



Notes and Announcements

- Reading Material: Chapter 5.

Exercises

1. **SumPrimes.** Redo the `SumPrimes` program from Assignment 3 but using a `while` loop inside the `isPrime` method. The program takes a command line argument `N` and a sequence of `N` positive integers and prints the numbers that are prime only, followed by their sum. Hint: Write a method with the following signature:

```
public static boolean isPrime(int n)
```

2. **Palindromes2.** Write a method `isPalindromePhrase` that accepts a string as argument and returns `true` or `false` indicating if the string is a palindrome or not. In this version of the method, whitespaces, commas, and apostrophes are ignored. For example, “Lonely Tylenol” and “Madam, I’m Adam” are both palindromes. The signature of the method should be:

```
public static boolean isPalindromePhrase(String str)
```

You are not allowed to generate a new string in your implementation of this method, and your iteration must be expressed with a `while` loop.

Use this method to write a program `Palindromes2` that takes an integer command line argument `N` followed by `N` strings and prints the strings that are palindromes according to this extended definition.

3. **KthRoot.** The k th root of a number x can be found by an iterative method that can be described as follows. Start with an initial estimate t of the k th root (this may be the number x itself, for example) and obtain an improved estimate by computing the expression $1/k (x / t^{k-1} + (k-1) * t)$. The process is repeated until the root is found. Write a method `kthRoot` that takes two arguments: a double x and an integer k and computes and prints the k th root of x . Write an appropriate `main()` to test your method.

4. **MonteCarloPi.** Monte Carlo simulations are techniques that consist of choosing sample experiments at random from a large set and then making deductions on the basis of the probabilities estimated from the result of these experiments. In this problem, you are to implement a Monte Carlo method for estimating the value of π .

Consider the first quadrant of a unit circle centered at $(0,0)$. This quarter circle lies inside a unit square. A point with coordinates (x,y) is inside the quarter circle iff $x^2 + y^2 \leq 1$. The area of the quarter circle region can be estimated by picking, at random, points (x,y) that lie in the unit square, and for each point determining whether the point lies in the region. The fraction of points that fall in the region should give an estimate of $\pi/4$ (ratio of the area of the region and the area of the enclosing unit square). Multiplying by 4 gives an estimate of π .

Write a program `MonteCarloPi` that takes a command line integer parameter `N` and prints an estimate of π using `N` random points as described above. Run your program with `N = 10, 100, 10000`, and comment on the values you get.

5. **BinaryToDecimal.** Write a method `binaryToDecimal` that takes a string as argument (the string consists of a sequence of ‘0’ and ‘1’ characters representing the binary representation of a number) and returns an integer with the decimal value of the number. The decimal value of a number with the binary representation of the form $d_n d_{n-1} \dots d_i \dots d_1 d_0$ may be computed as $\sum_{i=0}^n d_i \times 2^i$.

Use the method above to write a program that takes a command line argument N followed by N strings representing binary number representations and prints their decimal values.

6. **MakeChange.** Write a program that reads a command line integer N (number of Lebanese pounds in thousands) and prints out the best way (fewest number of bills) to make change using 100, 50, 20, 10, 5 and one thousand bills.

```
> java MakeChange 92
1 50,000
2 20,000
2 1,000
```

Hint. Your program should dispense as many bills of 100 thousands as possible, then 50 thousands, then 20 thousands, then 10 thousands, then 5 thousands, a finally one thousand