CSC 191B: Lab #1: Just Plug It In!

Learning Outcomes

- Get up and running with MATLAB
- Use variables and basic input and output
- Recognize numerical error

Problem Statement. The surface area of a sphere of radius r is given by the formula

$$A = 4\pi r^2.$$

In this lab, we want to explore what happens to the area when we increase the radius by a tiny amount δr. We could compute the increase in area in multiple ways:

$$\delta A = 4\pi(r + \delta r)^2 - 4\pi r^2 \tag{1}$$
$$\delta A = 4\pi(2r + \delta r) \cdot \delta r \tag{2}$$
$$\delta A = 8\pi r \cdot \delta r. \tag{3}$$

The first two formulae are mathematically equivalent while the third is an approximation that ignores the $(\delta r)^2$ term. Using Matlab functions `input` and `fprintf`, write a script that asks the user for the radius r in kilometers and a change of radius δr in millimeters and outputs the change in area in square meters according to each of the three formulae. Use your script to compute the change in surface area of the Earth (radius of 6367 kilometers) if its radius increased by 1.234 millimeters.

Discussion.

1. What kinds of error cause the differences among the results of the three formulae?
2. What's the difference between using `%f` and `%e` to print floating point numbers?
   (Hint: type `doc fprintf` at the MATLAB prompt.)

What to turn in.

- A single MATLAB file (e.g., `SAscript.m`) that includes your script, the results of the change of the Earth's surface area in comment lines, and the answers to the discussion questions in comment lines.

Grading rubric

- Script: 60 points (must use `input` and `fprintf` and evaluate formulae correctly)
- Earth results: 20 points (must show differences among results)
- Discussion questions: 10 points each