[This question paper contains 8 printed pages.]

Sr. No. of Question Paper : 731

Unique Paper Code : 32341201

Name of the Paper : Programming in Java

Name of the Course : **B.Sc. (H) Computer Science**

Semester : II (DSC-1) (Admissions 2019)

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1.   Write your Roll No. on the top immediately on receipt of this question paper.

2.   The question paper consists of **two** sections. **Section A** is compulsory. Attempt any **four** questions from **Section B**.

3.   State the assumptions taken, if any, in your answers.

4.   All parts of a question must be answered together.

5.   If required, you may make suitable assumptions and state them clearly.

6.   **The data types of variables/data members/arrays and return types of the methods/member methods should be assumed suitably unless explicitly mentioned.**

P.T.O.

SECTION A

1. (a) Write the output(s) of the following Java code snippets :

    (i)
    ```
    class AddBytes {
        public static void main(String[] args) {
            System.out.println("Adding bytes");
            byte b1 = 10, b2 = 10;
            System.out.println("b1 + b2 = " + (b1 + b2));
            b2 = 20;
            System.out.println("b1 + b2 = " + b1 + b2);
        }
    }
    ```

    (3)

    (ii)
    ```
    class Operators {
        public static void main(String[] args) {
            int a = 5;
            int b = 9;
            System.out.println(a | b);
            System.out.println(a & b);
            System.out.println(a ^ b);
            System.out.println(~a);
            System.out.println(~a & 0x0f);
        }
    }
    ```

    (5)

    (iii)
    ```
    class Parent {
        public Parent(int i) {
            System.out.println(5);
        }
    }
    class Child extends Parent {
        public Child(int i) {
    ```

```
                super(i);
                System.out.println(10);
            }
        }
    public class QPDemo {
        public static void main(String[] args) {
         Child c = new Child(5);
        }
    }
```

(5)

(iv) `class ArrayLoop {`

```
        public static void main(String[] args) {
            int arr[][] = { {52, 21, 60},
                            {34, 56, 95},
                            {16, 11, 31},
                            {93, 17, 85}
                          };
            for(int i=0, j=0; i<3 && j<3; i++)
                System.out.print(arr[i][j] + " ");
            System.out.println();
            for(int i=1, j=1; i<3 && j<3; j++)
                System.out.print(arr[i][j] + " ");
            System.out.println();
            for(int i=0, j=2; i<3 && j<3; j+=2)
                System.out.println(arr[i][j] + " ");
        }
    }
```

(5)

(b) Define a recursive Java method **recMeth** (. . .) to calculate the product of digits of a number **n** passed as an argument to the method.   (5)

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(c) Write a program in Java (using *try-with-resources* functionality) to read a file **"SourceFile.txt"** and copy only those lines that contain both the characters '#' and '@' to another file **"DestFile.txt"**.   (5)

(d) Define a Java class **ObjReturn** having a data member **a** of the type float. Define a parameterized constructor to initialize **a**. Define a method **decOb()** that extracts the decimal part of **a** and stores it as a data member of another object of the same class. The method then returns the new object.   (5)

(e) Write a program in Java to create a frame using Java AWT. Implement **mouseEntered()** and **mouseClicked()** events such that: (5)

     (i) Size of the frame should be doubled when mouse enters it.

     (ii) Background colour of the frame changes to **'YELLOW'** when mouse is clicked inside the frame.

SECTION B

2.   (a) Write a program in Java that accepts a string through command line and works as follows :   (6)

- If the number of arguments is zero, the exception raised should be handled by the program and a message **"Error 01: No valid argument!"** is displayed on the screen and the program ends.

- If the number of arguments is greater than that required, a message **"Error 02 : The number of arguments is more than that required!"** is displayed on the screen and the program ends.

- If an argument (string) contains a digit, the string is printed on the screen otherwise the string is written to a file named **"StoredString.txt"**.

(b) What are packages in Java? What Java statement should be written in a file named **PackTest.java** assuming that a class named **PackTest** is saved inside the **pack1** package? (4)

3. Define the following user-defined methods in Java with appropriate parameters and return values to perform the tasks as mentioned against their names : (5×2=10)

   (i) **strComp(...)**: The method accepts two strings as arguments and returns the one whose length is shorter. If both strings are of equal length, the one that is placed earlier in the alphabetical order is returned.

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(ii) **getAverage(...)**: The method accepts a 2D array, number of rows and number of columns as parameters and returns the average of all values in the array.

4. (a) Which of the following are valid declarations?   (5)

      (i) `int  i  =  OxCAFE;`

      (ii) `boolean  b  =  0;`

      (iii) `char  c  =  'B';`

      (iv) `byte  b  =  128;`

      (v) `char  c  =  "A";`

(b) What are automatic type conversion rules in java? Explain each with an example.   (5)

5. Write a program in Java to create a stack of integers, populate it with data and display the data on the screen. The program defines the following structures for the same :

- An interface **Stack** with prototypes of two methods **push()** and **pop()**. The interface also has a default method **clearStack()** that empties the stack.

- A class **StackClass** which implements the interface **Stack**. The class has two private data

members- an array of integers **arrStack** and an integer **top**. The class also provides a parameterized constructor, a display method to display the array elements and appropriate definitions to the methods of the interface.

- A driver class **StackDemo** with a **main()** method to create an object of the class **StackClass** with 5 elements and invoke all the methods.   (10)

6. (a) Explain the term polymorphism. How does Java support run time polymorphism? Illustrate with an example.   (4)

   (b) Write a program in Java that accepts a number from the user and calculates factorial of the number. If the entered number is negative, a user defined exception is generated, else the square of the number is printed.   (6)

7. (a) Write Java statements/prototype for the following tasks :   (2×3=6)

      (i) a method that accepts a 2D array of integers, a string object and returns a character.

      (ii) a while loop that reads lines of text from the keyboard and prints them on screen until the key combination Ctrl+z is entered.

(iii) a try catch block to handle opening of a file in read mode.

(b) Differentiate between **paint()** and **repaint()** methods defined by AWT. (4)

8. Using Java Swing, write a program in Java to do the following : (10)

- Create a frame titled **"Frame Message"** having two buttons captioned **"Click It"** and **"Erase It"** respectively. When a user clicks on the button **"Click It"** a message **"Button has been clicked"** is displayed on the frame and when the button **"Erase It"** is clicked, the message gets erased from the frame.

- Create two buttons named **'RED'** and **'BLUE'**. When a button is pressed the background color should be set to the color named by the button's label.

- Using appropriate adapter class, display the message:

  "Typed character is: <typedCharacter>" in the frame window when user types any key.

Your Roll No...............
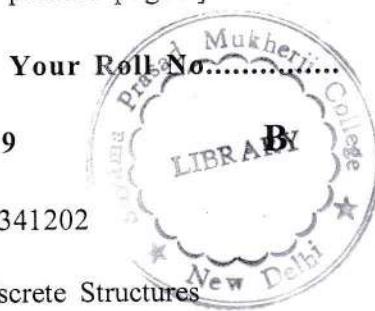
Sr. No. of Question Paper : 749

Unique Paper Code : 32341202

Name of the Paper : Discrete Structures

Name of the Course : **B.Sc. (Hons.) Computer Science**

(For Admissions of 2019 & 2020)

Semester : II

Duration : 3 hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Question No. **1** is compulsory in **Section A**.

3. Attempt any **four** questions from **Section B**.

4. Parts of a question should be attempted together.

P.T.O.

SECTION A

1. (a) A class of 30 students comprises of boys who can play Cricket (C), Hockey (H) and Football (F). The following table shows how many students play each single game and in their various combinations:

Game	C	H	F	CH	CF	HF	CHF
Play	3	3	2	2	11	10	4

Find how many students play at east one game? (5)

(b) Consider a set A = {U, V, W, X}. Let R be the relation defined on A as

R = {(U, U), (V, V), (Y, W), (W, Y) (X, Y), (X, X)}

Answer the following :

(i) Draw a Digraph for the given relation R.

(ii) Is R an Equivalence Relation or a Partial order relation? Justify your answer. (5)

(c) A graph has e edges and v vertices. Show that the given expression holds true in any connected planar graph with at least 2 edges and no loops

$$e \leq 3v - 6$$

Prove that K_5 is non-planar using the above expression. (5)

(d) Ashish, Aryan and their friend Abhay were playing inside the house. One of them broke a vase. When Mrs. Sharma, their mother, asked them about the vase, she gets these replies

Aryan : "I didn't break it"

Ashish : "Neither did I"

Abhay : "Aryan broke the window".

With the help of truth table find who broke the window, if two of the children lied? (5)

(e) Find the particular solution for the given Recurrence Relation

$$a_r - 5\, a_{r-1} = 3, \; r \geq 1$$

with the boundary conditions $a_0 = 1$. (5)

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(f) Use Master method to find asymptotic bounds for the following recurrence relation :

$$T(n) = 27\ T(n/3) + \theta(n^3) \tag{5}$$

(g) Convert the following statement in symbolic form:

"If you send me the URL, then I will finish configuring the software. If you do not send me the URL, then I will go for a walk and If I go for a walk, then I will keep my blood pressure in control leads to the conclusion If I do not configure the software, then I will keep my blood pressure in control." (5)

SECTION B

2. (a) Use mathematical induction to prove that :

2n < n! ∀ n with n ≥ 4. (5)

(b) Let f: R → R and g: R → R, where R is the set of real numbers.

Given $f(x) = x^2$ and $g(x) = x + 5$.

Find f o g and g o f.

State whether f(x) is bijective. (5)

3. (a) Consider the word "MATHEMATICS". Calculate the number of ways these letters can be arranged. Calculate the number of ways the letters can be arranged such that the vowels should occur together. (5)

(b) Let R be a relation defined by xRy if and only if $|x - y|$ is even. Show that R is an equivalence relation. (2)

(c) Let f1 and f2 be functions from R to R such that :

$f1(x) = x^2$ and $f2(x) = x - x^2$. Compute $0(f1.f2)$

(3)

4. (a) How many vertices and edges are there in each of the following graphs?

(i) K_3

(ii) C_5

(iii) W_4

(iv) $K_{3,4}$

(v) Q_3 (5)

(b) Define Isomorphism. Are the following pair of graphs isomorphic? Justify.   (5)
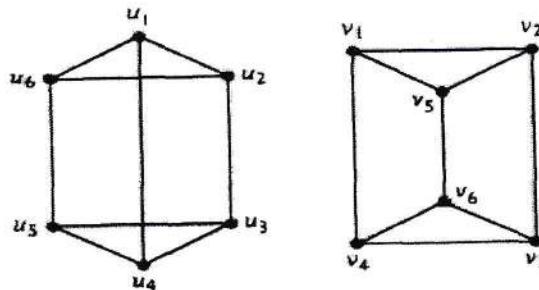
5.   (a) Given that:

$$T(n) = 2\,T\,(n/2) + Cn$$

Using substitution method, prove that T(n) is $\theta(n \lg n)$.   (5)

(b) Show all the steps of Insertion Sort to put the following list of items in an ascending order :

5	2	7	4	9	3	6	1	8

6.   (a) "If you send me an e-mail message, then I will finish writing the program," "If you do not send me an e-mail message, then I will go to sleep early," and "If I go to sleep early, then I will wake up feeling refreshed".

Show that the above premises leads to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed."   (5)

(b) Solve the given recurrence relation for the sequence defined by :

$$C_n = 5C_{n-1} - 6C_{n-2}$$

with initial conditions $C_1 = 2$, $C_3 = 1$.   (5)

7.   (a) Given a relation R on set A = {1,2,3,5,6,10,15,30} such that

R = {(a, b) : a is divisor of b and a ∈ A, b ∈ A}

Show that R is a POSET. Draw its Hasse Diagram.

(5)

(b) Prove that $(\neg p \wedge ((\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \equiv R$.

(3)

(c) Find the inverse and contra-positive for the statement :

"If you send me the URL, then I will finish configuring the software."   (2)

8. (a) Given that the value of $p \rightarrow q$ is false, determine the value of $(p' \vee q') \rightarrow q$. (5)

(b) Suppose that a connected planar simple graph has 20 vertices, each of degree 3. Into how many regions does a representation of this planar graph split the plane? (3)

(c) How many edges does a full binary tree with 1000 internal vertices have? (2)

(700)