CS115 Lab 4 Key

1. (20 points) Use classes and objects. For each of the following problems complete an 1.Input-Process-Output Design, 2.Test Table, 3.Java Program.

A. (cube vs sphere)

INPUT – length of side of cube, real number >0

constant - need Math.PI

PROCESS

calculate surface area of cube

calculate volume of cube

calculate radius of sphere with same surface area as cube (need to solve sphere surface area formula for radius=)

calculate radius of sphere with same volume as cube (need to solve sphere volume formula for radius=)

OUTPUT

output two radii (to 2 decimal places) with messages

Test Case Sample Data

small integer side

large integer side

small real side

large real side

import java.util.Scanner;

import java.text.DecimalFormat;

public class CubeSphere {

public static void main(String[] args) {

double cubeSide, cubeSurfaceArea, cubeVolume, radius1, radius2;

Scanner in = new Scanner(System.in);

DecimalFormat twoDecimal = new DecimalFormat( "####.00" );

System.out.println("Enter the length of the side of a cube: ");

cubeSide=in.nextDouble();

cubeSurfaceArea = cubeSide \* cubeSide \* 6;

cubeVolume = cubeSide \* cubeSide \* cubeSide;

radius1 = Math.sqrt(cubeSurfaceArea/(4 \* Math.PI));

radius2 = Math.pow((3./4)\*cubeVolume/Math.PI,1./3); // careful with 3/4 and 1/3, must force real number division

System.out.println( "The radius of sphere with same surface area is " + twoDecimal.format(radius1));

System.out.println( "The radius of sphere with same volume is " + twoDecimal.format(radius2));

}

}

B. (ParseDate)

INPUT – user birthday as String dd/mm/yyyy format

programmer birthday hard coded in program

PROCESS

parse the user birthday string into String for day, String for month, String for year

use Integer.parseInt to convert those three strings to three integers

create a Date object from the three integers (careful with order of arguments in constructor)

create a Date object for the programmers birthday

OUTPUT

Date object user birthday

"Your birthday is the same as the programmer birthday (true/false): " and call .equals on user birthday Date object passing it the programmer birthday Date object

Test Case

birthday matching programmer birthday

birthday not matching programmer birthday

import java.util.Scanner;

public class ParseDate {

public static void main(String[] args) {

String birthDay\_dd\_mm\_yyyy;

Date birthDay;

Date myBirthday = new Date(10,21,1964);

int day, month, year;

Scanner in = new Scanner(System.in);

System.out.println("Enter the your birth day in dd/mm/yyyy format: ");

birthDay\_dd\_mm\_yyyy=in.next();

day=Integer.parseInt(birthDay\_dd\_mm\_yyyy.substring(0,2));

month=Integer.parseInt(birthDay\_dd\_mm\_yyyy.substring(3,5));

year=Integer.parseInt(birthDay\_dd\_mm\_yyyy.substring(6));

birthDay= new Date(month, day, year);

System.out.println(birthDay);

System.out.println("Your birthday is the same as the programmer birthday (true/false): " +myBirthday.equals(birthDay));

}

}

C. (DieExpectation)

INPUT none

PROCESS

create an initialize an integer accumulator to 0

create a Random object

call nextInt on the Random object 5 times and accumulate into the accumulator

output accumulator/5. careful for integer division

call nextInt on the Random object 5 more times and accumulate into the accumulator

output accumulator/10. careful for integer division

OUTPUT

output accumulator/5. careful for integer division

output accumulator/10. careful for integer division

Test Case

run it multiple times and see if the second average consistently gets closer to 3.5

import java.util.Random;

public class DieExpectation {

public static void main(String[] args) {

Random myRandomGenerator = new Random();

int sum=0;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

System.out.println("Average after 5 rolls = "+sum/5.);

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

sum=sum+myRandomGenerator.nextInt(6)+1;

System.out.println("Average after 10 rolls = "+sum/10.);

}

}

D. (BuildingHeight)

INPUT - distance, angle in degrees, real numbers >0, angle<90

constant - variance=3

PROCESS

HIGH\_HEIGHT=DISTANCE \* tan(ANGLE+3) NOTE MATH.tan() uses radians, conversion needed from degrees using Math.toRadians

LOW\_HEIGHT=DISTANCE \* tan(ANGLE-3)

OUTPUT - HIGH\_HEIGHT LOW HEIGHT

Test Cases

angle 45 degrees - so distance is same as actual height

small angle, small distance

small angle, large distance

large angle, small distance

large angle, large distance

import java.util.Scanner;

public class BuildingHeight {

public static void main(String[] args) {

double angle, distance, upperHeight, lowerHeight;

final double VARIANCE=3;

Scanner in = new Scanner(System.in);

System.out.println("Enter the angle estimate in degrees (assuming +- 3 degrees variance)? ");

angle=in.nextDouble();

System.out.println("Enter the actual distance to the building? ");

distance=in.nextDouble();

upperHeight=distance\*Math.tan(Math.toRadians(angle+VARIANCE));

lowerHeight=distance\*Math.tan(Math.toRadians(angle-VARIANCE));

System.out.println( "Lower height estimate: " + lowerHeight);

System.out.println( "Upper height estimate: " + upperHeight);

}

}