Homework 3

Due 9am, October 31. No extensions....

What to hand in. For each problem, hand in a copy of your java source code and a script file showing input/output from typical program runs.

Problem 1 (Beginner): Write a Java program that will prompt a user for four floating point numbers, print each of the numbers, and then compute and print the largest and smallest values.

Hint. If you are using Java 1.4 or later, read keyboard input with the method `getTextFromConsole()`. Use the methods `Math.min()` and `Math.max()` to compute the smallest and largest values in just one line.

Problem 2 (Beginner): Figure 1 shows a mass m resting on a frictionless surface. The mass is connected to two walls by springs having stifnesses k_1 and k_2.

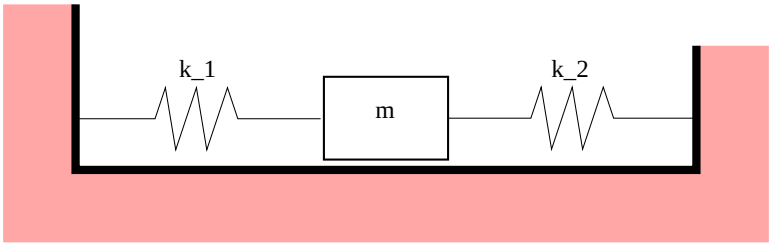

Figure 1: Mass-Spring System

The natural period of the mass-spring system is:

$$T = 2\pi\sqrt{\frac{m}{k_1 + k_2}} \tag{1}$$

Write a Java program that will prompt a user for m, k_1, and k_2, check that the supplied values are all greater than zero, and then compute and print the natural period of the mass-spring system.

Problem 3 (Beginner): Write a Java program that will print a list of points (x, y) on the graph of the equation

$$y(x) = \left[\frac{x^4 + \left[\frac{x}{sin(x)} \right]}{x - 2} \right] \tag{2}$$

for the range $-4 \leq x \leq 10$ in intervals of 0.2.

Note: Your program segment must be smart enough to detect a division by zero before it occurs, and print out an appropriate message before continuing with evaluations of $y(x)$.

Problem 4 (Moderate): A square of sheet metal having side length 2L cm has four pieces cut out symmetrically from the corners as shown in Figure 2. Assuming that L is a constant and L > 2x, then the remaining metal can be folded into a pyramid.

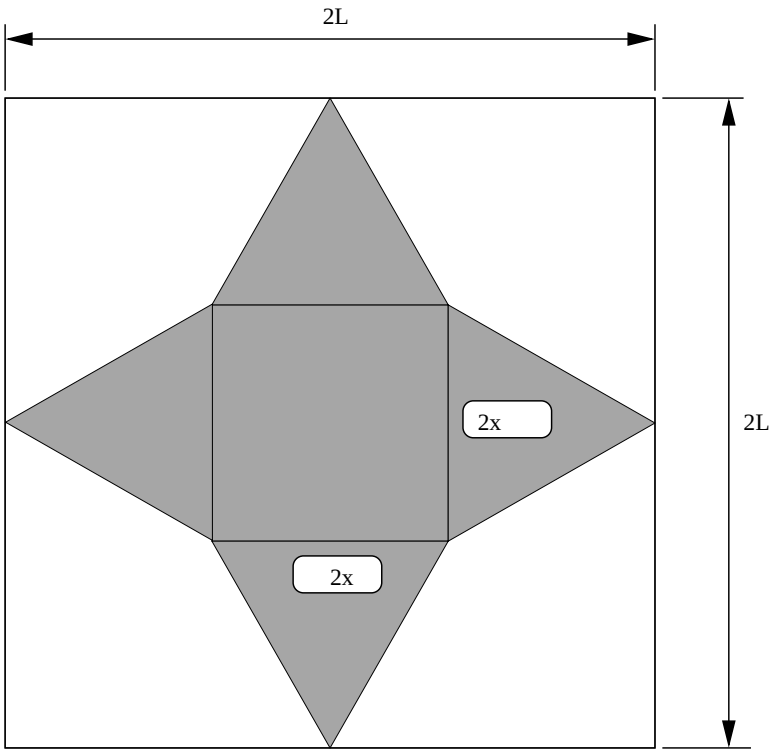

Figure 2: Sheetmetal Schematic for a Folded Pyramid

Things to do:

1. Show that the pyramid volume is given by:

$$\text{Volume}(x) = \frac{4x^2}{3}\sqrt{(L^2 - 2Lx)}\text{cm}^3 \tag{3}$$

and that the maximum volume occurs when x = 2L/5 cm.

2. Write a Java program that will prompt a user for the length L, and then compute and print volumes for appropriate values of x.

3. Organize your output into a tidy table, e.g., something like:

```
L = 20 cm
=========================================
              x (cm)         volume (cm^3)
=========================================
              ......              ........
              ......              ........
              ......              ........
              ......              ........
=========================================
```

4. Use your Java program to show that when L = 10 cm, the maximum pyramid volume occurs when x = 4cm.

Hint. I suggest that you write a program that similar to the folded box example given in the class reader.