1.00/1.001 Introduction to Computers and Engineering Problem Solving

Fall 2002

Problem Set 2

Due: Day 8

Problem 1. A Simple Loop (20%)

Recall in 18.02 when you studied power series, you learned the Taylor series expansion for e^x (for x is any real number) is

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + ...$$

Within a **`main()`** routine, use a **`while`** loop to calculate e^x using the Taylor series expansion. Prompt the user to enter x using **`JOptionPane.showInputDialog()`**. Terminate the **`while`** loop using the condition in the **`while`** statement. Output the value of x and the result of e^x.

Note that you should define a tolerance (use **`TOLERANCE = 10`**$^{-6}$). Once you discover that a term in your expansion is less that the tolerance, your loop should terminate and you should output your result.

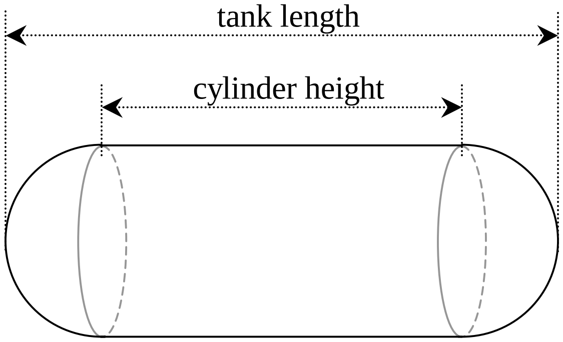
Check your answer using the **`Math.exp(x)`** function. You will find **`Math.pow(a, b)`** function useful in this problem.

Think about how you might implement this problem if instead of using a **`while`** loop, you used a **`for`** loop, or a **`do-while`** loop. Also think about what other ways you might exit the loop. At the end of the program, remember to include **`System.exit(0)`** so that after you run the program, it will exit properly. You will need to do this every time you use the Swing toolkit library.

Problem 2. Simple Classes (80%)

Write two simple classes, one called **`Cylinder`** and the other **`Hemisphere`**. They should at least have the minimum private data fields that determine the dimension of the object. For example, **`Hemisphere`** would have to have a data field called **`radius`**, since given the radius, we could determine the size of a **`Hemisphere`** object. (**`Cylinder`** should have **`radius`** and **`height`** as its two data fields.) In each class, implement the constructor, a **`getVolume()`** method, and methods that return the data fields.

Write another class called **`Tan`**k. Gas tanks on trucks look like a cylinder with a hemisphere attached on each end. In this problem set, since we are only going to be concerned about the volume of the tank, therefore, we could just have one **`Cylinder`** and one **`Hemisphere`** object. However, if later in the term you wanted the **`Tank`** class to have some other functions, you would probably want **`Tank`** to contain two **`Hemisphere`** objects instead of one. In the constructor, you will only have to create one **`Hemisphere`** and one **`Cylinder`** object given the radius and length of the tank. Remember the length of the tank is different from the height of the **`Cylinder`**. The following figure demonstrates the difference.



In the **`Tank`** class, write a **`getVolume()`** method and methods to get data fields as well.

In **`main()`**, prompt the user to enter the values for the length and radius of the tank and create a tank object. Remember to check if the user entered value are valid before passing them to the constructor. Output the tank's dimension and the corresponding volume.

Formulas:
Volume of a cylinder: area of circle * height = $\pi * r^2 * h$
Volume of a hemisphere: 0.5 * volume of a sphere = 2/3 * $\pi * r^3$

Turnin

Turnin Requirements

- Hardcopy and electronic copy of ALL source code (all .java files).
- Place a comment with your name, username, section, TA's name, assignment number, and list of people with whom you have discussed the problem set on ALL files you submit.
- Do NOT turn in electronic or hardcopies of compiled byte code (.class files).

Electronic Turnin

Use *SecureFX* (or another secure ftp or secure shell program) to upload your problem set to your 1.00 homework locker.

Detailed instructions of how to upload are on the course website.

Since your problem set is due at the beginning of lecture, your uploaded problem should have a timestamp of no later than morning on the due date.

Penalties

- Missing Hardcopy: -10% off problem score if missing hardcopy.
- Missing Electronic Copy: -30% off problem score if missing electronic copy.
- Late Turnin: -30% off problem score if 1 day late. More than 1 day late = NO CREDIT.

If your problem set is late, or if a professor has granted you an extension in advance, do not submit a printed copy of your problem set.