revnum using recursive technique.
 void check : checks whether the number is palindrome or not by invoking the function reverse() and display the result with an appropriate message.

Specify the class Palindrome giving details of the constructor(), void accept(), int reverse(int) and void check(). Define the main() function to create an object and call the functions accordingly to enable task.

Question 7 [10]

Declare a matrix A[][] of order M× M where m is the number of rows and number of the columns. Such that M must be greater than 2 and less than 10. Accept the value of M from the user. Display an appropriate message for an invalid input. Allow the user to input integers into the matrix. Perform the following task,

Display the original matrix

Rotate the matrix 90° clockwise as shown below

Original matrix

1	2	3
4	5	6
7	8	9

Rotated Matrix

7	4	1
8	5	2
9	6	3

Find the sum of the elements of four corners of the matrix.

Test your program for the following data and also some random data

Example-1

Original matrix

1	2	3
4	5	6
7	8	9

Rotated Matrix

7	4	1
8	5	2
9	6	3

Sum of the corner elements = 20

Example 2

Original matrix

1	2	4	9
2	5	8	3
1	6	7	4
3	7	6	5

Rotated Matrix

3	1	2	1
7	6	5	2
6	7	8	4
5	4	3	9

Sum of the corner is 13

Example 3

Input M=14

Output: Size of Range

Question 8

A class **Mix** has been defined to mix two words, character by character, in the following manner: The first character of the first word is followed by the first character of the second word and so on. If the words are of different length, the remaining characters of the longer word are put at the end.

Example: If the First word is "JUMP" and the second word is "STROLL", then the required word will be "JSUTMRPOLL". [10]

Some of the members of the class are given below:

Class name : **Mix**

Data member/instance variable:

wr1, wr2 : to store a word
len : to store the length of the word

Member functions/methods:

Mix() : default constructor to initialize the data members with legal initial values
void feedword() : to accept the word in UPPER case
void mix_word() : mix the two words into a single word.
void display() : displays the word

Specify the class Mix giving the details of the constructor(), void feedword(), void mix_word() and void display(). Define the main() function to create objects 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 stepwise.

Question 9 [5]

A queue is a linear data structure which works on the principle of FIFO, enables the user to enter data from the rear end and remove data from the front end . Define a class **CirQueue** with the following details:

Class name : **Queue**

Data members / instance variables:

arr [] : array to store the integers
cap : stores the maximum capacity of the array
front : to point the index of the front end
rear : to point the index of the rear end

Member functions:

Queue (int max) : constructor to initialize the data member
cap=max, front=-1 and rear=-1
void push(int n) : to add integer in the queue from the rear
end if possible, otherwise display the
message "QUEUE IS FULL"
int pop() : removes and returns the integer from the
front end of the queue if any, else otherwise
display the message "QUEUE IS UNDER FLOW"
void show() : displays the queue elements

Specify the class **Queue** giving details of the functions **void push(int)** and **int pop()**. Assume that the other functions have been defined.

Question 10 [5]

Write a class **Sentence** to store a sentence and another class **Duplicate** to replace the duplicate characters. The details of the classes are given.

Class name : **Sentence**

Data members/instance variable

str : to store a sentence in the string variable of protected type

Member function/methods

Sentence() : constructor to assign string variable.
void accept() : to accept a sentence in the variable str.
void display() : to display the sentence after performing the task.

Class Name : **Duplicate**

Data member/instance variable

len : to store the length of sentence str
void removeDuplicate(): to remove the duplicate characters of each words in
sequence so that it should have only one occurrence. The
new sentence should possess only one space between two
words, if it contains more spaces in the original string.

For example : Ammmmiit Kuulkkkarnni iiiiss aa ssssttuudddeentt of cccllasssss
tttwwweellllvvvvve

Output:- Amit Kulkarni is a student of class twelve.

Specify the class Sentence giving the details of the function void accept() and void display()

Using the concept of inheritance, specify the class \Duplicate giving the details of the function void removeDuplicate().

The super class, main function and algorithm need NOT be written.

Question 11

[2]

(a) A linked list is formed the object of the class below.

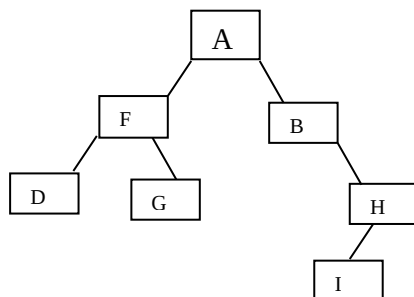
```
class node
{
    double sal;
    node next;
}
```

Write an algorithm or a method to add a node at the end of an existing linked list.

The method declaration is as follows

void addnode(Node ptr, double ss)

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



(i) Write the preorder traversal of the above tree structure.

[1]

(ii) Name the parent of the Node D and B

[1]

(iii) State the level of E and F when the root is at level zero(0).

[1]