

Reading Time: 15 minutes

MARKS: 70

Writing Time: 3 hrs.

(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 .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**

- i) The dual of $Y.X+X'+1=1$ will be: [1]
a) $(Y+X).(X.0)=0$
b) $(Y+X).(X'.0)=1$
c) $(Y.X).(X'.1)=0$
d) $(Y+X).(X'.0)=0$
- ii) The law which states $X+(Y+Z)=(X+Y)+Z$ is: [1]
a) Idempotence
b) Associative
c) Involution
d) Distributive
- iii) From the declaration given below state the nature of the identifiers A,B,C,D: [1]
class A extends B implements C
a) Super class- A, Subclass –B, Interface -C
b) Super class- B, Subclass –A, Interface -C
c) Super class- C, Subclass –B, Interface -A
d) Super class- A, Subclass –C, Interface -B
- iv) Canonical SOP form of $A+B$ will be: [1]
a) $AB+AB'+A'B$
b) $A'B+AB'+A'B'$
c) $AB'+AB'+A'B$
d) $AB+A'B'+A'B$
- v) The converse of the given conditional statement will be ? [1]
Statement:- if 16 is divisible by 2 then it is an even number.
a) 16 is an even number if it is divisible by 2.
b) if 16 is an even number then it is divisible by 2.
c) 16 is an even number as it is divisible by 2..
d) if 16 is not an even number then it is not divisible by 2.

- vi) Write a statement to replace all the 'o' with 'p' in the given string. [1]
String s="Site is beginnersBook.com";
- vii) Draw the logic circuit for: $F=(A \text{ XOR } B) \text{ AND } C$. [1]
- viii) Write any one difference between half adder and full adder? [1]
- ix) State any two characteristics of a binary tree. [1]
- x) State any one purpose of using the keyword **this** in Java programming. [1]

Question 2

- i) Convert the following infix notation to postfix form. [2]
 $(A - B) / C * (D - E) + F$
- ii) A double dimensional array arr[4][4] has contain floating type elements. If arr[2][2] is stored at memory location 2000, find the base address of the array. Assume that the array is row major oriented. [2]
- iii) With reference to the code given below answer the questions that follow.

```
int strange(int x,int y)
{ // Assuming x>=0 and y >0
if(x>=y)
{
    x=x-y;
    return strange(x,y);
}
else
{ return x ;} }
```

- a) What will the function strange () return when x=15 and y = 6 ? [2]
- b) What the function strange() is doing? [1]

- iv) With reference to the code given below answer the questions that follow.

```
void calling(int i)
{
int f=2;
show(n,f);
}

int show(int n, int f)
{
if(n= =f)
return 1;
if (n%f = = 0 || n= =1)
return 0;
else
return show(n, f+1)
```

a) What will be the function show() return when the value of n is 11 ? [2]

b) What is the aim of function show() ? [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

i) Given the Boolean function : $F(A,B,C,D) = \pi(4,6,7,10,11,12,14,15)$

(a) Reduce the above expression by using 4-variable Karnaugh map, showing the 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]

ii) Given the Boolean function : $F(A,B,C,D) = \sum(0,1,2,4,5,6,8,9,12,13,14)$

(a) Reduce the above expression by using 4-variable Karnaugh map, showing the 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) In a home delivery store , it was observed that the sales were more if any one of the following conditions were true- [5]

- There were rains and the time was after 8 pm
- The season was summer and the year-end sale was on.
- The year –end sale was not on but there were rains.
- The time was not after 8 pm and the year –end sale was not on.

The inputs are:

INPUTS	
R	There were rains
S	The season was summer and the year-end sale was on.
T	The time was after 8 pm
Y	The year-end sale was not on.

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

Output: M [1 indicates purchased, 0 indicates not purchased for all cases]

Draw the truth table for the inputs and outputs given above and write the **SOP** expression.

ii) State the De Morgan’s laws. Prove anyone using truth table [3]

iii) Verify the following expression using Boolean laws: [2]

$$(z+x) (z+x+y) = (z+x) (x+y)$$

Question 5

i) Define half adder. Construct the truth table and logic diagram of half adder. [5]

ii) Draw Truth Table for $P \wedge (\sim P \vee Q)$. [3]

iii) Write min term and max term, when the inputs are A=0, B=1, C=1 and D=0. [2]

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 DeciOct has been defined to convert a decimal number into its equivalent octal number.

Some of the members of the class are given below:

Class name : **DeciOct**

Data member/instance variable

n : to store the decimal number
oct : stores the octal equivalent number

Member functions/Methods

DeciOct() : default constructor to initialize data members n=0 and oct=0

void getnum(int nn) : assign nn to n

void deci_oct() : calculate the octal equivalent of 'n' and stores it in 'oct' using **recursive technique.**

void show() : Display the decimal number 'n' and calls the function deci_oct() and display it's octal equivalent.

Specify the class DeciOct , giving the details of the constructor(), void getnum(int),void deci_oct() and void show(). Define the main() function to create an object and call the functions accordingly.

Question 7

A class **Flex** works on an array to perform certain tasks.

[10]

Design a class Flex to bring the even elements at front and sends odd elements at the back.

The members of the class are given below:

Class name : **Flex**

Data member/instance variable

Exa[], Exb[] : integer arrays of size n
int n : integer to store the size of member arrays

Member functions/Methods

Flex() : parameterized constructor to initialize n and allocate memory to the member array
void fnGet() : to fill the member array Exa[] with random integers
void fnDisplay() : to display member arrays with proper message
void fnTransfer() : transfer the elements from Exa[] to Exb[] such that the even elements are in front and the odd elements are at the end.

Specify the class Flex giving details of the above member data and methods. **You need not** to write main function.

Question 8

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:

[10]

Class name : **Sort**

Data member/instance variable

str : to store a string
len : integer to store the length of the string

Member functions/Methods

Sort() : Default constructor to initialise the data members
void readword() : to accept the word
void arrange() : to arrange the word in alphabetical order using any standard sorting technique.
void display() : to display the original word along with the sorted word

Specify the class Sort giving details of the above member data and methods and constructor, 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 stepwise.

This can be achieved by using comments in the program. The programs must be written in Java. (Flowcharts and Algorithms are **not** required.)

Question 9

[5]

i) A super class Circle has been defined to store the details of a circle. Another class Circumference is derived from Circle which performs certain calculations.

The details of the members of both the classes are given below:

Class name : **Circle**

Data member/instance variable :

int Rad : an integer to store radius

Member functions/Methods

Circle() : parameterized constructor to initialize the data members

void show() : to display the member data

Class name : **Circumference**

Data member/instance variable :

double Cir : to store circumference

Member functions/Methods

Circumference() : parameterized constructor to pass arguments to the base class and initialize the data member of current class to null

void CalCircum() : calculates the circumference using the formula

$$2 \pi r \text{ where } \pi = 22/7$$

void show() : to display the member data

Assume that the superclass Circle has been defined. Using the **concept of Inheritance** specify the class Circumference giving the details of the constructor, void CalCircum() and void show().

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

Question 10

Define a class Repeat which allows the user to add elements from one end(rear) and remove [5]

The details of the members of the class Stack are given below:

Class name : **Stack**

Data member/instance variable :

st [] : array to hold names
 top : to store the position of the topmost element
 ctr : to count the number of elements of the stack

Member functions/Methods

Stack () : default constructor to initialize the data members
 Stack (int cap) : constructor to initialise size=cap and top= -1
 void pushname(String n) : to push a name into the stack. if the stack is full display message 'Overflow'.
 String popname(String n) : Removes a name from the top of the stack and returns it. if the stack is empty display message 'Underflow'.
 void display() : display the elements of the stack.

Specify the class Stack giving details of the constructor, void pushname(String n), String popname() and void display().

You need **not** to write main function and algorithm.

Question 11

i) A linked list is formed from the objects of the class: [2]

```

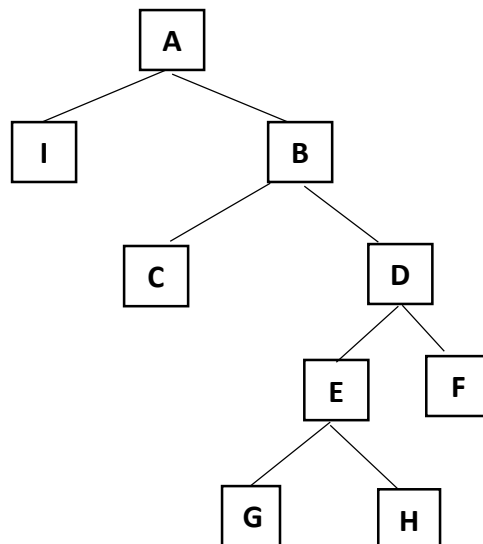
class Node
{
    int item;
    Node next;
}
  
```

Write an Algorithm **OR** a Method to insert a node at the middle of an existing linked list. The method declaration is as follows:

```

void InsertNode( Nodes starPtr, int n )
  
```

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



- i) What is the degree of node E. [1]
- ii) Write the post-order traversal of the above tree. [1]
- iii) What is the height of the tree when the root of the tree is at level 0 ? [1]