PRE BOARD EXAMINATION: 2022-23
CLASS – XII
SUBJECT – COMPUTER SCIENCE

Maximum Marks:70

Time Allowed: 3 hours

*(Candidates are allowed **additional 15 minutes** for **only** reading the paper. They must **not** start writing duringthis time.*

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*Answers **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)
(*Attempt all questions*)

Question 1:

(i) If A=1, B=0, C=0 and D=1, then MAXTERM will be [1]
a. A+B+C'+D
b. AB'C'D
c. A'+B+C+D'
d. AB'C'D'

(ii) If F(A,B,C)=∑(0,2,3,5) Then canonical POS will be [1]
a. AB'C'+A'BC'+A'BC+AB'C
b. (A+B+C')(A'+B+C).(A'+B'+C)(A'+B'+C')
c. (A'+B'+C')(A'+B+C).(A'+B'+C)(A'+B'+C')
d. A'B'C'+A'BC'+A'BC+AB'C

(iii) The Following proposition (~P^Q)V(P^~Q)V(~P^~Q) is equal to [1]
a. (~P^~Q)
b. ~(P^Q)
c. ~(PV~Q)
d. ~P+~Q

(iv) What is the contrapositive for the given proposition AV~B→C [1]
a. ~AVB-→~C
b. C→AV~B
c. ~C→~(AV~B)
d. NONE OF THESE

(v) The law which states $X+XY = X$ is: [1]
a) Commutative Law
b) Distributive Law
c) Absorption Law
d) Involution

(vi) Name the combinational circuit capable of adding two 3-bit numbers. [1]
(vii) State one purpose of using „this" operator in Java. [1]
(viii) What is Linked List? [1]
(ix) Define Interface? Write the keyword for using interface in a class. [1]
(x) State any one purpose of using the keyword super in Java Programming. [1]

Question 2:

(i) The array D [-2…10][3…8] contains double type elements. If the base address is 4110, find the address of D [4] [5], when the array is stored in Column Major Wise. [2]

(ii) Convert the following infix expression into postfix form: A + B / C * (D/E * F) [2]

(iii) With the reference to following program code, answer the questions

that follow:

```
void trick (int a, int b)
{
int p=1;
for ( int j=1; j<=b; j++ , p*=a);
System.out.println(p);
}
```

a) What will be the output of the method **trick( )** when the values of **a=3** and **b=4**? [2]

b) What is the method **trick( )** computing? [1]

(iv) The following function magicfun() is a part of some class. What will the function magicfun() return, when the value of n=7 respectively? Show the dry run/working: [3]

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

PART – II (50 Marks)

Answer six questions in this part. Choosing two questions from Section – A, two from Section – B and two fromSection – C

SECTION – A

(*Attempt any two questions)*

Question 3:

(a) Given the Boolean function F(A, B, C, D) = X (2, 3, 4, 5, 6, 7, 8, 10, 11).

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

(ii) Draw the logic gate diagram for the reduced expression. Assume that the variables and their complements are available as inputs. [1]

(b) Given the Boolean function F(P, Q, R, S) = π(0, 1, 2, 4, 5, 6, 8, 10).

(i) Reduce the above expression by using the 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. Assume that the variables and their complements are available as inputs. [1]

Question 4.

(a) A training institute intends to give scholarships to its students as per the criteria given below: [5]

The student has excellent academic record but is financially weak.

OR

The student does not have an excellent academic record and belongs to a backward class.

OR

The student does not have an excellent academic record and is physically impaired.

The inputs are:

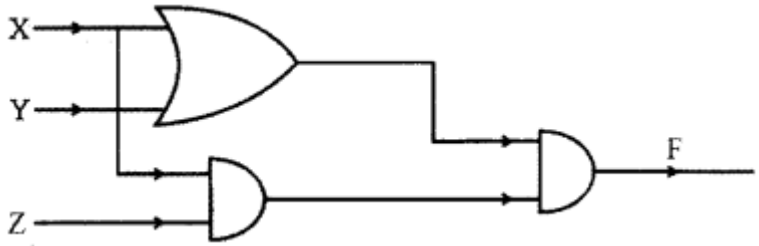
INPUTS	
A	Has excellent academic record
F	Financially sound
C	Belongs to a backward class
I	Is physically impaired

(In all the above cases 1 indicates Yes and 0 indicates No).
Output: X [1 indicates Yes, 0 indicates No for all cases]
Draw the truth table for the inputs and outputs given above and write the SOP expression for X(A, F, C, I).
(b)Diffrentiate between Half Adder and Full Adder. Draw the circuit diagram and truth table for Full Adder[3]
(c) Simplify the following expression, using Boolean laws: [2]

A.(A' + B).C.(A + B)

Question 5.

(a) How is a decoder different from a multiplexer? Write the truth table and draw the logic circuit diagram for a 3 to 8 decoder and explain its working. [5]
(b) From the logic circuit diagram given below, derive the Boolean expression and simplify it to show that it represents a logic gate. Name and draw the logic gate. [3]



(c) Using a truth table, state whether the following proposition is a Tautology, Contradiction or Contingency:

~(P =>Q)<=>(~P∨Q) [2]

SECTION – B

*Answer **any two** questions*

Each program should be written in such a way that it clearly depict the logic of the problem.
This can be achieved by mnemonic names and comments in the program.

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

The programs must be written in JAVA.

Question 6. [10]

A class Capital has been defined to check whether a sentence has words beginning with a capital letter or not.
Some of the members of the class are given below:
Class name: Capital
Data member/instance variable:
sent: to store a sentence
freq: stores the frequency of words beginning with a capital letter

Member functions/methods:
Capital () : default constructor
void input (): to accept the sentence
boolean isCap(String w): checks and returns true if the word begins with a capital letter, otherwise returns false
void display(): displays the sentence along with the frequency of the words beginning with a capital letter
Specify the class Capital, giving the details of the constructor( ), void input( ), boolean isCap(String) and void display( ). Define the main( ) function to create an object and call the functions accordingly to enable the task.

Question 7. [10]

Design a class ArmNum to check if a given number is an Armstrong number or not. [A number is said to be Armstrong if sum of its digits raised to the power of length of the number is equal to the number]
Example:
$371 = 3^3 + 7^3 + 1^3$
$1634 = 1^4 + 6^4 + 3^4 + 4^4$
$54748 = 5^5 + 4^5 + 7^5 + 4^5 + 8^5$
Thus, 371, 1634 and 54748 are all examples of Armstrong numbers.
Some of the members of the class are given below:
Class name : ArmNum
Data members/instance variables:
n : to store the number
l : to store the length of the number
Methods/Member functions:
ArmNum (int nn) : parameterized constructor to initialize the data member n = nn
int sum_pow(int i) : returns the sum of each digit raised to the power of the length of the number using recursive technique eg., 34 will return $3^2 + 4^2 = 25$ (as the length of the number is 2)
void isArmstrong() : checks whether the given number is an Armstrong number by invoking the function sum_pow () and displays the result with an appropriate message.

Specify the class ArmNum giving details of the constructor( ), int sum_pow(int) and void isArmstrong( ). Define a main() function to create an object and call the functions accordingly to enable the task.

Question 8. [10]

A class Shift contains a two-dimensional integer array of order (m×n) where the maximum values of both m and n are 5. Design the class Shift to shuffle the matrix (i.e. the first row becomes the last, the second row becomes the first and so on). The details of the members of the class are given below:
Class name: Shift
Data member/instance variable:
mat[][]: stores the array element
m: integer to store the number of rows
n: integer to store the number of columns
Member functions/methods:
Shift(int mm, int nn): parameterized constructor to initialize the data members m=mm and n=nn
void input(): enters the elements of the array

void cyclic(Shift p): enables the matrix of the object (P) to shift each row upwards in a cyclic manner and store the resultant matrix in the current object
void display(): displays the matrix elements
Specify the class Shift giving details of the constructor(), void input(), void cyclic(Shift) and void display(). Define the main() function to create an object and call the methods accordingly to enable the task of shifting the array elements.

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, whereverrequired / specified.

[Flowcharts are **not** required]

Question 9 [5]

A superclass Product has been defined to store the details of a product sold by a wholesaler to a retailer. Define a subclass Sales to compute the total amount paid by the retailer with or without fine along with service tax. Some of the members of both classes are given below:
Class name: Product
Data members/instance variables:
name: stores the name of the product
code: integer to store the product code
amount: stores the total sale amount of the product (in decimals)
Member functions/methods:
Product (String n, int c, double p): parameterized constructor to assign data members: name = n, code = c and amount = p
void show(): displays the details of the data members
Class name: Sales
Data members/instance variables:
day: stores number of days taken to pay the sale amount
tax: to store the sen ice tax (in decimals)
totamt: to store the total amount (in decimals)
Member functions/methods:
Sales(….): parameterized constructor to assign values to data members of both the classes
void compute(): calculates the service tax @ 12.4% of the actual sale amount
calculates the fine @ 2.5% of the actual sale amount only if the amount paid by the retailer to the wholesaler exceeds 30 days calculates the total amount paid by the retailer as (actual sale amount + service tax + fine)
void show (): displays the data members of the superclass and the total amount
Assume that the superclass Product has been defined. Using the concept of inheritance, specify the class Sales giving the details of the constructor (…), void compute()) and void show(). The superclass, main function and algorithm need NOT be written.

Question 10 [5]

A bookshelf is designed to store the books in a stack with LIFO(Last In First Out) operation. Define a class Book with the following specifications:
Class name: Book
Data members/instance variables:
name[]: stores the names of the books
point: stores the index of the topmost book
max: stores the maximum capacity of the bookshelf
Methods/Member functions:
Book(int cap): constructor to initialise the data members
max = cap and point = -1
void tell(): displays the name of the book which was last entered in the shelf. If there is no book left in the shelf, displays 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(): displays all the names of the books available on the shelf
Specify the class Book giving the details of ONLY the functions void tell() and void add(String). Assume that the other functions have been defined.
The main function need not be written.

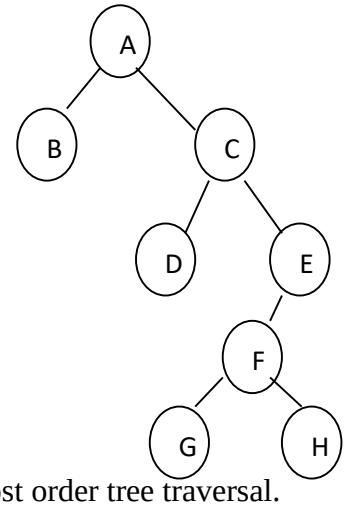
Question 11

(a) A linked list is formed from the objects of the class Node. The class structure of the Node is given below:[2]

```
class Node
{
int n;
Node link;
}
```

Write an Algorithm OR a Method to search for a number from an existing linked list.
The method declaration is as follows:
void FindNode(Node str, int b)

(b) Answer the following from the diagram of a binary Tree



(i) Write the Post order tree traversal. [1]

(ii) Name the Leaves of the tree [1]

(iii) Size of the tree [1]