

# II 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.)

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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 [ ].

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### 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 :

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

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

- (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)  $\sim y \rightarrow \sim x$
  - (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  $y(A, B) = (A + B)(A' + B')$ . [1]
- (vii) Draw NOR gate using NAND gate only. [1]
- (viii) State any one purpose of using the keyword *extends* in Java programming. [1]
- (ix) Define *interface inheritance*. [1]
- (x) What do you mean by Base Case? [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 8000, 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 = 2, s = 0;
```

```
while (n!=1)
```

```
{
```

```
if(n % i == 0)
```

```
{
```

```
s = s + i;
```

```
n = n/i;
```

```
}
```

```
else 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 <= 1) return 0;
```

```
else
```

```
return print(n - 2) + 2 * n - 1;
```

```
}
```

(a) What will the function **quiz()** return when the value of **n = 6**? [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  $F(A, B, C, D) = \pi (0, 2, 3, 7, 10, 11, 14, 15)$ .
- (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 using NOR gate only. Assume that the variables and their complements are available as inputs. [1]

**Question 4**

- (i) The inaugural function of the newly constructed flyover has been organized by the Public Works Department. Apart from a few special invitees, entry is permitted only if :
- The person is an employee of the PWD of Class I category with more than 10 years of working experience.

**OR**

- The person is an employee of any other government or authorized private organization either at the managerial level or with more than 10 years of working experience.

The inputs are :

A : The person is a Class 1 employee of PWD.

B : The person is an employee of any other government or authorized private organization.



- C : The person has more than 10 years of working experience.  
 D : The person is holding a managerial post.  
 Output :  
 X : Denote eligibility (1 indicate yes in all cases and 0 denote no in all cases)

Draw the truth table for X(A, B, C, D) and write the SOP expression, for X(A, B, C, D). [5]

- (ii) What is a HALF adder? Draw the POS expression of SUM using NOR gate only. [3]  
 (iii) Write the Canonical POS for :  $F(P, Q, R) = \pi(0, 2, 4, 6, 7)$  [2]

**Question 5**

- (i) What is a Multiplexer? Draw the logic circuit for a  $8 \times 1$  Logic Diagram. Explain its working. [5]  
 (ii) What is difference between Encoder and Decoder? Write the truth Table for  $3 \times 8$  Decoder. [3]  
 (iii) Simplify using Boolean laws  $F(A, B, C) = (A + B') + (A + C')(A + B' + C')$ . [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 to check a number is automorphic number or not . An automorphic number is number that's square contain the same digits at the end as number is having. Example 6 (square of 6 is 36 , contains 6 at the end) 5, 25 , etc



Some of the members of the class are given below:

Class name : automorphic

**Data members**

n : integer type number.  
Sq : to store square form.

**Member functions**

automorphic(int n) : constructor to assign n value.  
booleanisAuto(int n1, int sq1) : Accept n value and square of n and return true/false if n is automorphic number or not using recursion.  
void display() : to display data members also print n is automorphic number or not.

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

**Question 7**

[10]

A class Matrix contains an square matrix of m\*m size , contains the following functions

Class Name : Matrix

**Data members**

ary[ ] : integer matrix  
M : size of the matrix

**Member functions/methods**

Matrix(int m1) : parameterized constructor to assign the data members and initialize matrix  
voidinput() : to accept the matrix elements  
Matrix swap(Matrix A) : Swap the elements of both the diagonals of A object matrix and return it.  
void display() : displays the array elements in matrix format.



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

Input Matrix	Output Matrix ( after diagonals swap)
4 5 6 7	7 5 6 4
8 7 9 3	8 9 7 3
2 3 6 5	2 6 3 5
1 2 3 9	9 2 3 1

### Question 8

[10]

A class Mystring has been defined to count the words which starts from an vowel in a text.

Define the class Mystring using following methods :

Class name : Mystring

#### Data members

Sent : to store a string

Count : To count words starts from an vowel.

#### Member functions

Mystring( ) : Default Constructor

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

int check(String w) : Return 1 if 'w' word is starting with an vowels otherwise return 0.

void display( ) : Display the string and also count the numbers of words starts from an vowels and print it.

Specify the class Mystring giving details of the constructor and void read( ), int check(String w) and void display( ) only. Write the main function to create objects and call the function accordingly.



## SECTION 'C'

Answer only **two** questions.

Each program should be written in such a way that it 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

[5]

List is an entity which can insert or delete the elements from the top only. class List with the following detail.

Class Name : List

#### Data members

names[ ] : entity to hold the names of books.

top : stores the index value of topmost element.

max : to store the size of the array

#### Member functions

List(int mm) : constructor to initialize max = mm, top = 0.

void add(int v) : to insert the elements at the top if possible otherwise display the message "OUT OF SIZE".

String del() : to remove and return an element from the top index, if possible otherwise display the message "EMPTY LIST" and return "\$\$".

void display() : displays the elements of the names [ ].

a) Specify the class List giving details of the constructor(int ), void add(int ), String del( ). The main function and algorithm need not to be written.



**Question 10****[5]**

A class Employee contains employee details and another class Salary calculates the employee's net salary. The details of the two classes are given below :

Class name : Employee

**Data members**

empNo : stores the employee number.

empName : stores the employee name

**Member functions :**

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

void display() : display the employee details.

Class name : Salary

**Data members**

basic : double variable to store the basic pay.

**Member functions**

Salary(...) : parameterized constructor to assign values to of both classes data members

double calculateNetSalary() : calculates the employee's net salary according to the following rules :

DA = 10% of basic

HRA = 15% of basic

Salary = basic + DA + HRA

PF = 8 % of Salary

Net Salary = Salary - PF

void display() : display all the data members of both classes with net salary.

Specify the class Salary giving details of the constructor and the member functions void calculate( ) and void display( ). Assume Employee class has been already defined. The main function need not be written.



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

```
class Node
```

```
{
```

```
    int item; Node next;
```

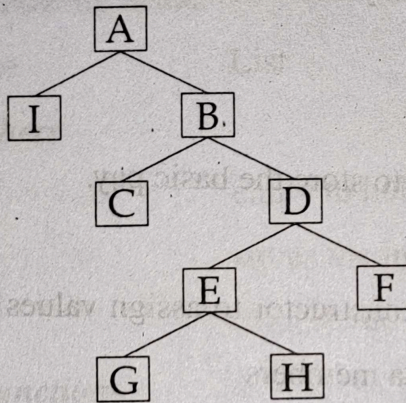
```
}
```

Write an algorithm or a method to delete last node from the list. The method declaration is given below :

```
int count(Node startPtr)
```

[5]

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



(i) Postorder traversal of tree

[2]

(ii) External Nodes of left subtree

[2]

(iii) Sibling of B, and degree of H

[1]

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