

CS 3310 - Data & File Structures
Instructor: Ajay Gupta, Western Michigan University
Lab TA: Yu Guo

Brennan C. Muir

Assignment 4 - Sorting Problems

PHASE 1: SPECIFICATION

Write a JAVA application to solve the following problem:

1. Read the data from a file and store into a linked-list, as well as, an array-list
2. Sort the data with 4 sorting methods: bubble, selection, merge, and binary-insertion.
3. Allow the application to handle generic elements
4. Application should be able to handle billions of data.
5. Analyze the 4 sorting methods by time and space complexity. Empirically, as well as, theoretically, and specify which is the best.

PHASE 2: DESIGN

My program is composed of a Driver, LinkedList Class, Stack and Queue Classes, and a Node Class. The Driver runs the whole program, including popping and pushing for stacks and add/delete for Queue. It finally checks for a minVal in a stack.

PHASE 3: RISK ANALYSIS

I'm not 100% sure about running with multiple different types. (String with int with float, etc.)
I am running on a machine with a 2.3 GHz Intel Core i7 Quad Core processor and 8GB of RAM.
Application could run faster with more data.

PHASE 4: VERIFICATION

From the tests that I have run, I did not run into any issues regarding my algorithms. The following are the time results for running each sort for Linked Lists and Array Lists. Merge Sort worked best for Linked List, while Insertion Sort worked best for Array List. My current machine can handle a billion types of data.

Sorting Analysis			
	Linked List	Array List	Big-O (Time/Space)
Bubble Sort	3128.67 μ s	3465.98 μ s	$\Omega(n)/O(1)$
Selection Sort	3590.62 μ s	2290.77 μ s	$\Omega(n^2)/O(1)$
Merge Sort	970.43 μ s	2474.16 μ s	$\Omega(n \log(n))/O(n)$
Binary-Insertion Sort	1336.06 μ s	1421.96 μ s	$\Omega(n)/O(1)$

PHASE 5: TESTING

Tested and passed using Gupta's provided files for strings.

PHASE 6: REFINING THE PROGRAM

I would maybe have made a "prettier" output. Cleaned up my driver too.

PHASE 7: PRODUCTION

I prepared a copy of the entire program for Lab TA's evaluation, as specified by the TA. Then, I sent electronically the copy to the Lab TA.

PHASE 8: MAINTENANCE

To fully benefit from the program evaluation feedback received from the Lab TA, I will perform program maintenance