

CS 146  
Data Structures and Algorithms

Summer Semester 2015

Department of Computer Science  
San José State University  
Instructor: Ron Mak

Homework #5  
**More Sorting Algorithms**

<b>Assigned:</b> Tuesday, July 14
<b>Due:</b> Friday, July 24 at 11:59 pm
100 points max

The purpose of this assignment is to give you a closer look at the **heapsort**, **mergesort**, and **quicksort** algorithms. Add these algorithms to your work from Assignment #4.

Do two versions of mergesort:

- Sort an array.
- Sort a linked list.

Do two versions of quicksort:

- Suboptimal first element as the pivot choice.
- Median-of-three pivot choice.

The total sorts for this assignment:

- insertion sort
- Shellsort (two versions, optimal and suboptimal  $h$  sequences)
- heapsort
- mergesort (two versions, array and linked list)
- quicksort (two versions, optimal and suboptimal pivot choices)

The algorithms should sort, in the lowest to highest (increasing) order:

- An unsorted array of unique random numbers in random order.
- An array of unique numbers that's already sorted in increasing order. These numbers do not need to be random. Your algorithms should not know ahead of time that the array was already sorted.
- An array of unique numbers that's already sorted in reverse (decreasing) order. These numbers do not need to be random. Your algorithms need to resort the numbers in increasing order without knowing ahead of time that the array was already sorted in reverse order.

- An array of all zeroes. Your algorithms should not know ahead of time that all the array elements contain the same value.

Verify that your arrays are properly sorted!

## Output

For each sort, your program should print:

- How much time it took in milliseconds.
- How many comparisons it made between two values.
- How many moves it made of the values.

Examples:

- If you shift five values over one position each, that's five moves.
- Two values exchanging places (a swap) is two moves.

You can output these results in a single table.

Sample output: <http://www.cs.sjsu.edu/~mak/CS146/assignments/5/output-5.txt>

## Teamwork

You may work individually as a team of one, or you can partner with another student as a team of two.

You can be on only one team at a time. If you partner with someone, both of you will receive the same score for this assignment. You'll be able to choose a different partner or work alone for subsequent assignments.

## What to turn in

Create a zip file containing:

- Your Java source files.
- Any instructions on how to build and run your code.
- Text files containing your outputs
- A short report (1 or 2 pages) that describes your conclusions from doing this assignment.

Name the zip file after yourself or yourselves.

Examples: `smith.zip`, `smith-jones.zip`

Each team should email the zip file to [ron.mak@sjsu.edu](mailto:ron.mak@sjsu.edu). Your subject line must be:

**CS 146 Assignment #5 *Your name(s)***

Example:

**CS 146 Assignment #5 Mary Smith & John Jones**

If you work with a partner, you should email only one assignment between the two of you. Whoever emails the assignment should CC the partner so that when I send you your team score, I can just do a "Reply all".