

Computer Project

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Assignment 1

Write a program to accept a date in format dd/mm/yyyy and accept the name of the day on 1st January of the corresponding year. Find the day for the given date. Do validation check where required.

ex: input: date:5/7/2001

day on 1st January: Monday

output: day on 5/7/2001: Thursday

Algorithm

Date

- Step 1: Start
- Step 2: initialize name of week
- Step 3: initialize number of days in a month
- Step 4: initialize dd mm yy
- Step 5: Accomodate for a Leapyear by adding one if a leapyear is encountered
- Step 6: formats the string to be sensible for internal use
- Step 7: End

generate_day

- Step 1: Start
- Step 2: genenrates the required date
- Step 3: converting first_day_of_january from string to number
- Step 4: loop through the days of week if it is found use the index
- Step 5: if it is not foound bail out
- Step 6: simple error handling for a malfromed input
- Step 7: offsetting by day
- Step 8: offsetting by month
- Step 9: by looping through the days of the month
- Step 10: returning a correctly formatted string for printing
- Step 11: End

parse_input

- Step 1: Start
- Step 2: formatting accroding to dd/mm/yyyy
- Step 3: End

Date

- Step 1: Start
- Step 2: manages main input and output
- Step 3: End

main

- Step 1: Start
- Step 2: accept input properly
- Step 3: System.out.print("day on 1st January: ");
- Step 4: parsing the input into usable format
- Step 5: Handles apparent error condition
- Step 6: Handles apparent error condition
- Step 7: outputs the required day
- Step 8: End

Source Code

```
import java.util.Scanner;

public class Date
{
    // Stores the names of the days
    private String[] days_of_week = null;

    // number of days in a single month
    private int[] days_in_month = null;

    // Accepted from the user
    private int day;

    // Accepted from the user
    private int month;

    // Accepted from the user
    private int year;

    // First Day of January
    private String first_day_of_january;

    Date(int dd, int mm, int yyyy, String fdoj)
    {
        // initialize name of week
        this.days_of_week = new String[]{"monday", "tuesday",
        "wednesday", "thursday", "friday", "saturday", "sunday"};

        // initialize number of days in a month
        this.days_in_month = new int[]{31, 28, 31, 30, 31, 30, 31,
        31, 30, 31, 30, 31};

        // initialize dd mm yy
        this.day = dd;
        this.month = mm;
        this.year = yyyy;

        // Accomodate for a Leapyear by adding one if a leapyear is
        encountered
        if(yyyy % 4 == 0 && yyyy % 100 != 0 || yyyy % 400 == 0)
            this.days_in_month[1] += 1;

        // formats the string to be sensible for internal use
```

```
this.first_day_of_january = fdoj.trim().toLowerCase();
}

String generate_day()
{
    // genenrates the required date
    // converting first_day_of_january from string to number
    // loop through the days of week if it is found use the index
    // if it is not foound bail out

    // num first day of january falls on
    int num_fdoj = -1;
    for(int i = 0; i < this.days_of_week.length; i++)
    {
        if(this.days_of_week[i].equals(this.first_day_of_janu-
ary))
        {
            num_fdoj = i;
            break;
        }
    }

    // simple error handling for a malfromed input
    if(num_fdoj == -1)
        return null;

    // days from first january
    int days_from_1stjan = 0;

    // offsetting by day
    days_from_1stjan += this.day-1;

    // offsetting by month
    // by looping through the days of the month
    for(int i = 0; i < this.month-1; i++)
        days_from_1stjan += this.days_in_month[i];

    // correctly offsetting days of year with days of week and
    converting to string using lookup table;
    String new_day = this.days_of_week[(days_from_1stjan +
num_fdoj)%this.days_of_week.length];

    // returning a correctly formatted string for printing
    return (new_day.charAt(0)+"").toUpperCase() + new_day.sub-
string(1);
}

static int[] parse_input(String d)
{

```

```
// parses the string into a integer array delemetarized with
/  
String[] s = d.split("/");  
  
// initialize an int array  
int[] di = new int[]{Integer.parseInt(s[0]), Integer.parse-  
seInt(s[1]), Integer.parseInt(s[2])};  
  
// formatting accroding to dd/mm/yyyy  
if(di[0] > 31 || di[0] < 1) return null;  
if(di[1] > 12 || di[1] < 1) return null;  
if(di[2] > 9999 || di[2] < 0) return null;  
  
return di;  
}  
  
// manages main input and output  
public static void main(String args[])  
{  
    // input system  
    Scanner sc = new Scanner(System.in);  
  
    // accept input properly  
    // System.out.print("date: ");  
    String str_date = sc.next();  
  
    // System.out.print("day on 1st January: ");  
    // day of first january  
    String jan_1st = sc.next();  
  
    // parsing the input into usable format  
    // date array  
    int[] date = parse_input(str_date);  
  
    // Handles apparent error condition  
    if(date == null)  
    {  
        System.err.println("Malformed Input");  
        return;  
    }  
  
    // gnenrate object  
    Date d = new Date(date[0], date[1], date[2], jan_1st);  
  
    // get generated day  
    String new_day = d.generate_day();  
  
    // Handles apparent error condition  
    if(new_day == null)
```

```
        {
            System.err.println("Input is either out of bounds or
nonsensical");
            return;
        }

        // outputs the required day
        System.out.println("day on "+str_date+": " + new_day);
    }
}
```


Variable Listing

Name	Function	Type	Scope
days_of_week	Stores the names of the days	String[]	Date
days_in_month	number of days in a single month	int[]	Date
day	Accepted from the user	int	Date
month	Accepted from the user	int	Date
year	Accepted from the user	int	Date
first_day_of_january	First Day of January	String	Date
num_fdoj	num first day of january falls on	int	generate_day
days_from_1stjan	days from first january	int	generate_day
new_day	correctly offsetting days of year with days of week and converting to string using lookup table;	String	generate_day
s	parses the string into a integer array delemetarized with /	String[]	parse_input
di	initialize an int array	int[]	parse_input
sc	input system	Scanner	main
str_date	System.out.print("date: ");	String	main
jan_1st	day of first january	String	main
date	date array	int[]	main
d	gnerate object	Date	main
new_day	get generated day	String	main

Assignment 2

Write a program to add two times given by the user in hour,min and seconds.

Class name: TimeAdd

Data member: hr(hour),min(minutes),sec(seconds)

Member methods:

TimeAdd(): DEFAULT constructor

void accept(): accept time from user

TimeAdd timeAdd(TimeAdd t): add two time objects return the final time value.

*

Algorithm

TimeAdd

Step 1: Start
Step 2: second
Step 3: initialize the time
Step 4: End

accept

Step 1: Start
Step 2: accept input from the user
Step 3: check if mins are between 0 and 60
Step 4: check if mins are between 0 and 60
Step 5: End

timeAdd

Step 1: Start
Step 2: add two time objects return final value
Step 3: generate a new timeadd object
Step 4: End

display

Step 1: Start
Step 2: display time in hour, mins and seconds
Step 3: End

main

Step 1: Start
Step 2: 3 value of Timeadd
Step 3: accept values for t's
Step 4: add time objects
Step 5: display the times
Step 6: End

Source Code

```
import java.util.Scanner;

public class TimeAdd
{
    int hr;          // hours
    int min;         // minutes
    int sec;         // second

    public TimeAdd()
    {
        // initialize the time
        this.hr = 0;
        this.min = 0;
        this.sec = 0;
    }

    void accept()
    {
        // input handler
        Scanner sc = new Scanner(System.in);

        // accept input from the user
        this.hr = sc.nextInt();
        this.min = sc.nextInt();
        this.sec = sc.nextInt();

        // check if mins are between 0 and 60
        if(this.min >= 60 || this.min < 0)
        {
            System.err.println("Minutes make no sense!");
            System.exit(1);
        }

        // check if secs are between 0 and 60
        if(this.sec >= 60 || this.sec < 0)
        {
            System.err.println("Seconds make no sense!");
            System.exit(1);
        }
    }

    TimeAdd timeAdd(TimeAdd t)
    {
```

```
// add two time objects return final value
// generate a new timeadd object
// add and store the value of this and t
TimeAdd x = new TimeAdd();
x.hr = t.hr + this.hr;
x.min = t.min + this.min;
x.sec = t.sec + this.sec;
return x;
}

void display()
{
    // display time in hour, mins and seconds
    System.out.println("Hr:      "+this.hr+"Min:"+this.min+"      Sec:
"+this.sec);
}

public static void main(String args[])
{
    // 3 value of Timeadd
    // Timeadds
    TimeAdd[] t = new TimeAdd[]{new TimeAdd(), new TimeAdd(),
null};

    // accept values for t's
    t[0].accept();
    t[1].accept();

    // add time objects
    t[2] = t[0].timeAdd(t[1]);

    // display the times
    t[0].display();
    t[1].display();
    t[2].display();
}
}
```

Variable Listing

Name	Function	Type	Scope
hr		int	TimeAdd
min	hours	int	TimeAdd
sec	minuites	int	TimeAdd
sc	input handler	Scanner	accept
x	add and store the value of this and t	TimeAdd	timeAdd
t	Timeadds	TimeAdd[]	main

Assignment 3

Write a program to take lower and upper range from the user and print all the binodd numbers within that range. (A binodd number is a number whose binary equivalent have all the 1s present in the odd position of the binary number considering from MSB to LSB)
Example: 17 is a binodd number as its binary equivalent is 10001 where 1s are in the position 1st and 5th position of the binary number which are odd position of the number.

Algorithm

isBinOdd

- Step 1: Start
- Step 2: loop until num not equals to zero
- Step 3: two bits are checked
- Step 4: if they are not 01 then its an anomaly
- Step 5: therefore return false
- Step 6: otherwise return true
- Step 7: End

main

- Step 1: Start
- Step 2: accept upper limit
- Step 3: accept lower limit
- Step 4: loop from lower limit to upper limit
- Step 5: if any big odds are encountered print it
- Step 6: End

Source Code

```
import java.util.Scanner ;

public class BinOdd
{
    static boolean isBinOdd(int num)
    {
        // loop until num not equals to zero
        // two bits are checked
        // if they are not 01 then its an anomaly
        // therefore return false
        while(num != 0)
        {
            if((num & 3) != 1)
                return false;
            num >>= 2;
        }

        // otherwise return true
        return true;
    }

    public static void main(String args[])
    {
        // input handler
        Scanner sc = new Scanner(System.in);

        // accept upper limit
        // upper limit
        int upper_limit = sc.nextInt();

        // accept lower limit
        // lower limit
        int lower_limit = sc.nextInt();

        // loop from lower limit to upper limit
        // if any big odds are encountered print it
        while(lower_limit < upper_limit)
        {
            if(isBinOdd(lower_limit))
                System.out.println(lower_limit);
            lower_limit++;
        }
    }
}
```

}

Variable Listing

Name	Function	Type	Scope
sc	input handler	Scanner	main
upper_limit	upper limit	int	main
lower_limit	lower limit	int	main

Assignment 4

Write a program to accept a square matrix CIR[][] of order MXM where M is no. of rows and no. of columns. Value of M varies from $2 \leq M \leq 10$. Accept alphabet character values in UPPERCASE as input. Display appropriate mess for invalid input. Perform following tasks.

- i) Display Original Matrix.
- ii) Find the sum of Unicode values of the elements of four corners of the matrix.
- iii) Rotate matrix 90 degrees anti-clockwise and display it

Example:

INPUT:

M = 3

A F D
D B T
C A A

OUTPUT:

Original Matrix:
A F D
D B T
C A A

Sum = 256

Final Matrix:
D T A
F B A
A D C

Algorithm

Matrix

- Step 1: Start
- Step 2: initializing M with M
- Step 3: initializing mat of size M by M
- Step 4: End

display

- Step 1: Start
- Step 2: loop accross the matrix elements
- Step 3: print each element
- Step 4: End

unicodeSum

- Step 1: Start
- Step 2: adding all the corners of the matrix
- Step 3: returning the recorded sum
- Step 4: End

rotateMat

- Step 1: Start
- Step 2: loop through the coloums from first to last
- Step 3: loop through the rows from last to first
- Step 4: rotate the mat matrix
- Step 5: setting original matrix to rotated matrix
- Step 6: End

readMat

- Step 1: Start
- Step 2: create input handler
- Step 3: accept size as input
- Step 4: loop through the matrix to generate the matrix by accepting input
- Step 5: return the generated matrix
- Step 6: End

main

- Step 1: Start
- Step 2: accpting input from user
- Step 3: displaying original matrix
- Step 4: displaying the sum of the corners
- Step 5: roatate the actual matrix
- Step 6: display the rotated matrix
- Step 7: End

Source Code

```
import java.util.Scanner;

public class Matrix
{
    // stores the size of square matrix
    int M;

    // stores the matrix itself
    char[][] mat;

    Matrix(int M)
    {
        // initializing M with M
        this.M = M;

        // initializing mat of size M by M
        this.mat = new char[M][M];
    }

    void display()
    {
        // loop accross the matrix elements
        // print each element
        for(int i = 0; i < this.M; i++)
        {
            for(int j = 0; j < this.M; j++)
            {
                System.out.print(this.mat[i][j]+" ");
            }
            System.out.println();
        }
    }

    int unicodeSum()
    {
        // stores the sum of the corners of the mat
        int sum = 0;

        // adding all the corners of the matrix
        sum += this.mat[0][0] + this.mat[M-1][0] + this.mat[0][M-1] +
this.mat[M-1][M-1];

        // returning the recorded sum
    }
}
```

```
        return sum;
    }

    void rotateMat()
    {
        // rotated matrix
        char[][] rot_mat = new char[this.M][this.M];

        // loop through the coloums from first to last
        // loop through the rows from last to first
        // rotate the mat matrix
        for(int i = 0; i < M; i++)
        {
            for(int j = 0; j < M; j++)
            {
                rot_mat[i][j] = this.mat[j][M-i-1];
            }
        }

        // setting original matrix to rotated matrix
        this.mat = rot_mat;
    }

    static Matrix readMat()
    {
        // create input handler
        // input handler
        Scanner sc = new Scanner(System.in);

        // accept size as input
        // Input from the user about the size of matrix
        int M = sc.nextInt();

        // matrix object for matrix operations
        Matrix m = new Matrix(M);

        // loop through the matrix to generate the matrix by accept-
ing input
        for(int i = 0; i < M; i++)
        {
            for(int j = 0; j < M; j++)
            {
                m.mat[i][j] = sc.next().charAt(0);
            }
        }

        // return the generated matrix
        return m;
    }
}
```

```
public static void main(String args[])
{
    // accpting input from user
    // Matrix object
    Matrix m = readMat();

    // displaying original matrix
    System.out.println("Original Matrix: ");
    m.display();

    // displaying the sum of the corners
    System.out.println("Sum = "+m.unicodeSum());

    // rotate the actual matrix
    m.rotateMat();

    // display the rotated matrix
    System.out.println("Rotated Matrix: ");
    m.display();
}
}
```


Variable Listing

Name	Function	Type	Scope
M	stores the size of square matrix	int	Matrix
mat	stores the matrix itself	char[][]	Matrix
sum	stores the sum of the corners of the mat	int	unicodeSum
rot_mat	rotated matrix	char[][]	rotateMat
sc	input handler	Scanner	readMat
M	Input from the user about the size of matrix	int	readMat
m	matrix object for matrix operations	Matrix	readMat
m	Matrix object	Matrix	main

Assignment 5

Design a class StringModify in your default package that will contain two methods that will work on string values. The method definitions of the class is given below:

- i) StringModify(String st): parameterized constructor
- ii) String insertStringAt(String w,int pos): to insert string w at valid position pos and returns final sentence without changing any other data.
- iii) String deleteCharAt(char w,int pos): to delete character w from valid position pos and returns final sentence without changing any other data.

Write a possible menu in main method to implement the above logic for any random sentence by calling methods.

DO POSSIBLE CHECKING WHERE REQUIRED.

Algorithm

StringModify

- Step 1: Start
- Step 2: initializes the original
- Step 3: End

insertStringAt

- Step 1: Start
- Step 2: checks if pos is a valid position
- Step 3: if not return null
- Step 4: append w at pos in st
- Step 5: use the + string concatenation operator
- Step 6: End

deleteCharAt

- Step 1: Start
- Step 2: checks if pos is a valid position
- Step 3: if not return null
- Step 4: checks if the char at pos is actually the required char
- Step 5: if yes then it returns modified string otherwise just the original string
- Step 6: End

main

- Step 1: Start
- Step 2: accept menu entry option
- Step 3: if the option is ridiculous just return
- Step 4: accept a sentence
- Step 5: End

Source Code

```
import java.util.Scanner;

public class StringModify
{
    // original string
    String st;

    StringModify(String st)
    {
        // initializes the original
        this.st = st;
    }

    String insertStringAt(String w, int pos)
    {
        // checks if pos is a valid position
        // if not return null

        if(pos < 0 || pos >= this.st.length())
            return null;

        // append w at pos in st
        // use the + string concatenation operator

        return this.st.substring(0, pos) + w + this.st.substring(pos);
    }

    String deleteCharAt(char w, int pos)
    {
        // checks if pos is a valid position
        // if not return null

        if(pos < 0 || pos >= this.st.length())
            return null;

        // checks if the char at pos is actually the required char
        // if yes then it returns modified string otherwise just the
        original string

        return st.charAt(pos) == w ? this.st.substring(0,
pos)+this.st.substring(pos+1) : this.st;
    }
}
```

```
public static void main(String args[])
{
    // Input Handler
    Scanner sc = new Scanner(System.in);

    // accept menu entry option
    // option of menuentry
    int opt = sc.nextInt();

    // if the option is ridiculous just return
    if(opt != 1 && opt != 2)
        return;

    // accept a sentence
    // generate an object of StringModify using that sentence
    StringModify s = new StringModify(new Scanner(System.in).nextLine());

    // the new string that needs to be attached or removed
    String w = sc.next();

    // position of the attachment or removal
    int pos = sc.nextInt();

    switch(opt)
    {
        case 1:
            System.out.println(s.insertStringAt(w, pos));
            break;

        case 2:
            System.out.println(s.deleteCharAt(w.charAt(0),
pos));

            break;
    }
}
```

Variable Listing

Name	Function	Type	Scope
st	original string	String	StringModify
sc	Input Handler	Scanner	main
opt	option of menuentry	int	main
s	generate an object of String-Modify using that sentence	StringModify	main
w	the new string that needs to be attached or removed	String	main
pos	position of the attachment or removal	int	main

Assignment 6

Given two possible numbers M and N, such that M is between 100 and 10000 and N is less than 100. Find the smallest integer that greater than M and whose digits add up to N. For example, if M = 100 and N = 11, then the smallest integer greater than 100 whose digits add up to 11 is 119

Write a program to accept the numbers M and N from the user and print the smallest required number whose sum of all its digits is equal to N. Also, print the total number of digits present in the required number. The program should check for the validity of the inputs display an appropriate message for an invalid input.

Test your program with the sample data and some random data.

Example 1

INPUT:

M = 100

N = 11

OUTPUT:

The required Number = 119

Total number of digits = 3

Example 2

INPUT:

M = 1500

N = 25

OUTPUT:

The required Number = 1699

Total number of digits = 4

Example 3

INPUT:

M = 99

N = 11

OUTPUT:

INVALID INPUT

Algorithm

SumDigit

- Step 1: Start
- Step 2: initializing M with local M
- Step 3: initializing N with local N
- Step 4: End

digitSum

- Step 1: Start
- Step 2: create a duplicate of M
- Step 3: while M is not 0 loop
- Step 4: add all the digits of M
- Step 5: End

genNum

- Step 1: Start
- Step 2: check the value of M and N to make sure they are in range
- Step 3: if not just return -1 to mark invalid input
- Step 4: start a loop which to go from M till the upper bound
- Step 5: check if any of the numbers is actually the required number
- Step 6: if the number is found return the number of digits in the number
- Step 7: store the number in M
- Step 8: other wise return -1 marking an invalid input
- Step 9: End

main

- Step 1: Start
- Step 2: accept input from the user
- Step 3: use the input to initialize the object
- Step 4: if the digit is -1 then it is invalid input
- Step 5: End

Source Code

```
import java.util.Scanner;

public class SumDigit
{
    // lower bound of operations
    int M;

    // the number to be derived from digits
    int N;

    SumDigit(int M, int N)
    {
        // initializing M with local M
        this.M = M;

        // initializing N with local N
        this.N = N;
    }

    int digitSum()
    {
        // create a duplicate of M
        // local version of M for computation
        int M = this.M;

        // stores the sum of digits
        int sum = 0;

        // while M is not 0 loop
        // add all the digits of M
        // return the added digits
        while(M != 0)
        {
            sum += M%10;
            M /= 10;
        }

        return sum;
    }

    int genNum()
    {
        int digits = -1;
```

```
// check the value of M and N to make sure they are in range
// if not just return -1 to mark invalid input
if(this.M >= 10000 || this.M < 100 || this.N > 100)
    return -1;

// start a loop which to go from M till the upper bound
// check if any of the numbers is actually the required num-
ber
while(this.M < 10000)
{
    if(digitSum() == this.N)
    {
        digits = (int)(Math.log10(this.M) + 1);
        break;
    }
    this.M++;
}

// if the number is found return the number of digits in the
number
// store the number in M
// other wise return -1 marking an invalid input
return digits;
}

public static void main(String args[])
{
    // input handler
    Scanner sc = new Scanner(System.in);

    // accept input from the user
    // use the input to initialize the object
    // call genNum and display the value
    SumDigit s = new SumDigit(sc.nextInt(), sc.nextInt());

    //stores the digits
    int digits = s.genNum();

    // if the digit is -1 then it is invalid input
    if(digits == -1)
    {
        System.out.println("INVALID INPUT");
    }
    else
    {
        System.out.println("The required Number = "+s.M);
        System.out.println("Total number of digits = "+digits);
    }
}
```

}

Variable Listing

Name	Function	Type	Scope
M	lower bound of operations	int	SumDigit
N	the number to be derived from digits	int	SumDigit
M	local version of M for computation	int	digitSum
sum	stores the sum of digits	int	digitSum
digits	return the added digits	int	genNum
sc	input handler	Scanner	main
s	call genNum and display the value	SumDigit	main
digits	stores the digits	int	main

Assignment 7

Write a program to accept a paragraph containing **TWO** sentences only. The sentences may be terminated by either '.', '?', or '!' only. Any other character may be ignored. The words are to be separated by single blank space and must be in UPPER CASE.

Perform the following tasks:

- Check for the validity of the accepted paragraph for the number of sentences and for the terminating character.
- Separate the two sentences from the paragraph and find common words in the two sentences with their frequency of occurrence in the paragraph.
- Display both the sentences separately along with common words and their frequency, in the format given below:

Test your program for the following data and some random data:

Example 1

INPUT:

IS IT RAINING? YOU MAY GET WET IF IT IS RAINING.

OUTPUT:

IS IT RAINING?

YOU MAY GET WET IF IT IS RAINING.

COMMON WORDS	FREQUENCY
--------------	-----------

IS	2
----	---

IT	2
----	---

RAINING	2
---------	---

Example 2

INPUT:

ARE YOU COMING? I AM GETTING LATE.

OUTPUT:

ARE YOU COMING?

I AM GETTING LATE.

NO COMMON WORDS

*

Algorithm

Sentences

- Step 1: Start
- Step 2: initializing the raw
- Step 3: initializing sentences with the given criteria
- Step 4: End

checkValidity

- Step 1: Start
- Step 2: check if there is exactly 2 sentences
- Step 3: if not return false
- Step 4: convert the raw input to upper case
- Step 5: check if the upper cased string is exact match to the raw string
- Step 6: if not return false
- Step 7: if all conditions pass return true
- Step 8: End

findWordFrequency

- Step 1: Start
- Step 2: gets the number of occurrence of the particular word
- Step 3: loop through the local raw until no more words are left
- Step 4: check if the word matches if so increment f
- Step 5: return frequency of words
- Step 6: End

getCommonWord

- Step 1: Start
- Step 2: loop through the words
- Step 3: if a match is encountered print the word
- Step 4: return the generated output
- Step 5: End

main

- Step 1: Start
- Step 2: accept input
- Step 3: print the required value
- Step 4: End

Source Code

```
import java.util.Scanner;

public class Sentences
{
    // stores the actual raw input
    String raw;

    // stores the 2 sentences
    String[] sentences;

    Sentences(String raw)
    {
        // initializing the raw
        this.raw = raw;

        // initializing sentences with the given criteria
        this.sentences = raw.split("\\?|\\.|!");
    }

    boolean checkValidity()
    {
        // check if there is exactly 2 sentences
        // if not return false
        if(this.sentences.length != 2)
            return false;

        // convert the raw input to upper case
        // check if the upper cased string is exact match to the raw
        string
        // if not return false
        if(!this.raw.toUpperCase().equals(this.raw))
            return false;

        // if all conditions pass return true
        return true;
    }

    int findWordFrequency(String word)
    {
        // stores the frequency of words
        int f = 0;

        // the raw paragraph with a space at the end
```

```
String raw = this.sentences[0]+" "+this.sentences[1]+" ";

// stores the words present in raw
String[] words = raw.split(" ");

// gets the number of occurrence of the particular word
// loop through the local raw until no more words are left
// check if the word matches if so increment f
for(String w : words)
{
    if(word.equals(w))
    {
        f++;
    }
}

// return frequency of words
return f;
}

String getCommonWord()
{
    // the raw paragraph with a space at the end
    String raw = this.sentences[0]+" "+this.sentences[1]+" ";

    // generate the words for the sentences
    String[] words1 = this.sentences[0].split(" ");

    // generate the words for the sentences
    String[] words2 = this.sentences[1].split(" ");

    // generated common words formatted output
    String x = "";

    // loop through the words
    // if a match is encountered print the word
    for(String w1 : words1)
    {
        for(String w2 : words2)
        {
            if(w1.equals(w2))
            {
                x += w1 + " "+ findWordFrequency(w1)+"0;
                break;
            }
        }
    }

    // return the generated output
```



```
        return x;
    }

    public static void main(String args[])
    {
        // input handler
        Scanner sc = new Scanner(System.in);

        // setnece object
        Sentences se = new Sentences(sc.nextLine());

        // composited output
        String x = se.getCommonWord();

        // accept input
        // print the required value
        if(x.equals(""))
        {
            System.out.println("NO COMMON WORDS");
        }
        else
        {
            System.out.println(se.sen-
tences[0].trim()+se.raw.charAt(se.sentences[0].length()));
            System.out.println(se.sen-
tences[1].trim()+se.raw.trim().charAt(se.raw.trim().length()-1));
            System.out.println("00COMMON WORDSFREQUENCY");
            System.out.println(x);
        }
    }
}
```

Variable Listing

Name	Function	Type	Scope
raw	sotres the actual raw input	String	Sentences
sentences	stores the 2 sentences	String[]	Sentences
f	stores the frequency of words	int	findWordFrequency
raw	the raw paragraph with a space at the end	String	findWordFrequency
words	stores the words present in raw	String[]	findWordFrequency
raw	the raw paragraph with a space at the end	String	getCommonWord
words1	generate the words for the sentences	String[]	getCommonWord
words2	generate the words for the sentences	String[]	getCommonWord
x	generated common words formatted output	String	getCommonWord
sc	input handler	Scanner	main
se	setnece object	Sentences	main
x	composited output	String	main

Assignment 8

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 a word

Member functions/methods:

Mix() : default constructor to initialize the data members with legal initial value
void feedword() : to accept the word in UPPER case
void mix_word(Mix P, Mix Q) : mixes the words of object P and Q as stated above stores the resultant word in the current object
void display() : display 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.

Algorithm

Mix

- Step 1: Start
- Step 2: Initialize values to default values
- Step 3: initializing wrd with ""
- Step 4: initializing len with 0
- Step 5: End

feedword

- Step 1: Start
- Step 2: accept a singular word
- Step 3: store the word in wrd
- Step 4: check if the word is upper case
- Step 5: if no kill the program
- Step 6: otherwise initialize len
- Step 7: End

mix_word

- Step 1: Start
- Step 2: loop through the letter of P and Q until a boundary of the smaller is hit
- Step 3: take the remaining value of P if any and add them to the wrd
- Step 4: take the remaining value of Q if any and add them to the wrd
- Step 5: correct the value of len
- Step 6: End

display

- Step 1: Start
- Step 2: display the value of the word
- Step 3: End

main

- Step 1: Start
- Step 2: accept input for P and Q
- Step 3: call mix_word function to execute operation
- Step 4: display computed value
- Step 5: End

Source Code

```
import java.util.Scanner;

public class Mix
{
    // to store a word
    String wrd;

    // to store the length of the word
    int len;

    Mix()
    {
        // Initialize values to default values
        // initializing wrd with ""
        this.wrd = "";

        // initializing len with 0
        this.len = 0;
    }

    void feedword()
    {
        // accept a singular word
        // input handler
        Scanner sc = new Scanner(System.in);

        // store the word in wrd
        this.wrd = sc.next();

        // check if the word is upper case
        // if no kill the program
        if(!this.wrd.toUpperCase().equals(this.wrd))
            System.exit(1);

        // otherwise initialize len
        this.len = this.wrd.length();
    }

    void mix_word(Mix P, Mix Q)
    {
        // loop through the letter of P and Q until a boundary of
        the smaller is hit
        while(this.len < P.len && this.len < Q.len)
```

```
{
    this.wrd                                     +=
""+P.wrd.charAt(this.len)+Q.wrd.charAt(this.len);
    this.len++;
}

// take the remaing value of P if any and add them to the wrd
if(this.len < P.len)
    this.wrd += P.wrd.substring(this.len);

// take the remaing value of Q if any and add them to the wrd
if(this.len < Q.len)
    this.wrd += Q.wrd.substring(this.len);

// correct the value of len
this.len = this.wrd.length();
}

void display()
{
    // display the value of the word
    System.out.println(this.wrd);
}

public static void main(String args[])
{
    // P in the mix_word
    Mix P = new Mix();

    // Q in the mix_word
    Mix Q = new Mix();

    // the mix object for computation
    Mix m = new Mix();

    // accept input for P and Q
    P.feedword();
    Q.feedword();

    // call mix_word function to execute operation
    m.mix_word(P, Q);

    // display computed value
    m.display();
}
}
```

Variable Listing

Name	Function	Type	Scope
wrđ	to store a word	String	Mix
len	to store the length of the word	int	Mix
sc	input handler	Scanner	feedword
P	P in the mix_word	Mix	main
Q	Q in the mix_word	Mix	main
m	the mix object for computation	Mix	main

Assignment 9

Q9) Design a class FiboPrime which will display all the the Fibonacci numbers upto n terms which have atleast one prime digit in the number. For example 2,3,5,13,21 are some of the examples of Fibonacci numbers having atleast one prime digit in it.

Class name: FiboPrime

Data members:

n: number of terms

Method:

FiboPrime(int): constructor

int fibo(int n): returns nth Fibonacci number

void displayFiboPrimes(): Display all the Fibonacci numbers upto n terms which have atleast one digit as prime

boolean isPrime(int p): returns true or false if p is either prime or not.

You can add method(s) if required.

Algorithm

FiboPrime

Step 1: Start
Step 2: initializing fibo prime using n
Step 3: End

fibo

Step 1: Start
Step 2: loop until n is zero
Step 3: set $a = a + b$
Step 4: and $b = a - b$
Step 5: return b as the nth fibo number
Step 6: End

isPrime

Step 1: Start
Step 2: if p is 1 then its not prime
Step 3: loop through numbers starting from 2 till p
Step 4: if anyone is divisible by p return false
Step 5: if all the conditions fail then it must be true
Step 6: End

hasPrime

Step 1: Start
Step 2: loop through the digits of a number
Step 3: if a prime number is found return true
Step 4: otherwise return false
Step 5: End

displayFiboPrimes

Step 1: Start
Step 2: loop through all the fibo numbers until n terms
Step 3: if a prime fibo is encountered print it
Step 4: End

main

Step 1: Start
Step 2: create an object using user input
Step 3: call displayFiboPrimes using that object
Step 4: End

Source Code

```
import java.util.Scanner;

public class FiboPrime
{
    // number of terms
    int n;

    FiboPrime(int n)
    {
        // initializing fibo prime using n
        this.n = n;
    }

    int fibo(int n)
    {
        // second fibo number
        int a = 1;

        // first fibo number
        int b = 0;

        // loop until n is zero
        // set a = a+b
        // and b = a-b
        while(n != 0)
        {
            a = a+b;
            b = a-b;
            n--;
        }

        // return b as the nth fibo number
        return b;
    }

    boolean isPrime(int p)
    {
        // if p is 1 then its not prime
        if(p == 1) return false;

        // iterator from 2 until p
        int i = 2;
```

```
// loop through numbers starting from 2 till p
// if anyone is divisible by p return false
while(i != p)
{
    if(p % i == 0)
        return false;
    i++;
}

// if all the conditions fail then it must be true
return true;
}

boolean hasPrime(int p)
{
    // loop through the digits of a number
    // if a prime number is found return true
    // otherwise return false
    while(p != 0)
    {
        if(isPrime(p%10))
            return true;
        p/=10;
    }

    return false;
}

void displayFiboPrimes()
{
    // iterator from 1 to n
    int i = 1;

    // fibo accumulator
    int fb = 1;

    // loop through all the fibo numbers until n terms
    // if a prime fibo is encountered print it
    while(i < n)
    {
        fb = fibo(i);
        if(hasPrime(fb))
            System.out.println(fb);
        i++;
    }
}

public static void main(String args[])
{

```

```
// Input handler
Scanner sc = new Scanner(System.in);

// create an object using user input
// call displayFiboPrimes using that object
new FiboPrime(sc.nextInt()).displayFiboPrimes();
}
}
```

Variable Listing

Name	Function	Type	Scope
n	number of terms	int	FiboPrime
a	second fibo number	int	fibo
b	first fibo number	int	fibo
i	iterator from 2 until p	int	isPrime
i	iterator from 1 to n	int	displayFiboPrimes
fb	fibo accumulator	int	displayFiboPrimes
sc	Input handler	Scanner	main

Assignment 10

Write a program to declare a matrix $A[][]$ having order $M \times N$ (where M is no. of rows and N is no. of columns) where values of both M and N must be greater than 2 and less than 10. Allow the user to accept value for matrix. Perform the following tasks:

- a) Display original matrix
- b) Sort each odd row of the matrix in descending order using bubble sort algorithm and each even row of the matrix in ascending order using selection sort algorithm.
- c) Display the final updated matrix.

Algorithm

MxN

- Step 1: Start
- Step 2: initializing A with a new matrix
- Step 3: initializing rows and cols
- Step 4: End

bsort

- Step 1: Start
- Step 2: loop through the arr
- Step 3: check if any element is smaller is than the next element
- Step 4: if it is then swap the elements
- Step 5: End

ssort

- Step 1: Start
- Step 2: loop through the arr
- Step 3: check if any element is bigger than the currently selected element
- Step 4: End

sort

- Step 1: Start
- Step 2: loop through the rows
- Step 3: sort the loops according to ther index
- Step 4: if odd send them to bsort
- Step 5: else send them to ssort
- Step 6: this would sort the matrix
- Step 7: End

display

- Step 1: Start
- Step 2: using an iterative forloop print all the values
- Step 3: print a newline at the end of line
- Step 4: End

main

- Step 1: Start
- Step 2: creating object of MxN
- Step 3: take input from stdin
- Step 4: display original matrix
- Step 5: sort the original in the fation metioned matrix
- Step 6: display the sorted matrix
- Step 7: End

Source Code

```
import java.util.Scanner;

public class MxN
{
    // Original Matrix
    int[][] A;

    // number of rows
    int M;

    // number of cols
    int N;

    MxN(int M, int N)
    {
        // initializing A with a new matrix
        this.A = new int[M][N];

        // initializing rows and cols
        this.M = M;
        this.N = N;
    }

    void bsort(int[] arr)
    {
        // iterator
        int i = 0;

        // internal iterator
        int j = 0;

        // loop through the arr
        // check if any element is smaller is than the next element
        // if it is then swap the elements
        while(i < arr.length)
        {
            j = i;
            while(j < arr.length-1)
            {
                if(arr[j+1] > arr[j])
                {
                    // bubble sort array element stuck
```



```
        int x = arr[j+1];
        arr[j+1] = arr[j];
        arr[j] = x;
    }
    j++;
}
i++;
}
}

void ssort(int[] arr)
{
    // iterator
    int i = 0;

    // internal iterator
    int j = 0;

    // minimum number index
    int jmin = 0;

    // loop through the arr
    // check if any element is bigger than the currently selected
element
    // if it is then swap the elements
    while(i < arr.length)
    {
        j = 0;
        jmin = 0;

        while(j < arr.length)
        {
            if(arr[i] < arr[jmin])
            {
                jmin = j;
            }
            j++;
        }

        int x = arr[i];
        arr[i] = arr[jmin];
        arr[jmin] = x;

        i++;
    }
}

void sort()
{
```

```
// iterator
int i = 0;

// loop through the rows
// sort the loops according to ther index
// if odd send them to bsort
// else send them to ssort
// this would sort the matrix
while(i < M)
{
    if((i+1) % 2 == 0)
        ssort(this.A[i]);
    else
        bsort(this.A[i]);
    i++;
}

void display()
{
    // index of the rows
    int i = 0;

    // index of the cols
    int j = 0;

    // using an iterative forloop print all the values
    // print a newline at the end of line
    while(i < M)
    {
        j = 0;
        while(j < N)
        {
            System.out.print(j+" ");
            j++;
        }
        System.out.println();
        i++;
    }
}

public static void main(String args[])
{
    // input handler
    Scanner sc = new Scanner(System.in);

    // creating object of MxN
    // object of MxN
    MxN m = new MxN(sc.nextInt(), sc.nextInt());
}
```

```
// row iterator
int i = 0;

// col iterator
int j = 0;

// take input from stdin
for(i = 0; i < m.M; i++)
{
    for(j = 0; j < m.N; j++)
    {
        m.A[i][j] = sc.nextInt();
    }
}

// display original matrix
m.display();

// sort the original in the fation metioned matrix
m.sort();

// display the sorted matrix
m.display();
}
}
```

Variable Listing

Name	Function	Type	Scope
A	Original Matrix	int[][]	MxN
M	number of rows	int	MxN
N	number of cols	int	MxN
i	iterator	int	bsort
j	internal iterator	int	bsort
x	bubble sort array element stuck	int	if
i	iterator	int	ssort
j	internal iterator	int	ssort
jmin	minimum number index	int	ssort
x	if it is then swap the elements	int	while
i	iterator	int	sort
i	index of the rows	int	display
j	index of the cols	int	display
sc	input handler	Scanner	main
m	object of MxN	MxN	main
i	row iterator	int	main
j	col iterator	int	main

Assignment 11

A superclass Binary has been defined to accept a binary number and a subclass ToHex has been defined to convert binary number into its equivalent hexadecimal number using short cut logic of combining bits. Some of the members of the class are given below:

Class name : Binary

Data members

n : stores the binary number

Member functions:

BinHex(int n) : constructor to initialize the data member

void display(): display the binary number

Class name: ToHex

Data member:

hex: to store hexadecimal number

Methods:

ToHex(...): parameterized constructor

void bin_hex() : calculates the hexadecimal equivalent of n and stores it in hex.(using short cut logic of combining bits)

void display() : displays the binary number and hexadecimal number. You can add any extra methods if required.

Using concept of inheritance write details of both the classes and write main method accordingly.

*

Algorithm

BinHex

- Step 1: Start
- Step 2: initialize n using local n
- Step 3: End

display

- Step 1: Start
- Step 2: loop through n digits
- Step 3: when n is zero exit
- Step 4: print each digit of number
- Step 5: display a new line at the end for pretty print
- Step 6: End

ToHex

- Step 1: Start
- Step 2: initialize super object
- Step 3: hexnumber version of n
- Step 4: End

bin_hex

- Step 1: Start
- Step 2: until n is zero loop
- Step 3: generate a number from binary encoded decimal number
- Step 4: attaching the number after generation to the hex value
- Step 5: remove 4 digits from the end of n
- Step 6: End

display

- Step 1: Start
- Step 2: calling super's display function
- Step 3: a character mapper is used for prining
- Step 4: loop through n digits base 16
- Step 5: when n is zero exit
- Step 6: print each digit of number
- Step 7: display a subtle newline at the end
- Step 8: End

main

- Step 1: Start
- Step 2: object is generated using user input
- Step 3: execute bin_hex
- Step 4: display the usable information

Step 5: End

Source Code

```
import java.util.Scanner;

class BinHex
{
    // stores the binary number
    int n;

    BinHex(int n)
    {
        // initialize n using local n
        this.n = n;
    }

    void display()
    {
        // local version of n
        int n = this.n;

        // output number
        String output = "";

        // loop through n digits
        // when n is zero exit
        // print each digit of number
        while(n != 0)
        {
            output = n%10 + output;
            n /= 10;
        }

        // display a new line at the end for pretty print
        System.out.println(output);
    }
}

public class ToHex extends BinHex
{
    // to store hexadecimal number
    int hex;

    ToHex(int n)
    {
        // initialize super object
    }
}
```



```
        super(n);

        // hexnumber version of n
        this.hex = 0;
    }

    void bin_hex()
    {
        // local copy of n
        int n = super.n;

        // shift register
        int shl = 0;

        // until n is zero loop
        // generate a number from binary encoded decimal number
        // attaching the number after generation to the hex value
        // remove 4 digits from the end of n
        while(n != 0)
        {
            // decoded binary encoded decimal
            int number = (((n % 10000)/1000) << 3) |
                (((n % 1000)/100) << 2) |
                (((n % 100)/10) << 1) |
                (n % 10);

            this.hex = this.hex | (number << shl);

            n /= 10000;
            shl += 4;
        }
    }

    void display()
    {
        // calling super's display function
        super.display();

        // output number
        String output = "";

        // a character mapper is used for prining
        // a hex character mapper
        char[] hex_map = {'0', '1', '2', '3', '4', '5', '6', '7',
            '8', '9', 'A', 'B', 'C', 'D', 'E', 'F'};

        // loop through n digits base 16
        // when n is zero exit
        // print each digit of number
```

```
        while(hex != 0)
        {
            output = hex_map[hex%16] + output;
            hex /= 16;
        }

        // display a subtle newline at the end
        System.out.println(output);
    }

    public static void main(String arg[])
    {
        // input handler
        Scanner sc = new Scanner(System.in);

        // object is generated using user input
        // to hex object
        ToHex th = new ToHex(sc.nextInt());

        // execute bin_hex
        th.bin_hex();

        // display the usable information
        th.display();
    }
}
```

Variable Listing

Name	Function	Type	Scope
n	stores the binary number	int	BinHex
n	local version of n	int	display
output	output number	String	display
hex	to store hexadecimal number	int	BinHex
n	local copy of n	int	bin_hex
shl	shift register	int	bin_hex
number	decoded binary encoded decimal	int	while
output	output number	String	display
hex_map	a hex character mapper	char[]	display
sc	input handler	Scanner	main
th	to hex object	ToHex	main

Assignment 12

A super class Sentence accepts a sentence in uppercase terminated by `^` only. A sub-class Encrypt will encrypt the words in the sentence with a valid logic given below.

Class name: Sentence

Data members:

sen: accepts a sentence in uppercase and terminated by `^` only. Words in the sentence can be separated by one or more spaces.

Methods:

Sentence(String): constructor

void show(): update the sentence where each word will be separated by single space and terminated by `^`. Display the updated sentence.

Class name: Encrypt

Data member:

nsen: stores encrypted sentence

Methods:

Encrypt(...): constructor

void encrypt(): encrypt the words in the updated sentence as per logic given below:

i) For the word(s) starting with vowel, write the vowel then append consecutive consonants and vowels present in the word. Example say if the word is EXAMINATION then encrypted word will be EXAMINATINO

ii) For the word(s) starting with consonant, arrange the characters in the word in descending order as per ASCII value. Example say if the word is CONSTANT then encrypted word will be TTSONNCA.

Finally create the encrypted sentence with encrypted word terminated by `^`

void show(): display updated original and encrypted sentence.

*

Algorithm

Sentence

Step 1: Start
Step 2: initialize the sentence
Step 3: End

show

Step 1: Start
Step 2: display sen
Step 3: End

Encrypt

Step 1: Start
Step 2: initializing super class by sending original sentence
Step 3: initialize null sting for nsen
Step 4: End

encrypt

Step 1: Start
Step 2: split the sentence into ' '
Step 3: remove the '.' at the end becuase its of no use
Step 4: iterate over the words
Step 5: if the word starts with vowel
Step 6: then attach vowels and consonats one after another
Step 7: otherwise sort the whole chars in desending order
Step 8: bubble sort the chars
Step 9: End

show

Step 1: Start
Step 2: call the super show function
Step 3: display the encrypted sentence
Step 4: End

main

Step 1: Start
Step 2: test if the line ends with '.'
Step 3: if not nuke the program
Step 4: encrypt text supplied
Step 5: show the encrpyted text
Step 6: End

Source Code

```
import java.util.Scanner;

class Sentence
{
    // actual sentence
    String sen;

    Sentence(String sen)
    {
        // initialize the sentence
        this.sen = sen;
    }

    void show()
    {
        // display sen
        System.out.println(this.sen);
    }
}

public class Encrypt extends Sentence
{
    // stores encrypted sentence
    String nsen;

    Encrypt(String sen)
    {
        // initializing super class by sending original sentence
        super(sen);

        // initialize null sting for nsen
        this.nsen = "";
    }

    void encrypt()
    {
        // split the sentence into ' '
        // remove the '.' at the end becuae its of no use
        // words of the sentence ladies and gentle men
        String[] words = super.sen.substring(0, su-
per.sen.length()-1).split(" ");

        // words iterator controler
```

```
int i = 0;

// iterate over the words
// if the word starts with vowel
// then attach vowels and consonants one after another
// otherwise sort the whole chars in descending order
// bubble sort the chars
// if word length is 1 then don't do anything just attach the
word
while(i < words.length)
{
    if(words[i].length() == 1)
    {
        this.nsen += words[i] + " ";
    }
    else if("aeiouAEIOU".indexOf(words[i].charAt(0)) >= 0)
    {
        // list of vowels
        String vowels = "";

        // list of consonants
        String consonants = "";

        // iterator j
        int j = 0;
        while(j < words[i].length())
        {
            if("aeiouAEIOU".indexOf(words[i].charAt(j)) >=
0)
            {
                vowels += words[i].charAt(j);
            }
            else
            {
                consonants += words[i].charAt(j);
            }
            j++;
        }

        j = 0;
        while(j < vowels.length() && j < conso-
nants.length())
        {
            this.nsen += vowels.charAt(j);
            this.nsen += consonants.charAt(j);
            j++;
        }

        if(j < vowels.length())
```

```
        this.nsen += vowels.substring(j);

        if(j < consonants.length())
            this.nsen += consonants.substring(j);

        this.nsen += " ";
    }
    else
    {
        char[] letters = words[i].toCharArray();

        // iterator k
        int k = 0;

        // iterator l
        int l = 0;

        for(k = 0; k < letters.length; k++)
        {
            for(l = 0; l < letters.length-1; l++)
            {
                if(letters[l] < letters[l+1])
                {
                    // duplicate letters
                    char x = letters[l];
                    letters[l] = letters[l+1];
                    letters[l+1] = x;
                }
            }
        }

        this.nsen += new String(letters);

        this.nsen += " ";
    }
    i++;
}
this.nsen += ".";
}

void show()
{
    // call the super show function
    super.show();

    // display the encrypted sentence
    System.out.println(this.nsen);
}
```



```
public static void main(String args[])
{
    // input handler
    Scanner sc = new Scanner(System.in);

    // line input
    String line = sc.nextLine();

    // test if the line ends with '.'
    // if not nuke the program
    if(line.charAt(line.length()-1) != '.')
        return;

    // encrypt object creation
    Encrypt e = new Encrypt(line);

    // encrypt text supplied
    e.encrypt();

    // show the encrpyted text
    e.show();
}
}
```

Variable Listing

Name	Function	Type	Scope
sen	actual sentence	String	Sentence
nsen	stores encrypted sentence	String	Sentence
words	words of the sentence ladies and gentle men	String[]	encrypt
i	words iterator controler	int	encrypt
vowels	list of vowels	String	if
consonants	list of consonants	String	if
j	iterator j	int	if
letters	if word length is 1 then dont do anything just attach the word	char[]	else
k	iterator k	int	else
l	iterator l	int	else
x	duplicate letters	char	if
sc	input handler	Scanner	main
line	line input	String	main
e	encrypt object creation	Encrypt	main

Assignment 13

A superclass Number is defined to accept number of terms and also calculate the factorial of a number. Define a subclass Series to find the product of the series

$P = x * x^{2/3!} * x^{4/4!} * x^{8/5!} * x^{16/6!} \dots \dots \dots n \text{ terms}$

The details of the members of both classes are given below:

Class name: Number

Data member/instance variable:

n: to store an integer number

Member functions/methods:

Number(int): constructor to initialize the data member

int factorial(int a): returns the factorial of a number(use recursion)

(factorial of $n(n!) = 1 \times 2 \times 3 \times \dots \times n$)

void display(): displays the value of n

Class name: Series

Data member/instance variable:

prod: to store the product of the series

x: accepts value of unknown variable x(in double)

Member functions/methods:

Series(int) : parameterized constructor to initialize the data members of both the classes

void calProd(): calculates the PRODUCT of the given series

void display(): displays the data members of both the classes

*

Algorithm

Number

Step 1: Start
Step 2: initialize the value of n using local value
Step 3: End

factorial

Step 1: Start
Step 2: if a == 1 return a
Step 3: if that is not the case multiply a with the return value of factorial(a-1)
Step 4: End

display

Step 1: Start
Step 2: print the value of n
Step 3: End

Series

Step 1: Start
Step 2: initialize the super class object
Step 3: initialize the local value of x
Step 4: initialize prod to 1 (-_-)
Step 5: End

calProd

Step 1: Start
Step 2: loop using the iterator
Step 3: generate the product using the fomulae provided
Step 4: End

display

Step 1: Start
Step 2: call super's display function
Step 3: print the product of the value
Step 4: End

main

Step 1: Start
Step 2: generates the series from user input
Step 3: calculate the product
Step 4: display the product
Step 5: End

Source Code

```
import java.util.Scanner;

class Number
{
    // to store an integer number
    int n;

    Number(int n)
    {
        // initialize the value of n using local value
        this.n = n;
    }

    int factorial(int a)
    {
        // if a == 1 return a
        if(a == 1) return a;

        // if that is not the case multiply a with the return value
        of factorial(a-1)
        return a * factorial(a-1);
    }

    void display()
    {
        // print the value of n
        System.out.println(this.n);
    }
}

public class Series extends Number
{
    // to store the product of the series
    int prod;

    // accepts value of unknown variable x(in double)
    int x;

    Series(int n, int x)
    {
        // initialize the super class object
        super(n);
    }
}
```

```
// initialize the local value of x
this.x = x;

// initialize prod to 1 (--)
this.prod = 1;
}

void calProd()
{
    // create an iterator
    int i = 1;

    // loop using the iterator
    // generate the product using the fomulae provided
    while(i <= n)
    {
        this.prod *= Math.pow(x, i)/factorial(i);
    }
}

void display()
{
    // call super's display function
    super.display();

    // print the product of the value
    System.out.println(this.prod);
}

public static void main(String args[])
{
    // input handler
    Scanner sc = new Scanner(System.in);

    // generates the series from user input
    // series object
    Series s = new Series(sc.nextInt(), sc.nextInt());

    // calculate the product
    s.calProd();

    // display the product
    s.display();
}
}
```

Variable Listing

Name	Function	Type	Scope
n	to store an integer number	int	Number
prod	to store the product of the series	int	Number
x	accepts value of unknown variable x(in double)	int	Number
i	create an iterator	int	calProd
sc	input handler	Scanner	main
s	series object	Series	main

