

# Lab 06 (Due: Monday, March 14, 2016, 11 : 59 : 00pm Central Time)

CSCE 155N

## 1 Lab Objectives

- Write Simple Functions According to a Given Specification
- Design Generic Functions for Solving a Class of Problems
- Create Recursive Functions

## 2 Prior to Laboratory

- Review the laboratory handout
- Read Chapter 10 of Book (Attaway)
- Review Documentation for `nargin`, `nargout`, and `isnumeric`

## 3 Topics Covered in Lab

- Writing Functions According to a Specification
  - Multiple Inputs/Outputs
  - Modular Programs
  - Subfunctions
  - Recursive Functions
- Design Useful/Helpful Functions
  - Abstract/Generalize Solutions

## 4 Activities/Exercises

### Before You Begin

- Download files from <http://cse.unl.edu/~cse155n/labs/06> to your Z:\csce155nm directory

## 4.1 Subfunctions

- Modify `cylinderInfo.m`, so that the function returns the volume and area of a cylinder, given the height and radius of the base.

- 

$$\text{Volume} = \pi \times \text{radius}^2 \times \text{height}$$

- 

$$\text{Surface Area} = 2 \times \pi \times \text{radius}^2 + \text{height} \times 2 \times \pi \times \text{radius}$$

- Calculate the Volume in the subfunction `calcVolume`
- Calculate the Surface Area in the subfunction `calcSurfArea`

## 4.2 Recursive Functions

- Modify `ourCatalan.m`, so that the function returns the  $n^{\text{th}}$  Catalan Number Sequence (which is defined as)

$$C_0 = 1$$

$$C_{n+1} = \sum_{i=0}^n C_i \times C_{n-i}$$

for  $n \geq 0$

## 4.3 Advanced Functions

- Modify `ellipsoidInfo.m`, so that the function returns some information about an ellipsoid (or sphere) depending on the user's supplied input and expected output

- If the user supplies one input, the function will calculate information for a sphere

If the user supplies three inputs, the function will calculate information for an ellipsoid. The user would supply the values in the order:  $a$ ,  $b$ , then  $c$

- If the user expects one output, the function will return the volume of the object

If the user expects two outputs, the function will return the volume and surface area of the object.

- Volume of a Sphere

$$\frac{4}{3} \times \pi \times \text{radius}^3$$

- Surface Area of a Sphere

$$4 \times \pi \times \text{radius}^2$$

- Volume of an Ellipsoid

$$\frac{4}{3} \times \pi \times a \times b \times c$$

- (Approximate) Surface Area of an Ellipsoid

$$4 \times \pi \times \left( \frac{a^p \times b^p + a^p \times c^p + b^p \times c^p}{3} \right)^{\frac{1}{p}}$$

for  $p = 1.6075$

## 5 Code Documentation

Remember to document your files in the way that we did for the previous labs. It will come in handy when you look back at code after a long time, or when someone else is trying to understand what your code does.

## 6 What to Submit

You will be submitting five (5) files (`cylinderInfo.m`, `ourCatalan.m`, `ellipsoidInfo.m`, `members06lab.txt`, and `contributions06lab.txt`).

## 7 Additional Resources

Online MATLAB Documentation  
 CSE Webhandin  
 CSE webgrader

## 8 Point Allocation

Component	Points
<code>cylinderInfo.m</code>	25
<code>ourCatalan.m</code>	25
<code>ellipsoidInfo.m</code>	30
<code>members06lab.txt</code>	5
<code>contributions06lab.txt</code>	5
webgrader PDF	10
Total	100