# CS-160 Data Structures

## Instructor

Brad Miller
Olin, 321
email: bmiller@luther.edu
Skype: bonelake
Google+

## Office Hours

Monday – Friday: (1:30–2:30)
Other times by appointment, drop-in, or virtual. Really! I'm here to help you, so stop in.

## Text Book

We'll be using the book *Problem Solving with Algorithms and Data Structures using Python*, by Brad Miller and David Ranum. With the blessing of our publisher. Its available on http://interactivepython.org

## Goals

- To continue to improve your problem solving skills
- To increase your comfort with writing Python programs
- To become more "pythonic" in your coding practices
- To understand how Python implements common data structures and the tradeoffs incurred by those decisions.
- To learn to recognize common patterns in problem solving
- To learn how to critically evaluate algorithms

## Course Outline

1. Introduction
   (a) Review of Python Basics
   (b) More on defining our own classes
   (c) Inheritance
2. Algorithm Analysis
   (a) Big O analysis
   (b) Experimental analysis
   (c) Python data structures performance
3. Basic Data Structures
   (a) Stacks
   (b) Queues
   (c) Dequeues
   (d) Linked Lists
4. Recursion
   (a) The 3 laws of Recursion
   (b) Easy Recursive Problems
   (c) Hard Recursive Problems
   (d) Dynamic Programming – When Recursion takes too long
5. Searching and Sorting
   (a) Linear search
   (b) Binary search
   (c) Sort Algorithms
   (d) Bubble Sort
   (e) Insertion Sort
   (f) Merge Sort
   (g) Radix sort
   (h) Quicksort
6. Trees
   (a) Binary Trees
   (b) Heaps
   (c) Balanced Binary Trees

7. Graphs

    (a) Breadth First Search (The famous Kevin Bacon problem)
    (b) Depth First Search
    (c) Topological Sorting
    (d) Strongly Connected Components
    (e) Shortest Path Problems
    (f) Dijkstra's Algorithm
    (g) Prims algorithm

## Class Requirements:

### Participation

"The teacher's job is to design learning experiences, not primarily to impart information" Although there will be some lecture to this course a substantial amount of time will be spent solving problems and doing things. Please, read the assigned materials and come to class with questions. It is fine to be confused. You are not going to understand everything the first time you read it or hear it or do it.

### Homework

You will have at least weekly homework assignments, sometimes more frequently. You need to hand them in on-time, and I, in turn, will get them graded back to you within a week.

### Grading

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50%   Labs and Homework
40%   Exams  (likely 3 exams)
10%   Class participation
```

The grading scale is:

```
90 -- 100   A
80 -- 89    B
70 -- 79    C
60 -- 69    D
0 --  59    F
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