

# Data Structures and Algorithms in Java

Parth Sinha

Student of AI & ML

Oxford Brookes University

Email: [sinhaparth555@gmail.com](mailto:sinhaparth555@gmail.com)

**Abstract**—This paper presents a comprehensive study guide for Data Structures and Algorithms (DSA) implementation in Java, motivated by the educational content provided through FreeCodeCamp’s online learning platform. The study focuses on fundamental DSA concepts, their practical implementation, and real-world applications using Java programming language. Drawing inspiration from FreeCodeCamp’s open-source educational resources, particularly their comprehensive video tutorial on DSA, this work aims to bridge the gap between theoretical understanding and practical implementation of key programming concepts. The paper systematically covers essential data structures including arrays, linked lists, trees, and graphs, along with fundamental algorithms for sorting, searching, and graph traversal. Special emphasis is placed on time and space complexity analysis, providing learners with a solid foundation in algorithmic efficiency. This resource serves as both a learning tool for beginners and a reference guide for experienced programmers seeking to strengthen their DSA knowledge in Java.

**Index Terms**—Data Structures, Algorithms, Java Programming, Educational Computing, FreeCodeCamp, Online Learning

## I. INTRODUCTION

### A. Data Structure

A data structure is a specialized format for organizing, processing, retrieving, and storing data. It’s like a blueprint that dictates how data elements are arranged and connected[1], making it easier to work with and manipulate data.

*Types of data structure*

1) *Linear*: Data elements are arranged in a sequential or linear order, one after another. Each element is connected to its previous and next adjacent elements.[2]

Types Linear data structure:

- Array
- Linked List
- Stack
- Queue

2) *Non-linear*: Data elements are not arranged in a linear order but rather in a hierarchical or networked manner.[2]

Types of Non-Linear data structure:

- Tree
- Graph

### B. Algorithms

An algorithm is a precise sequence of instructions designed to solve a specific problem or perform a computation. It’s like a recipe, but for solving problems rather than cooking.

Let say you want to prepare a tea. So, the steps would be -

- Boil water.
- Put tea in tea pot
- Add hot water
- Put hot tea into cups.
- Do you need sugar?
  - If yes, put it into tea cups
  - If no, do nothing
- Stir, drink and enjoy

Lets take another example, we want to print average of 3 given numbers. Lets say you want to write algorithm for it. So, the steps would be -

- Perform sum of 3 numbers.
- Store it in a variable sum.
- Divide the sum by 3.
- Store the value in variable avg.
- Print the value stored in avg.

Here’s an example of how Java code will be displayed:

```
public void findAvg(int a, int b, int c) {  
    int sum = a + b + c;  
    int avg = sum/3;  
    System.out.println(avg);  
}
```

Listing 1: Avg of 3 numbers

#### 1) Analysis of Algorithms:

- An Algorithm is a set of instructions to perform a task or to solve a given problem.
- There are several different algorithms to solve a given problems.
- Analysis of algorithm deals in finding best algorithm which runs fast and takes in less memory.
- For example -
  - Find sum of first  $n$  natural numbers.
    - a) Input :-  $n = 4$   
Output :- 10 i.e.  $(1 + 2 + 3 + 4)$
    - b) Input :-  $n = 5$   
Output :- 15 i.e.  $(1 + 2 + 3 + 4 + 5)$

## REFERENCES

- [1] mahdi, “Data structures: a comprehensive introduction,” Apr 2024. [Online]. Available: [https://dev.to/m\\_\\_mdy\\_\\_m/data-structures-a-comprehensive-introduction-2013](https://dev.to/m__mdy__m/data-structures-a-comprehensive-introduction-2013)
- [2] A. Biswal, “What is data structure: Types, classifications and applications,” May 2021. [Online]. Available: <https://www.simplilearn.com/tutorials/data-structure-tutorial/what-is-data-structure>