# I TERM EXAMINATION 

CLASS: XII
COMPUTER SCIENCE
PAPER 1
(THEORY)
(Maximum Marks: 70)
(Time allowed: 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 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.
(b) Find the complement of the following Boolean expression using De Morgan's law:

$$
\mathrm{F}(\mathrm{P}, \mathrm{Q}, \mathrm{R})=\mathrm{P}+\left(\mathrm{Q}^{\prime}+\mathrm{R}\right)
$$

(c) Find the dual of: $\left(A^{\prime}+0\right) \cdot\left(B^{\prime}+1\right)=A^{\prime}$ [1]
(d) State whether the following proposition is a tautology, contradiction or a contingency:

$$
F=(P=>Q) V(Q=>\sim P)
$$

(e) Study the diagram given below and answer what will be the value of X when $\mathrm{A}=1$ and $\mathrm{B}=0$ ?


## Question 2

(a) State the difference between break and continue.
(b) A matrix $\mathrm{B}[10][20]$ is stored in the memory with each element requiring 2 bytes of storage. If the base address at $\mathrm{B}[2][1]$ is 2140, find the address of $\mathrm{B}[5][4]$ when the matrix is stored in Column Major Wise.
(c) What is Coersion? Explain with the help of an example.
(d) Why object is known as an instance of a class? Give suitable example.
(e) What is the significance of the keyword 'new' in Java? Mention the areas where it is used.

## Question 3

The following function check( ) is a part of some class. What will the function check( ) return when the value of (i) $\mathbf{n}=\mathbf{2 5}$ and (ii) $\mathbf{n}=10$. 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);
\}

## 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 4

(a) Given the Boolean function: $\mathbf{F}(\mathbf{A}, \mathbf{B}, \mathbf{C}, \mathbf{D})=\sum(\mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \mathbf{4}, \mathbf{5}, \mathbf{8}, \mathbf{9}, \mathbf{1 0}, \mathbf{1 1}, \mathbf{1 2}, \mathbf{1 3}, \mathbf{1 4})$.
(i) Reduce the above expression by using 4 -variable Karnaugh map, showing the various groups (i.e. octal, quads and pairs).
(ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.
(b) Given the Boolean function: $\mathbf{F}(\mathbf{A}, \mathbf{B}, \mathbf{C}, \mathbf{D})=\pi(\mathbf{3}, \mathbf{4}, \mathbf{6}, \mathbf{9}, \mathbf{1 1}, \mathbf{1 2}, \mathbf{1 3}, 14,15)$.
(i) Reduce the above expression by using 4 -variable Karnaugh map, showing the various groups (i.e. octal, quads and pairs).
(ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs.

## Question 5

(a) Draw the logic circuit diagram for an octal to binary encoder and explain its working when a particular digit is pressed. Also, state the difference between encoders and decoders.
(b) Draw the circuit of a two input XOR gate with the help of NOR gates.
(c) Convert the following expression to its cardinal SOP form:

$$
F(P, Q, R)=P^{\prime} Q^{\prime} R+P^{\prime} Q R+P Q^{\prime} R^{\prime}+P Q R^{\prime}
$$

## Question 6

A company intends to develop a device to show the high status power load for a household invertor depending on the criteria given below:

- 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 | A Air conditioner is on |
| :---: | :--- |
| G | G Geyser is on |
| R | R Refrigerator is on |
| W | 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 $\mathbf{X}(\mathbf{A}, \mathbf{G}, \mathbf{R}, \mathbf{W})$.
Also draw the logic circuit for simplified expression.
$\qquad$
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 7

[10]
Design a class Convert to find the date and the month from a given day number for a particular year.
Example: If day number is 64 and the year is 2020 , then the corresponding date would be: March 4, 2020 i.e.
$(31+29+4=64)$
Some of the members of the class are given below:
Class name : Convert
Data members/instance variables:
$\mathrm{n} \quad:$ integer to store the day number
d : integer to store the day of the month (date)
m : integer to store the month
y : integer to store the year

## Methods/Member functions:

Convert () : constructor to initialize the data members with legal initial values
void accept() : to accept the day number and the year
void day_to_date( ) : converts the day number to its corresponding date for a particular year and stores the date in
' d ' and the month in ' m '
void display() : displays the month name, date and year
Specify the class Convert giving details of the constructor ( ), void accept ( ), void day_to_date( ) and void
display( ). Define a main ( ) function to create an object and call the functions accordingly to enable the task.

## Question 8

Design a class BinSearch to search for a particular value in an array.
Some of the members of the class are given below:
Class name : BinSearch
Data members/instance variables:
arr[] : to store integer elements
$\mathrm{n} \quad$ : integer to store the size of the array
Member functions/methods:
BinSearch(int nn ) : parameterized constructor to initialize $\mathrm{n}=\mathrm{nn}$
void fillarray() : to enter elements in the array
void sort () : sorts the array elements in ascending order using any standard sorting technique
int bin_search(int l,int $u$,int $v$ ): searches for the value ' $v$ ' using binary search and recursive technique and returns its location if found otherwise returns -1
Define the class BinSearch giving details of the constructor ( ), void fillarray( ), void sort( ) and int bin_search (int,int,int). Define the main( ) function to create an object and call the functions accordingly to enable the task.

## Question 9

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".
Some of the members of the class are given below:
Class name : Mix

Data member/instance variable:
wrd : to store a word
len
: to store the length of the word

## Member functions/methods:

$\operatorname{Mix}() \quad$ : default constructor to initialize the data members with legal initial values
void feedword () : to accept the word in UPPER case
void mix_word(Mix P, Mix Q) : mixes the words of objects $P$ and $Q$ as stated above and stores the resultant word in the current object
void display() : displays the word
Specify the class Mix giving the details of the constructor( ), void feedword( ), void mix_word( Mix, Mix ) and void display( ). Define the main( ) function to create objects and call the functions accordingly to enable the task.
$\qquad$
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 and mnemonic names or pseudo codes for algorithms. The programs must be written in Java and the algorithms must be written in general / standard form, wherever required / specified. (Flowcharts are not required.)

## Question 10

Write a program to input two numbers and check whether the numbers are Twin Prime.
Twin Prime numbers are the Prime Numbers whose difference is two(2). For e.g. $(5,7),(11,13),(17,19)$
Question 11
Write a program to accept a number from the user and check it is an Automorphic Number.
Automorphic number is the number, which is contained in the last digit(s) of its square. For e.g. 25 is an automorphic number as its square is 625 and 25 is present as the last two digits.

Question 12
Write a program to input a string and print the Piglatin string.
A string is said to be in Piglatin form when it is obtained by forming a new word by placing the fore vowel of the original word at the start of the new word along with the letters following it. The letters present before the first vowel are shifted to the end of the new word, followed by 'ay'.

