

Introduction to Programming

Labs – Week 8b

Exercise 1

Write a program that takes one integer command line input `n` and prints out `n!`. Handle the Input/Output in `main()` function and to compute the factorial, write a function that has the following signature: `public static long factorial(int n)`

What is the largest value of `n` that your function can handle without overflow?

Note: Don't use the same name for the class and function in your code. A function with the same name as the class name has special meaning in Java which we'll learn later.

Exercise 2

Write a function named `percentEven()` that accepts an array of integers as a parameter and returns the percentage of even numbers in the array as a real number. For example, if a variable named `nums` refers to an array of the elements `{6, 2, 9, 11, 3}`, then the call of `percentEven(nums)` should return `40.0`. If the array contains no even elements or no elements at all, return `0.0`.

Exercise 3

Write a function that takes three real arguments, `x`, `y`, and `s`, and plots an equilateral triangle centered on `(x,y)` with side length `s`. Call the function a number of times in `main()` to produce an entertaining pattern.

Hint: Vertices of such equilateral triangles are

$$\begin{aligned} A &= (x, y + \sqrt{3}/2 * s) \\ B &= (x - s/2, y - \sqrt{3}/6 * s) \\ C &= (x + s/2, y - \sqrt{3}/6 * s) \end{aligned}$$

Exercise 4

Write a static method `arrayEq()` that takes two `int` arrays as arguments and returns `true` if the arrays have the same length and all corresponding pairs of elements are equal, and `false` otherwise.

Exercise 5

Consider the leftmost and rightmost appearances of some value in an array. We'll say that the "*span*" is the number of elements between the two inclusive. A single value has a span of `1`. Write a function `maxSpan()` that returns the largest span found in the given array.

Note: Efficiency is not a priority.

Example:

```
maxSpan([1, 2, 1, 1, 3]) returns 4
maxSpan([1, 4, 2, 1, 4, 1, 4]) returns 6
maxSpan([1, 4, 2, 1, 4, 4, 4]) returns 6
```

Exercise 6

Write a program **SawTooth.java** to plot $\frac{2}{\pi} [\sin(1t)/1 + \sin(2t)/2 + \sin(3t)/3 + \dots]$ for $0 \leq t \leq 6\pi$. As you plot more and more terms, the wave converges to a sawtooth wave. Then play it using standard audio.

Hint: See following example we did in the lectures for plotting function and playing audio

<https://introcs.cs.princeton.edu/java/15inout/FunctionGraph.java.html>

<https://introcs.cs.princeton.edu/java/15inout/PlayThatTune.java.html>