CPSC 131, Data Structures – Fall 2022 Container Review and Analysis Final Exam

Name *(required)*

CWID *(required)*   **Section** *(required)*

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Instructions:

Review, understand, and perform the three tasks described in the *Container Review and Analysis Overview*. Deliver your artifacts through Canvas before the Until Date. Late deliveries are not accepted. To summarize:

1. **Programming Portion**: Complete the programming portion using the provided starter code and saving the generated output to a comma-separated value (.csv) text file.
2. **Graphing Portion**: Complete the graphing portion by importing the generated .csv text file from the programming portion into a local spreadsheet application then graphing the data collected.
3. **Analysis Portion**: Complete the analysis portion by filling in this form with Adobe Acrobat.

   - Complete all 5 data analysis sections below. Leave no placeholders empty, all are required.

   - Document formatting, such as margins, font, font size, paragraph spacing, etc., shall not be altered.

   - ***.1:** Each graph must show one or more operations performed on two or more data structures.

   - ***.2:** Provide a detailed analysis explaining the information in the graph in terms of the operation's efficiency class (Big-Oh). Talk to what you see on the graphs and explain why you see it. If the graphs are not what you expected, point that out and explain. Compare and contrast the operations performed on the different data structures. Identify and describe patterns in the graphs, including peaks, trends, and variability. Your detailed analysis is expected to completely fill the text box. A box not completely filled suggests an incomplete analysis.

   - ***3:** Provide a specific, concrete real-world example application that uses the operation(s) being analyzed.

   - ***4:** Select from those analyzed the data structure best suited for the real-world example above. Your selection should be supported by the actual data collected and graphed. Explain why you selected the one you did, and why you did not select the others.

Point of Departure and Deliverable Artifacts:

Provided files	Files to deliver	Comments
main.cpp GroceryItem.hpp SomeObject.hpp Timer.hpp	1. main.cpp 2. GroceryItem.hpp 3. SomeObject.hpp 4. Timer.hpp	You shall not modify these files. The grading process will overwrite whatever you deliver with the one provided with this assignment. It is important that you deliver complete solutions, so don't omit these files.
GroceryItem.cpp	5. GroceryItem.cpp	Your (potentially) updated file from the previous assignment. The grading process detects and discards all changes made outside the designated TO-DO sections, including spacing and formatting.
Operations.hpp	6. Operations.hpp	Start with the file provided. Make your changes in the designated TO-DO sections (only). The grading process detects and discards all changes made outside the designated TO-DO sections, including spacing and formatting.
CPSC 131 Final Exam.pdf *(this file)*	7. CPSC 131 Final Exam.pdf	Your analysis report document including your resulting graphs. Use only Adobe Acrobat to populate this form.
sample-output.csv	8. output.csv	Capture your program's output to this text file and include it in your delivery. Failure to deliver this file indicates you could not get your program to execute.
sample-output.xlsx	9. output.xlsx, OR output.ods	Spreadsheet (MS Office Excel or LibreOffice Calc) containing your imported output.csv file and graphs created.
	readme.*	Optional. Use it to communicate your thoughts to the grader.
CPSC 131 Final Exam Rubric.xlsx		Rubric that will be used to grade your exam.
Grocery_UPC_Database-Small.dat Grocery_UPC_Database-Large.dat		Text files to be used as program input. Do not modify these files. They're big and unchanged, so don't include them in your delivery. Start with "*-Small.dat". Once you have a working program, use "*-Large.dat" as the input used to create your final output.csv file.

RegressionTests/
   GroceryItemTests.cpp
   CheckResults.hpp
   OperationsTests.cpp
		When you're far enough along and ready to have your work tested, then place this folder in your working directory and rebuild. These tests will be added to your delivery and executed during the grading process. The grading process expects all tests to pass.

Part A Inserting into a Vector at the back versus a Hash Table

Graph and analyze inserting an object at the back of an extendable vector versus inserting an object into a hash table. Provide a specific example of an application whose dominate operation is inserting an object into a data structure, then based on the data collected, graphed, and analyzed choose either the Vector or Hash Table to use in that application. Explain why you selected the one you did, and why you did not select the others.

A.1 Data Analysis Graphs

Figure A.1-1: _____   *Figure A.1-2:* _____

Figure A.1-3: _____

A.2 Detailed Analysis and Summation

A.3 Specific, Concrete, Real-world Example

A.4 Data Structure Selection

Part B   Removing from a SLL at the back versus a Vector at the front

Graph and analyze removing an object from the back of a singly linked list versus removing an object from the front of an extendable vector. Provide a specific example of an application whose dominate operation is removing an object from a data structure, then based on the data collected, graphed, and analyzed choose either the Singly Linked List or Vector to use in that application. Explain why you selected the one you did, and why you did not select the others.

B.1   Data Analysis Graphs

Figure B.1-1: _____

Figure B.1-2: _____

Figure B.1-3: _____

B.2 Detailed Analysis and Summation

B.3 Specific, Concrete, Real-world Example

B.4 Data Structure Selection

Part C Searching a Vector, DLL, SLL, BST, and a Hash Table

Graph and analyze searching for an object in an extendable vector versus a doubly linked list versus a singly linked list versus a balanced binary search tree versus a hash table. Provide a specific example of an application whose dominate operation is searching for an object in a data structure, then based on the data collected, graphed, and analyzed choose either the Vector, DLL, SLL, BST, or Hash Table to use in that application. Explain why you selected the one you did, and why you did not select the others. Hint, create graphs comparing all the structures and then just similar trends of select data structures. Zoom in and out, left and right highlighting interesting characteristics. (Remember, each graph must have at least two structures graphed.)

C.1 Data Analysis Graphs

Figure C.1-1: _____   *Figure C.1-2:* _____

Figure C.1-3: _____   *Figure C.1-4:* _____

Figure C.1-5: _____

C.2 Detailed Analysis and Summation

C.3 Specific, Concrete, Real-world Example

C.4 Data Structure Selection

Part D *You select #1*

You select one or more operations on two or more data structures that hasn't already been analyzed and capture that in your analysis below. Graph and analyze your selected operation(s) for your selected data structures. Provide a specific example of an application whose dominate operation is your selected operation, then based on the data collected, graphed, and analyzed choose one of your data structures to use in that application. Explain why you selected the one you did, and why you did not select the others.

D.1 Data Analysis Graphs

Figure D.1-1: _____   *Figure D.1-2:* _____

Figure D.1-3: _____

D.2 Detailed Analysis and Summation

D.3 Specific, Concrete, Real-world Example

D.4 Data Structure Selection

Part E *You select #2*

You select one or more operations on two or more data structures that hasn't already been analyzed and capture that in your analysis below. Graph and analyze your selected operation(s) for your selected data structures. Provide a specific example of an application whose dominate operation is your selected operation, then based on the data collected, graphed, and analyzed choose one of your data structures to use in that application. Explain why you selected the one you did, and why you did not select the others.

E.1 Data Analysis Graphs

Figure E.1-1: _____   *Figure E.1-2:* _____

Figure E.1-3: _____

E.2 Detailed Analysis and Summation

E.3 Specific, Concrete, Real-world Example

E.4 Data Structure Selection