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PROGRAMMING EXERCISES

Problem 1: Dice

Write a program for "computer dice", which replaces the dice in backgammon. The program generates two random numbers and prints them together with their amount. When the dice are the same program prints the appropriate message.

Problem 2: Points

Realize **Point** class with two attributes x and y, **double** type with private visibility. Realize constructor with two arguments of type ***double***: ***valX*** and ***valY***, which are assigned respectively to the attributes ***x*** and ***y***. Realize get and set methods for each of the attributes. Realize static method ***claculateDistance***, who by set two arguments of type ***Point*** – ***p1*** and ***p2*** returns the distance between them calculated by the formula:
$distance(p1, p2) = \sqrt{(x_{p1} - x_{p2})^2 + (y_{p1} - y_{p2})^2}$. Test realized method with sample data p1 = (1, 11.5), p2 = (5, 8.5) – expected result 5.

Problem 3: Method equals

Realize class method ***Point*** with the following signature: ***public boolean equals(Object obj)*** which returns true (***true***) if and only if the submitted argument is an existing object of class Point with the same coordinates as the current object that is calling the method equals, using only one return statement. Test the accuracy of actual method with data chosen by you.

Hint: you can use the operators ***instanceof*** and (eventually) ***if-then-else*** .

Problem 4: Decimal to hexadecimal

Write a program that converts a number from decimal to hexadecimal numeral system in the most efficient way and prints the result.

Directions: Use bitwise operators. The shift to the left is equivalent to multiplication by 2, and to the right of the integer division by 2.

Problem 5: Statistics

a) Write a program that generates and prints in cycle random real values in the range [0, 1), until the generated random value is greater than or equal to 0.99.

b) Formulate hypothesis for expected average number of values in each program execution.

c) Prove hypothesis experimentally by statistical experiment: modify the program so as to fulfill the functionality implemented in subparagraph a) 100 1,000 100,000 times, for every performance count the number of generated values in a separate variable (counter) and finally calculate the average of the numbers in various performances.

d) How to modify the program of subsection a) To generate an average of 10 values for a run. Check whether your hypothesis is correct using the experimental framework implemented in c).

Hint: You can calculate average value by calculating a sum of individual values for each run, and divide that sum to the number of runs. You can comment printing of generated values to speed up the experiment implementation.

Problem 6: Encryption and decryption of text

Write a program that, by given string **s** and integer (key) **k** encodes string by incrementing the Unicode code of each letter from **s** with the number **k**, and shifts each letter **k** positions to the right modulus length of the string (i.e. if a letter after shifting it right **k** positions goes outside the string, then we start counting the remaining positions from the left again – from the beginning of the string).

Write a program that enables decryption of encrypted text in the above algorithm.

Do you have ideas to improve the algorithm? If so - try to implement and test whether after decryption you get the original text.

Problem 7: Distances between points

Write a program that:

a) reads from a given text string x and y coordinates of the points in following format: **(x1, y1) (x2, y2) ... (xn, yn)** and stores them in an array of type Point. It is possible coordinates to be spread on several lines and there may be spaces between numbers and other characters (n <= 100);

b) by given coordinates of the point p, prints distance between it and each of the points in the array using formatted output;

c) prints the nearest and farthest points in the array with the distances to them.

Problem 8: Reading points from keyboard (console)

Modify the program from the problem 7, to read the coordinates of points from the keyboard.

*Hint: To enter text / number using keyboard use methods **nextLine()** or **nextInt()** of the class **java.util.Scanner**, for example:*

```
Scanner sc = new Scanner(System.in);
String inputStr = sc.nextLine();
```

ОСНОВНА ЛИТЕРАТУРА И ИНТЕРНЕТ РЕСУРСИ

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