

# Final Project- Comparison of Sorting Algorithms

---

**Due** Aug 20 by 11:59pm      **Points** 300      **Submitting** a text entry box or a file upload  
**Available** Aug 6 at 12am - Aug 22 at 11:59pm 17 days

---

This assignment was locked Aug 22 at 11:59pm.

As Chapter 20 in your textbook points out, we begin to put the science into Computer Science. Many tracks in STEM based fields including Computer Science involves conducting research. The field of computer science involves research. Computer Science majors must utilize the scientific method. The scientific method is the logical scheme used by scientists searching for answers to the questions posed within science. Scientific method is used to produce scientific theories. Computer Science majors should be able to produce scientific theories and use empirical evidence to prove or disprove theories, a priori and a posteriori. A successful computer science major should be able to; pose a question in the context of existing knowledge, formulate a hypothesis as a tentative answer, deduce outcomes and make predictions, test the hypothesis in a specific experiment, produce research artifacts and documentation

In this assignment you must utilize the scientific method. This assignment will represent your final project

You have studied chapters describe five sorting algorithms – bubble sort, selection sort, insertion sort, merge sort and quicksort. Chapter 20 provides information, illustrations and example code on the merge sort and quicksort code. Chapter 19 provides information, illustrations and example code on the bubble sort , selection sort and insertions sort.

Create software testing tools for bubble sort, insertion sort ,selection sort, merger sort, and quick sort. Your task for the Final Project is to conduct Bench Marking research to compare some of these algorithms you have studied in Computer Science I and II. You should design and implement a system to try to run at least four of the five the sorting methods with random data sets of 10,000 20,000 100,000 200,000 1,000,000 2,000,000 and 20,000,000 items.

You should run the program for each sorting algorithm 5 times for each data set size. Each time you run the program, you should record the time it takes to sort the data set and the size of the data. That is 5 readings for each data set size per sorting algorithm. If any sorting algorithm takes longer than 5 minutes to sort a particular data set size, you should stop the program for that trial and report this result in your report. If a sorting algorithm takes too long for any one trial, such as for 100,000 items, then it is not necessary to complete the trials for larger data sets, simply report the size of the data set for which that algorithm started to take too long.

**If you are creating separate projects for each type of sorting test, the program should have the following features**

- The program in the project should provide the capability to select or input the size of the array that will be populated with random integers.
- It should also provide the capability to select the number of times that the program will rebuild the array and rerun the test.

**If you are creating a single project that will perform all of the tasks, it should have the following input features.**

- The ability to select or input the type of sorting algorithm to use
- provide the capability to select or input the size of the array that will be populated with random integers
- provide the capability to select the number of times that the program will rebuild the array and rerun the test.

Chapter 20 describes a way to create a timer, start the timer when the sort begins, stop the timer when the sort ends, and capture the value of the time that elapsed. Feel free to create your own way for recording the elapsed time. However, if you do not have the luxury of time, then the process described in chapter 20 will work fine.

You may separate the programs to test each sorting method into separate IntelliJ Projects. This approach would have one project per sorting algorithm. You can then run your varying data sets multiple times per project. The user should be able to select or enter the size of the data set to generate Run each data set size 5 times per project and record the results.

Alternately, you could incorporate each segment into a more comprehensive application. I would recommend making them individually first. If you have additional time, incorporate them into a single project. If you take this approach, the user should be able to select the type of sorting algorithm to use, select or enter the size of the data set, and select or enter the number of times to repeat the test.

You may also consider working on this project collaboratively. If so, you can separate the task of creating different programs with a group member and then share components. If you work on the programs collaboratively. Each student must conduct their own test on the data sets and produce their own data

results, Workbook, report and presentation.

**Research Report** - You should submit a Research Report with your results and conclusions about the experiment. Your report should describe how you conducted the experiment. Additionally, your report should include a table containing data from an aspect of the overall research framework and data that you collected. Your report should also contain a chart that visually explains your interpretation of a segment of your results you find interesting. Your report should also include a written description of what the chart represents. Your Research Report should summarize your research findings.

The Research Report is not the Lab Report. The Lab Report describes your software development activities. Your software project is just a tool that you will use conducting your research. The Research Report should describe your thoughts and assumptions prior to the research. It should also contain the data that you accumulated. It should contain summaries of the data that you accumulated. It should contain at least one chart or graph illustrating something that you want to point out in your data. Finally, it should contain a conclusion on what you discovered from the data in your research. Many times what you thought prior to the research is not what you discovered after examining the results in the research. The research should have a format using the rules and guidelines that you have been following formatting your Lab Reports during this semester.

**Spreadsheet Workbook** - Your Spreadsheet Workbook should contain the detailed data generated by your software testing tool. The spreadsheet should include aggregation functions or formulas that summarize your data. Examples of aggregation functions are count(), sum(), average(), min(), max(). The Workbook should also contain charts or graphs illustrating something that you found interesting in the data that you analyzed.

**PowerPoint Presentation** - You must create and present a brief PowerPoint Presentation that outlines your research, findings and conclusions. The PowerPoint Presentation should not be more than 7 slides. I have included a document describing the outline of a small research presentation.

**Video Presentation** - Since this is an online section of CSCI 112, you cannot do a face to face presentation using your PowerPoint slides as a guide. You are going to substitute this by using a multimedia desktop recording tool named JING. This tool will permit you to capture the activity on your computer screen while recording audio. I provided a link to download and install JING on your personal computers. The link will also guide you do an online tutorial on using JING. I have also made arrangements with the computer center to install JING on computers in the SACC Lab in room C3-17. JING will limit you to a 5 minute presentation.

If you are familiar with an alternate software tool to create your Video Presentation, you are open to using the tool that you are familiar with. The Video Presentation should not be longer than 5 minutes.

## **Upload the following**

1. Your Research Report as a Word Processing Document
2. Your Spreadsheet Workbook used to analyze you data and create the chart
3. The Code used to the Create Data for the Report in a Zipped Container File. This will be either several different programming projects or one comprehensive project in a zipped file container
4. A Lab Report describing your software development processes
5. PowerPoint Presentation
6. link or file to play a JING multimedia presentation.

## **In Conclusion**

### **Details on the Artifacts to Submit for the Final Project**

1. You should submit a report with your results and conclusions about the experiment. Your report should describe how you conducted the experiment. Additionally, your report should include a table containing data from an aspect of the overall research framework and data that you collected. Your report should also contain a chart that visually explains your interpretation of the results that the chart represents. Your report should summarize your findings

Research Report should describe your research and the development of the tools used to conduct your research. The Research Report in not the Lab Report. The Lab Report describes your software development activities. Your software project is just a tool that you will use conducting your research. The Research Report should describe your thoughts and assumptions prior to the research. It should also contain the data that you accumulated. It should contain summaries of the data that you accumulated. It should contain at least one chart or graph illustrating something that you want to point out in your data. Finally, it should contain a conclusion on what you discovered from the data in your research. Many times what you thought prior to the research is not what you discovered after examining the results in the research. The research should be formatted using the rules and guidelines that you have been following formatting your Lab Reports during this semester.

2. You must create and present a brief PowerPoint Presentation that outlines your research, findings and conclusions. The PowerPoint Presentation should not be more than 7 slides. I have a included a document describing the outline of a small research presentation.
3. Zip File containing the Project or Projects used to accumulate your research data

4. A Lab Report describing your Software Development Activities. This includes the software design specifications (pseudo\_code, flowcharts). The Lab Report is a separate document from the Research Report.
5. A Spreadsheet Workbook containing your empirical data. This should contain aggregation functions to summarize your results and support your conclusions. The Spreadsheet Workbook should also contain 1 or two charts and or graphs visually illustrating your findings. The charts and or graphs should be accompanied with a brief paragraph or two describing what the charts and or graphs represent.
6. JING or equivalent Video Presentation

**Here is an outline for your final presentation**

**[Power Point Assignment Final Project.docx](#)** 

**[Power Point Assignment Final Project.pdf](#)** 

**Create a Video Presentation of Your Power Point and Report. Use the JING Video Recording Service to create and post your presentation**

**<https://www.techsmith.com/jing-tool.html>** **[\\_ \(https://www.techsmith.com/jing-tool.html\)](https://www.techsmith.com/jing-tool.html)**

**The Final Research Report should must contain the same minimum requirements as a Lab Report.**

The Minimum Requirements are List Below

### **Document Formatting**

- A document header - The Header section should contain your name
- A document footer - The footer should contain a page number

**Paragraphs Formatting should be formatted**

- 1.5 line spacing

- 12 points before and after the paragraph

### **Character Formatting**

- Body Text should be 12 points
- Segment Headers should be boldface

## **javadoc Requirement**

There is also a javadoc requirement for the Java application projects developed in the course. All Java projects must also contain javadoc documentation with it when submitted. There is an option to create javadocs in IntelliJ. As long as you have your code commented properly, the javadoc will be automatically generated when you selected the option to generate it in IntelliJ. I uploaded a pdf document describing how to comment your code to generate your javadoc documentation correctly. There are also hyperlinks leading to internet tutorials on creating javadoc documentation.