**CSC 2500 Programming Assignment 1**

Spring 2019 (Due 2/12/2019) at the beginning of class

Be sure to read the Programming Styledocument when turning in your assignment. This is an individual assignment;  you must work alone.

In this lab we will use the actual machine to validate our run-time complexity analysis and asymptotic run-time complexity analysis by comparing worst case, best case, and average case run times for Merge Sort and Insertion Sort.  You should implement the algorithms within a sorting class and then plot their time behavior as a function of n and compare this with plots of the expected behavior.

Some questions to think about and address in your project report:

 What size n0 is required to begin to exhibit asymptotic complexity?

* What size n is required for insertion sort to “beat” merge sort?
* What inputs are required to generate “average” complexity.  How about “best case and worst case”?
* How does measured run time correspond to operation counts that we use in abstract complexity analysis?  Are you counting the same thing?
* How to create your test driver so that it exercises your sort programs.
* How to create the sorting class so that it will be extensible and re-usable for future projects (we will be adding more sorts and sorting different types of data).

 To be effective in this assignment you should read and understand Chapters 2 and Section 3.1 thoroughly.

* Motivation & Background Writeup (15%)
* Procedures Writeup
  + 5% Pseudocode with Invariants and Pre/Post Conditions
  + 5% Correct Program Headers
  + 5% Implemented Pre/Post Conditions
  + 15% Implemented Invariants in Program
* 10% Testing Plan & Test Results
* 25% Correctness of Program – does it meet its postcondition, did you implement the invariants.
* 5% Good Program Structure (variable names, code re-use, good functional decomposition object-oriented design, and comments
* 5% List of Problems encountered
* 10% Conclusion and Performance Comparisons.

**C. Sc. 2500- Programming Style Document**

**Purpose**

The purpose of the programming assignments is to reinforce the abstract notions of complexity, correctness and algorithm properties presented in class. The programs and analysis represent classic algorithms in the field of Computer Science and involve, in general, more complex programming and analysis skills than the programs in previous classes.

**Programs**

Your work must be your own for individual assignments. You must work cooperatively in a group for the group programming assignments, although the group membership must change for each program.

**Report Style**

We will consider each program as a laboratory experiment requiring a complete writeup in the form of a written report (one per group). Each report must contain the following information:

* Motivation - this is very important to introduce the subject to the scientifically literate reader. The motivation should clearly state what is being attempted and what the reader might expect to learn in a way that will "grab" the reader.
* Background - this section should provide enough background so the reader can appreciate the experiment's significance, relevance, and complexity.
* Procedures - this section should describe what procedures were used in constructing the program. Specifically, this section should include
  + High-level pseudocode (as done in class)
  + Pre and Post Conditions of the program and each routine and loop invariants for each major loop all implemented as C assert() statements.
  + A list of problems encountered in developing the program
  + A description of the tests performed on the program and detailed results that show its correctness. At a minimum, black-box boundary testing as you did in CS 153.
* A reasonable conclusion which addresses the questions posed by the "Motivation" section.
* Revisions
  + CS 2500 is a Writing Emphasized Course. You will be allowed one revision of the project write-up, but not of the program; the program should be correct and complete on the first submission following good programming practices and documentation. There will be a 10 point/day penalty on any resubmissions (10 points minimum)