

## SCJ2013 Data Structure & Algorithms

# Simple Sort

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# Objectives

At the end of the class, students are expected to be able to do the following:

- Understand the purpose of sorting technique as operations on data structure.
- Use simple sort techniques in problem solving: Bubble sort, Insertion sort and Selection sort.
- Use divide and conquer sorting techniques in problem solving: Merge sort and Quick sort.
- Able to analyze the efficiency of the sorting technique.

# Introduction to Sort

## Sorting definition

- A process in which data in a list are **organized in certain order**; either ascending or descending order.

## Advantages of sorted lists:

- Easier to understand and analyze data collection.
- Searching process will be much faster.

## Sorting Example :

- Sorted in Ascending order: phone directory and dictionary
- Sorted in Descending order ; number of scores/points earned by every team in a competition. The winner get the highest score.

# Sorting Categories

## 2 Sorting Categories:

### 1. An internal sort

- Requires that the collection of data fit entirely in the computer's main memory. Suitable to sort a small size of list.

### 2. An external sort

- The collection of data will not fit in the computer's main memory all at once, but must reside in secondary storage. Suitable to sort large size of data.

# Types of List to be sorted

Types of lists to be sorted:

1. List of integers, char or list of strings

list of numbers

Student's marks	Student's marks
65	100
72	98
100	92
92	72
98	65

unsorted

Sorted into  
descending order

list of books

List of Books	List of Books
Data Structure	Data Structure
Learning English	Effective Communication
Math for Kids	Learn C++
Effective Communication	Learning English
Learn C++	Math for Kids

unsorted

Sorted into  
ascending order

# Types of List to be sorted

- List of records – the list contain more than one element or record.

Example: A list that contains student's information

Each record contains several field and a field called the record key

Record key – field that become the identifier to the record.

	Student Name	Matrix Number	CPA
[0]	Hisham	A5021	3.09
[1]	Zainal	A1051	2.55
[2]	Maria	A2000	3.60
[3]	Adam	A5501	3.00
[4]	Zahid	A2233	2.95

List of records

fields

# Sorting list of records

For sorting purposes, the records will be sorted based on the **sorting key**.

	Student Name	Matrix Number	CPA
[0]	Maria	A2000	3.60
[1]	Hisham	A5021	3.09
[2]	Adam	A5501	3.00
[3]	Zahid	A2233	2.95
[4]	Zainal	A1051	2.55

} Sorting key  
The list can be sorted either by student's name, matrix number or cpa.

The list above is sorted into descending order based on cpa value. From the sorted list, the highest score and the lowest score for the exam can be easily retrieve .



# Sorting Process

Main activity in the sorting process:

- 1. Compare:** compare between two elements. If they are not in correct order, then
- 2. Swap:** Change the position of the elements in order to get the right order.

The efficiency of sorting algorithm is measured based on :

- the number of comparisons and
- the number of swapping between elements



# Sorting Process

The sorting efficiency is measured based on the execution time of the algorithm when tested using sample cases of data.

3 sample cases of data:

1. Worse case analysis.
2. Average case analysis.
3. Best case analysis.

# Sample Cases of Data

- Worst-case analysis – involve the **maximum amount of work** an algorithm will require to sort a problem of a given size. (Usually, data is totally unsorted)
- Best-case analysis – involve the **minimum amount of work** an algorithm will require to sort a problem of a given size. (Usually, data is almost sorted)
- Average-case analysis considers the **expected amount of work** that an algorithm will require to sort a problem of a given size.

# Sorting Algorithms

- Quadratic Sorting Algorithms
  - Bubble Sort
  - Insertion Sort
  - Selection Sort
- Divide and Conquer Sorting Algorithms
  - Merge Sort
  - Quick Sort