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**School of Computing, Electrical and Applied Technology**

ISCG6426

Data Structures & Algorithms

# Assignment

**Semester 2, 2021**

**Due Date: Week 13 class**

**Total Marks:** 40

**Course Weighting:** 40%

**Learning outcomes covered in this assignment**

1. Apply object-oriented design and implementation techniques.
2. Interpret the trade-offs and issues involved in the design, implementation, and application of various data structures with respect to a given problem.
3. Explain the purpose and answer questions about data structures and design patterns that illustrate strengths and weaknesses with respect to resource consumption.
4. Assess the impact of data structures on algorithms.
5. Analyse the scalability of data structures and algorithms in terms of both space and time complexity.

**Cover Sheet**

|  |  |
| --- | --- |
| First Name | Vibhor |
| Last Name | Gupta |
| Student ID | 1481740 |
| Chosen Data Structure(s) or Algorithm(s) | Bubble Sort & Selection Sort |

By submitting files and/or work to the approved Moodle submission link for this assessment, I declare that all work has been performed by myself unless explicitly declared. Any code not created by me has been cited adequately. I accept that failure to comply with the Unitec Guidelines of Appropriate Student Conduct will result in enforcement of the relevant consequences.

16/10/2021



Signed:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_

## Documentation

### Data Structure / Algorithm

*The bubble sort, also known as sinking sort, is an extremely simple algorithm that repeats a simple step through the list, compares the elements that are next to each other, and if they happen to be in the wrong order then switches their position with each other. This process is repeated until the list has been sorted. Even among the sorting algorithms which are all considered simple algorithms, bubble sort is considered the simplest. It is one of the most rigorously analyzed algorithms. Due to the simplicity of the bubble sort algorithm, it is mostly used to introduce computer science students to the concept of algorithms. The history of the bubble sort algorithm goes as far back as 1956. it is one of the oldest computer algorithms in existence, back then it used to be referred to as "Sorting by exchange" or "Exchange Sorting" since then bubble sort has been extensively covered in the media and journals.*

*The selection sort is an in-place comparison sorting algorithm. The algorithm starts by dividing the list into two parts, it then goes through the entire list and finds the smallest elements and brings that element to the very top of the list, after that it goes through the entire list again and find the smallest element after that and so on until the list has been completely sorted. Selection sort is one of the slowest algorithms and can very well fall even behind bubble sort. Selection sort is good for checking if the list has already been sorted or when the memory is in short supply.*

### Strengths & Weaknesses

*The strengths of bubble sort are that it is easy to understand and very simple to write, it only takes a few lines to write the algorithm. Also, it takes very little space in the memory as the space complexity of the algorithm is O(1), which means only a single additional memory space is required. the best time complexity for bubble sort is O(n), but only when the list is already sorted or almost sorted. However, the disadvantages of bubble sort are that it is extremely slow and inefficient as the average time complexity of the bubble sort algorithm is O(n\*n) which is not great at all.*

*The strengths of the selection sort are that it is easy to understand and takes very little memory. the space complexity of selection sort is O(1) which means only one additional space is required to use this algorithm. However, the disadvantages are that it is extremely slow and inefficient as the best case time complexity of selection sort is O(n\*n) is not ideal.*

### Real-World Example

*Bubble sort is mostly used as an introduction to algorithms to computer science students. There is a very specific circumstance where bubble sort comes out to be the fastest sorting algorithm when the list is almost sorted. but apart from that scenario, there is not much use for the bubble sort algorithm. Bubble sort is used where the value of n is not too large and the programming effort is to be kept at a minimum. the only virtue of the bubble sort algorithm is that it requires no extra space in addition to that used to contain the input vector. Due to its inefficiency, the bubble sort algorithm has fallen out of favor in almost every place where it was used to be utilized.*

*Selection sort seems to have the same curse as bubble sort in that it is inefficient and slow and is only applicable when the number of elements is very small. For example, 5 or 10. However, that is hardly ever the case in the real world. As a result, there are not many places where selection sort is used in the real world. of the few places where selection sort is applicable, one is in sorting the playing cards.*

### Implementation

*I used C# windows form application to create an interactive UI for my project.*

*Graphical user interface, application

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*FIG 1: Front page of the assignment*

*Graphical user interface, application

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*FIG 2: Array generation and sort selection page of the project*

*Following are some snippets of the code I implemented:*

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*FIG 3: Bubble sort algorithm*

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*FIG 4: Selection sort algorithm*

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*FIG 4: Draw method*

*The SMFL first creates a visualization of a random array:*

*A picture containing chart

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*Then shows a visualization of the sorting of that array:*

*Chart, histogram

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