

1st Pre-Board Examination 2023-24  
Sub : Computer Science  
Class : XII

Set - 1

Time : 3 hrs.

(Candidates are allowed additional 15 minutes for only reading the paper  
They must NOT start writing during this time.)

M.M. : ~~80~~ 70

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

**Part I (20 Marks)**  
**(Answer all questions)**

Question : 1

- (i) The sum of Half Adder having two inputs A and B is : [1]  
(a)  $AB + A'B'$  (b)  $(A \odot B)$   
(c)  $(A \odot B)'$  (d)  $A'B' + AB'$
- (ii) **Assertion** : Product term and minterm in boolean algebra are always the same. [1]  
**Reason** : Minterm is the product of all the literals with or without bar with in logic system.  
(a) Both assertion and reason are true and reason is the correct explanation for assertion.  
(b) Both assertion and reason are true but reason is not the correct explanation for assertion.  
(c) Assertion is true and reason is false.  
(d) Assertion is false and reason is true.
- (iii) Choose the correct Logic Gate that provide output as 0 when both inputs are same (either 0 and 1) [1]  
(a) XNOR (b) XOR  
(c) NOR (d) NAND
- (iv)  $\sim A \vee \sim B$  is equivalent to? [1]  
(a)  $\sim A \rightarrow \sim B$  (b)  $\sim A \wedge \sim B$   
(c)  $A \rightarrow \sim B$  (d)  $B \vee A$
- (v) If  $(X \rightarrow Y)$  then its Contrapositive is : [1]  
(a)  $X' \rightarrow Y'$  (b)  $Y' \rightarrow X'$   
(c)  $Y \rightarrow X$  (d)  $X \rightarrow Y$
- (vi) **Assertion** : Multiplexer is a selector circuit [1]  
**Reason** : Multiplexer selects one input from many and directs to output signal.  
Which of the following option is correct?  
(a) Assertion and Reason both are true and Reason is the correct explanation of Assertion.  
(b) Assertion and Reason both are true and Reason is not the correct explanation of Assertion.  
(c) Assertion is true and Reason is false.  
(d) Assertion is false and reason is true.

- (vii) Write two characteristics of a Binary Tree. [1]
- (viii) Mention any two properties of the data members of an Interface. [1]
- (ix) State two advantages of using the concept of inheritance in java. [1]
- (x) Write the use of super keyword. [1]

**Question : 2**

- (i) A matrix N[11][8] is stored in the memory with each element requiring 2 bytes of storage. If the base address at N[2][3] is 2140, find the address of N[7][5] when the matrix is stored in Row Major Wise. [2]
- (ii) Convert the following infix expression into postfix expression : [2]  

$$\left[ \left\{ (a + b \uparrow c * d) \$ f \right\} + e / g \right]$$
- (iii) The following function is a part of some class to perform same task on string. Answer the question that follows with dry run or working : [3]

```
void work (String s, int v)
{
    if (v<s.length())
    {
        char ch=s.charAt(v);
        System.out.print(ch+" ");
        work(s,v+1);
        System.out.println("\n"+ch+"@");
    }
}
```

- (a) What is the output of the function work ("INTEL",0) when invoked?
- (b) What is the output of the function work ("run",0) when invoked?
- (iv) With reference to the code given below answer the question that follow with dry run/working :

```
public int solve (int p, int q)
{
    for (int r=0; p>0; r=q%p, q=p, p=r);
    return (p == 0 ? q : -1);
}
```

- (a) What will the function solve () return when the value of p=12 and q=8? [2]
- (b) What is the function solve () computing? [1]



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**Part II (50 Marks)**

**Section – A**

Answer any **two** questions.

**Question : 3**

(a) A school intends to select candidates for the Inter-School Athletic Meet, as per the criteria given below : [5]

\* The candidate is from the Senior School and has participated in an Inter-School Athletic Meet earlier.

OR

\* The candidate is not from the Senior School, but the height is between 5 ft. and 6 ft. and weight is between 50 kg. and 60 kg.

OR

\* The candidate is from the senior school and has height between 5 ft. and 6 ft., but weight is not between 50 kg. and 60 kg.

The inputs are :

INPUTS	
S	Student is from the Senior School
W	Weight is between 50 kg. and 60 kg.
H	Height is between 5 ft. and 6 ft.
A	Taken part in Inter-School Athletic Meet earlier

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

Output : **X** [1 indicates Yes, 0 indicates No for all the cases]

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

(ii) Reduce the above expression by using 4- variable Karnaugh map, showing the various groups (i.e. octal, quads and pairs). [5]

Draw the logic gate diagram for the reduced **SOP** expression for X(S, W, H, A) using **NAND** gate only. Assume that the variable and their complements are available as inputs.

**Question : 4**

(i) Given the Boolean function  $F(A,B,C,D) = \pi(0, 1, 2, 3, 5, 6, 7, 10, 13, 14, 15)$

(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) Define Full Adder. Construct truth table and logic diagram of a half adder. [3]

(iii) Draw the circuit of two input XOR gate with the help of NOR gates. [2]

**Question : 5**

(i) With the help of truth table and logic diagram explain 8 x 1 Multiplexer. [5]

(ii) Prove that:  $(A.B + A'.B'.C')$   $(A.B + A + B + C) = A.B$  [3]

(iii) Convert the following boolean expression into canonical POS: [2]

$$F(X,Y,Z) = (X' + Y').(Y + Z')$$

## Section – B

Answer any **two** questions.

### Question : 6

A class **DeciHex** has been defined to convert a decimal number into its equivalent hexadecimal number. Some of the members of the class are given below : [10]

Class Name	:	<b>DeciHex</b>
<b>Data Members/Instance Variables</b>	:	
n	:	(int) stores the decimal number
hex	:	(string) to store hexadecimal equivalent
<b>Member Functions/Methods</b>	:	
DeciHex()	:	constructor to initialize the data member n=0, hex=""
void getnum ()	:	to accept the value of 'n'
String deci_hex(int )	:	returns the hexadecimal equivalent of the integer 'n'.
void show()	:	displays the decimal no. 'n'. calls the function deci_hex() and displays the hexadecimal equivalent.

**Write the main function to create object of the class and call above member methods.**

### Question : 7

Design a class **UpperMat** to display the upper triangle of a square matrix of order [r x r]. The details of the class are given below : [10]

Class name	:	<b>UpperMat</b>
<b>Data Members/Instance Variable</b>	:	
arr[][]	:	two dimensional array of integer elements
r	:	integer to store size of matrix
<b>Member functions/Methods</b>	:	
UpperMat (int nr)	:	to initialize the size of the matrix r=nr
void fillarray()	:	to enter the elements of the matrix
void display()	:	to display the original matrix.
void dispUpper()	:	display the only upper triangle of the matrix.

**Example :**

**Input : r=3**

**Input Matrix**

3	5	7
1	6	4
2	4	7

**Original Matrix**

00	01	02	0
10	11	12	1
20	21	22	2

**Upper Triangle**

00	01	02	
10	11		
20			

**Write main function to create object of the class and call the functions accordingly to enable the task.**

### Question : 8

A class **the String** has been defined to perform string related operations : [10]  
Some of the members of the class are given below :

Class name	:	<b>theString</b>
<b>Data members/Instance variables</b>	:	
str	:	to store a string
cap	:	to store a counting of capital letters
sm	:	to store counting of small letters.
<b>Member functions/Methods</b>	:	
theString()	:	Default constructor
void read()	:	to accept a string in 'str'
void Recursive_fun(int)	:	to count the number of <b>uppercase</b> letters in <b>cap</b> and <b>lowercase</b> letters in <b>sm</b> from the string stored in str using <b>Recursive technique</b> .
void display()	:	displays the original string along with counting of uppercase letters and lowercase letters by invoking the function <b>Recursive_fun()</b> .

**Write main function to create object of the class and call the functions accordingly to enable the task.**

### Section – C

(Answer any **two** questions.)

### Question : 9

A super class contains details of the **Stock** of a retail store and a sub-class **Purchase** stores the details of the items purchased with the new rate and updates the stock. Some of the members of the class are given below : 10  
[5]

<b>Class name</b>	:	<b>Stock</b>
<b>Data members/instance variables</b>	:	
item	:	string to store the name of the item
qty	:	integer to store the quantity of an item in stock
rate	:	to store the unit price of an item
amt	:	to store the net value of the item in stock
<b>Member functions</b>	:	
Stock(...)	:	parameterized constructor to assign data members
void display()	:	displays the stock details.
<b>Class name</b>	:	<b>Purchase</b>
<b>Data members/instance variables</b>	:	
pqty	:	integer to store the purchased quantity
prate	:	to store the unit price of the purchased item.



<b>Member functions</b>	:	
Purchase(...)	:	parameterized constructor to assign values of data members of both the classes
void update()	:	to update the stock by adding the previous quantity by the purchased quantity and replace the rate of the item if there is a difference in the purchased rate. Also update the current stock value as : (quantity * unit price)
void display()	:	display the stock details before and after updation.

Assume that the super class **Stock** has been defined. Using the **concept of Inheritance** specify the class **Purchase** giving the details of the **constructor(...)**, **void update()** and **void display()**.

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

**Question : 10**

A bookshelf is designed to store the books in a stack with LIFO (Last In First Out) operation. Define a class **Book** with following specifications :

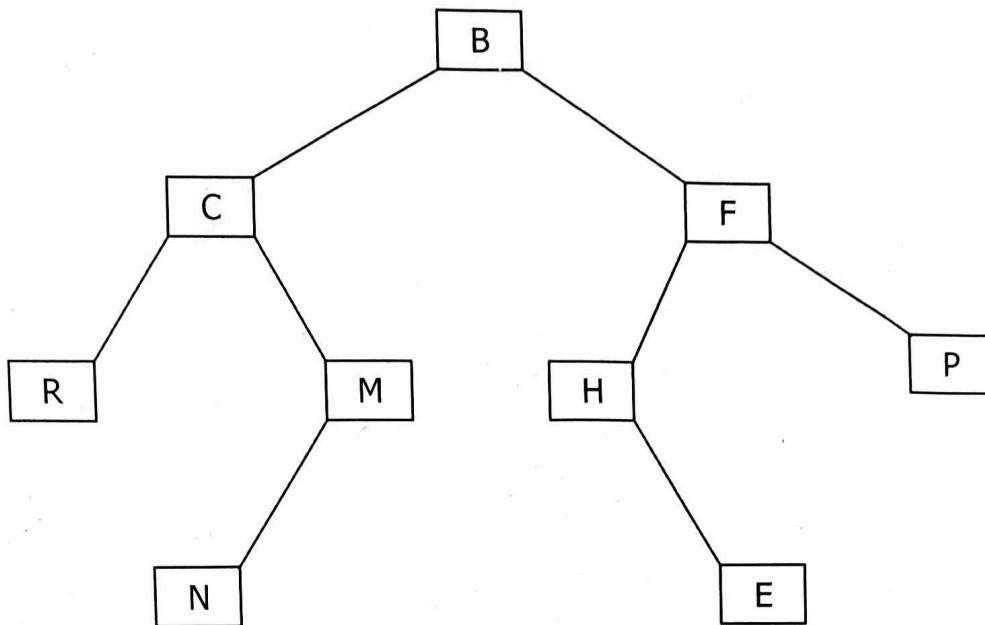
[5]

Class Name	:	<b>Book</b>
<b>Data Members/Instance variables</b>		
name[]	:	stores the name of the books
point <i>top</i>	:	stores the index of the topmost book
max	:	stores the maximum capacity of the bookshelf
<b>Methods/Member functions</b>	:	
Book() <i>in cap .</i>	:	constructor to initialise the data members max=cap and point=-1
void tell()	:	display the name of the book which was last entered in the shelf. If there is no book in the shelf, display the message "SHELF EMPTY"
void add(String v)	:	adds the name of the book to the shelf if possible, otherwise displays the message "SHELF FULL"
void display()	:	display all the names of the books available in the shelf.

Specify the class **Book** giving details of the functions **void tell()** and **void add(String)**. Assume that the other functions have been defined. **The main() function and algorithm need NOT be written.**

**Question : 11**

- (i) What is Complexity? Name the factors which effect the performance of a program. **[2]**
- (ii) Answer the following questions from the diagram of a Binary Tree given below :



- (a) Name the leaf nodes of the right sub tree. **[1]**
- (b) Write the post order traversal of the left sub tree of node B including itself. **[1]**
- (c) State the level number of nodes R and M when the root is at level 0. **[1]**