

**I PRE BOARD EXAMINATION
COMPUTER SCIENCE**

**Paper 1
(THEORY)**

Three hours

*(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** questions from Section B,
two questions from Section C.*

*All working including rough work, should be done on the same sheet as the
rest of the answers.*

The intended marks for questions or parts are given in brackets [].

PART - I

. Attempt **all** questions.

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

Question 1

(i) The law which states $(A' + B')'' = (A' + B')$ is :

[1]

- (a) Complement Law
- (b) De Morgan's Law
- (c) Involution Law
- (d) Commutative Law

(ii) $P \rightarrow PQ$ is equals to :

[1]

- (a) 1
 - (b) 0
 - (c) $P'Q$
 - (d) $P' + Q$
-

This paper consists of 10 printed pages.

- (iii) The complement of the Boolean expression $P \rightarrow Q$ is : [1]
- (a) $P' + Q$
 - (b) $P + Q'$
 - (c) $P \cdot Q$
 - (d) $P \cdot Q'$
- (iv) If $(\sim x \rightarrow y)$ then, its contrapositive will be : [1]
- (a) $x \rightarrow y$
 - (b) $\sim y \rightarrow x$
 - (c) $\sim y \rightarrow x$
 - (d) $\sim x \rightarrow y$
- (v) the propositional operator \rightarrow represents : [1]
- (a) Disjunction
 - (b) Conjunction
 - (c) Implication
 - (d) Equivalence
- (vi) Write the cardinal POS form of the the function $y(A, B) = AB$. [1]
- (vii) Draw OR gate using NOR gate only. [1]
- (viii) State any one purpose of using the keyword *extends* in Java programming. [1]
- (ix) Define *abstract class*. [1]
- (x) What do you mean by syllogism? [1]

Question 2

- (i) Convert the following *infix* notation to *postfix* form. [2]
- $$P * (Q / R + S) / (T - U / W)$$
- (ii) A matrix $X[-5 \dots + 15][2 \dots 10]$ is stored in the memory with each element [1]
requiring 4 bytes of storage. If the base address is 2160, find the address of
 $X[5][7]$ when the matrix is stored in column majorwise.

(iii) With reference to the code given below answer the questions that follow :

```
int Solve(int n)
{
    int i, s = 0;
    for(i = 2; n != 1; i++)
    {
        if(n % i == 0)
        {s = s + i; n = n/i; i--;}
    }
    return s;
}
```

- (a) What will the function **Solve()** return when the value of **n = 30**? [2]
- (b) What is the method **Solve()** computing? [1]

(iv) The following function **quiz()** is a part of some class. Assume 'n' is a positive integer, greater than 0, Answer the given questions along with dry run / working.

```
int quiz(int n)
{
    if(n <= 0) return n;
    else
    return quiz(n/2) * 10 + (n % 2);
}
```

- (a) What will the function **quiz()** return when the value of **n = 37**? [2]
- (b) State in one line what does the function **quiz()** do, apart from recursion? [1]

PART - II [50 MARKS]

Answer six questions in this part, choosing two questions from Section A and two questions from Section B and two from Section C.

SECTION - A

Answer any two questions.

Question 3

- (i) Given the Boolean function $F(A, B, C, D) = \Sigma (0, 2, 3, 4, 5, 6, 7, 8, 10, 11, 15)$
- (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 using NAND gate only. Assume that the variables and their complements are available as inputs. [1]
- (b) Given the Boolean function $F(A, B, C, D) = \pi (0,1,2,3,4,5,6,7,8,9,10,11,12,14,15)$.
- (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 using NOR gate only. Assume that the variables and their complements are available as inputs. [1]

Question 4

- (i) The principal of a school intends to select students for admission to Class XI on the following criteria: [5]
- Student is of the same school and has passed the Class X Board Examination with more than 60 % marks.
- OR
- Student is of the same school, has passed the Class X Board Examination with less than 60 % marks but has taken active part in co-curricular activities.
- OR
- Student is not from the same school but has either passed the Class X board Examination with more than 60 % marks or has participated in Sports at the national level.

INPUTS

S Student is of the same school

P Has passed the Class X Board Examination with More than 60% marks

C Has taken active part in co-curricular activities.

T Has participated in sports at the National Level.

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

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

Draw the truth table for X(S, P, C, T) the inputs and outputs given above and write the **POS** Expression

- (ii) What is a Full adder? Draw the logic circuit OF Full adder using two half adder and one OR gate. [3]
- (iii) Write the Cardinal POS for : $F(P, Q, R) = (P + R') \cdot Q$ [2]

Question 5

- (i) What is a Decoder? How is it different from a Encoder? Draw the logic circuit for a 3 to 8 Decoder and explain its working. [5]
- (ii) Verify if the following proposition is valid or not using truth table method: [3]
 $(P \rightarrow Q) \vee (P' \rightarrow R) = P \rightarrow (Q' \wedge R)$
- (iii) Simplify using Boolean laws $F(A, B, C) = AB' + AC' + BC$ [2]

SECTION - B

Answer any two questions

Each program should be written in such a way that its clearly depicts the logic of the problem.

This can be achieved by using mnemonic name and comments in the program.

(Flowcharts and Algorithms are **not** required)

The programs must be written in Java.

Question 6

[10]

Design a class change to convert a decimal number to its equivalent in base 16 Eg.

- (i) The decimal number 35 is 23 in base 16. (ii) The decimal number 107 is 6B in base 16.

Some of the members of the class are given below :

Class name : change

Data members

dec : integer type Decimal number

hex : String to store hexadecimal form.

Member functions

change() : constructor to assign initial values.

void input() : accepts integer to be converted to base 16.

String hexa(int n) : to convert n to hexadecimal form using recursion.

void display() : to display decimal and hexadecimal number.

Specify the class change giving the details of the constructor and the functions void input(), String hexa(int) and void display(). Also define the main function to create an object and call the methods accordingly to enable the task.

Question 7

A class Combine contains an array of integers which combines two arrays into a single array including the duplicate elements, if any, and sorts the combined array.

Some of the members of the class are given below:

Class Name : Combine

Data members

com[] : integer array

Size : size of the array

Member functions/methods

Combine(int nn) : parameterized constructor to assign size = nn

void inputarray() : to accept the array elements

void sort() : sorts the elements of combined array in ascending order using selection sort

void mix(Combine A, Combine B) : combines the parameterized object arrays and Store the result in the current object array along with the duplicate elements, if any.

void display() : displays the array elements.

Specify the class Combine giving details of the constructor(int), void inputarray(), void sort(), void mix(Combine, Combine) and void display(). Also define the main function to create an object and call the methods accordingly to enable the task.

Question 8

A class Mystring has been defined for the print the code of each word . code will be calculated by adding the ASCII code of each character eg: word is "ACE" then code will be calculate 201 (65 + 67 + 69) . Define the class Mystring using following methods

Class name : Mystring

Data members

str : to store a string

c : To store the code of word

Member functions

Mystring() : Constructor

void readstring() : reads the given string from input.

int code(String w) : Returns code for the 'w' word.

void display() : display each word in separate line with code of string str.

Specify the class Mystring giving details of the constructor and void readstring(), int code(int index), void word() only. Write the main function to create objects and call the unction accordingly.

SECTION 'C'

Answer only **two** questions.

Each program should be written in such a way that its 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

Link is an entity which can hold a maximum of 100 integers. Link enables the user to add elements from the rear end and remove integers from the front end of the entity.

Define a class Link with the following detail.

Class Name : Link

Data members

lnk[] : entity to hold the integer elements,

max : stores the maximum capacity of the entity,

begin : to point to the index of the front end.

end : to point to the index of the rear end.

Member functions

Link(int mm) : constructor to initialize max = mm, begin = 0, end = 0.

void addlink(int v) : to add an element from the rear index if possible otherwise display the message "OUT OF SIZE".

~~int~~ intdellink() : to remove and return an element from the front index, if possible otherwise display the message "EMPTY..." and return -99.

void display() : displays the elements of the entity.

a) Specify the class Link giving details of the constructor(int), void addlink(int), intdellink() THE MAIN FUNCTION AND ALGORITHM NEED NOT BE WRITTEN. [4]

b) What type of data structure is the above entity? [1]

Question 10**[5 Marks]**

A super class Detail has been defined to store the details of a customer. Define a sub class Bill to compute the monthly telephone charge of the customer as per the chart given below:

NUMBER OF CALLS	RATE
1 – 100	Only rental charge
101 – 200	90 paisa per call + rental charge
201 – 300	2.50 ₹ per call + rental charge
Above 300	4.5 ₹ per call + rental charge

The details of both the classes are given below :

Class Name : **Detail**

Data members

Name : to store the name of the customer.
Address : to store the address of the customer.
Telno : to store the phone number of the customer.
Rent : to store the monthly rental charge

Member functions :

Detail(..) : parameterized constructor to assign values to data members

void show() : to display the detail of the customer.

Class Name : **Bill**

Data members

N : to store the number of calls.
Amt : to store the amount to be paid by the customer.

Member functions:

Bill(..) : parameterized constructor to assign values to data
Member of both classes

void cal() : calculates the monthly telephone charge as per the charges given above

void show() : to display the detail of the customer and amount to be paid

Using the concept of inheritance, specify the class Bill giving details of the constructor(), void and void show(). THE SUPER CLASS AND MAIN FUNCTION AND ALGORITHM NEED NOT BE WRITTEN.

Question 11

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

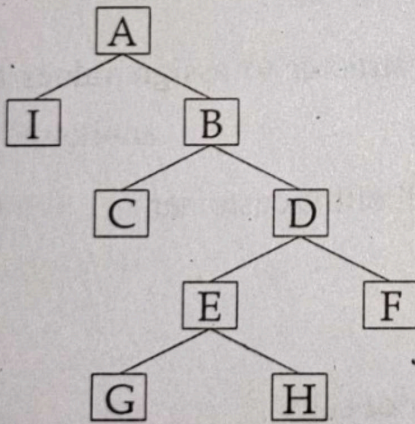
```
class Node
{
    int item; Node next;
}
```

Write an algorithm or a method to count the number of nodes in the linked list. The method declaration is given below :

```
int count(Node ptr_start)
```

[2]

(b) Answer the following questions from the diagram of the binary tree given :



(i) Inorder traversal of tree

[1]

(ii) Internal Nodes of Right subtree

[1]

(iii) Height of B, and Level of F

[1]

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