

Data Structures and Algorithms.

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Q) What is Data Structure?

→ A data structure is defined as a particular way of storing and organizing in our devices to use the data efficiently and effectively.

The main idea behind this is to minimize the time and space complexities. An efficient data structure takes minimum memory space and required minimum time to execute the data.

Q) What is Algorithms?

→ Algorithm is defined as a process or set of well-defined instructions that are typically used to solve a particular group of problems or perform a specific type of calculation.

Algorithm is a set of operations performed in step-by-step manner to execute a task.

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3) Complexities :-

The primary motive to use DSA is to solve the problem effectively and efficiently.

With the help of complexities we can measure / decide our program is efficient or not.

Complexity has two types:-

i) Time Complexity :-

Time complexity is used to measure the amount of time required to execute the code.

ii) Space Complexity :-

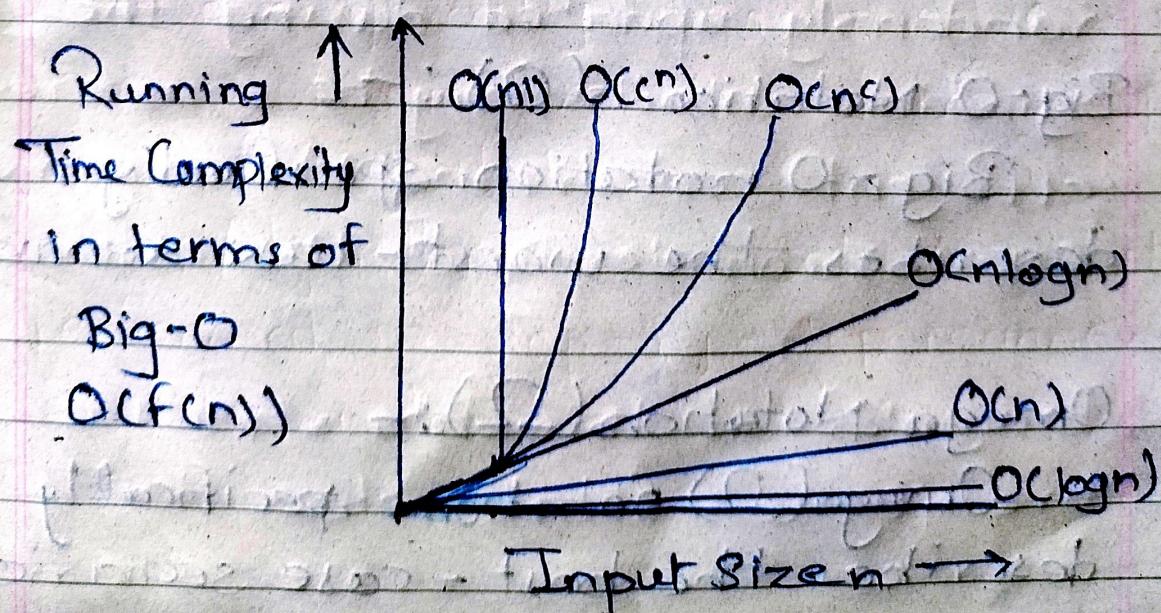
Space complexity means the amount of space required to execute the code successfully with their functionalities.

Complexities are measured with respect to their input parameters.

- * The time required for executing a code depends on the several factors, such as
 - i) The number of operations performed in the program.
 - ii) The speed of the device, and also
 - iii) The speed of data transfer if being executed on an online platform.

4) Asymptotic notation:-

Asymptotic notation is a mathematical tool that calculates the required time in terms of input size and does not require the execution of code.



Rate of Growth of Algorithms

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Where,

$O(n!)$, $O(c^n)$, $O(n^c)$ - Worst

$O(n \log n)$ - Bad

$O(n)$ - Fair

$O(\log n)$ - Good

$O(1)$ - Best.

It's neglects the system-dependent constants and is related to only the number of modular operations being performed in the whole program.

The following 3 asymptotic notations are mostly used to represent the time complexity of algorithms:-

- Big-O Notation :- (O) :-

Big-O notation specifically describes the worst-case scenario

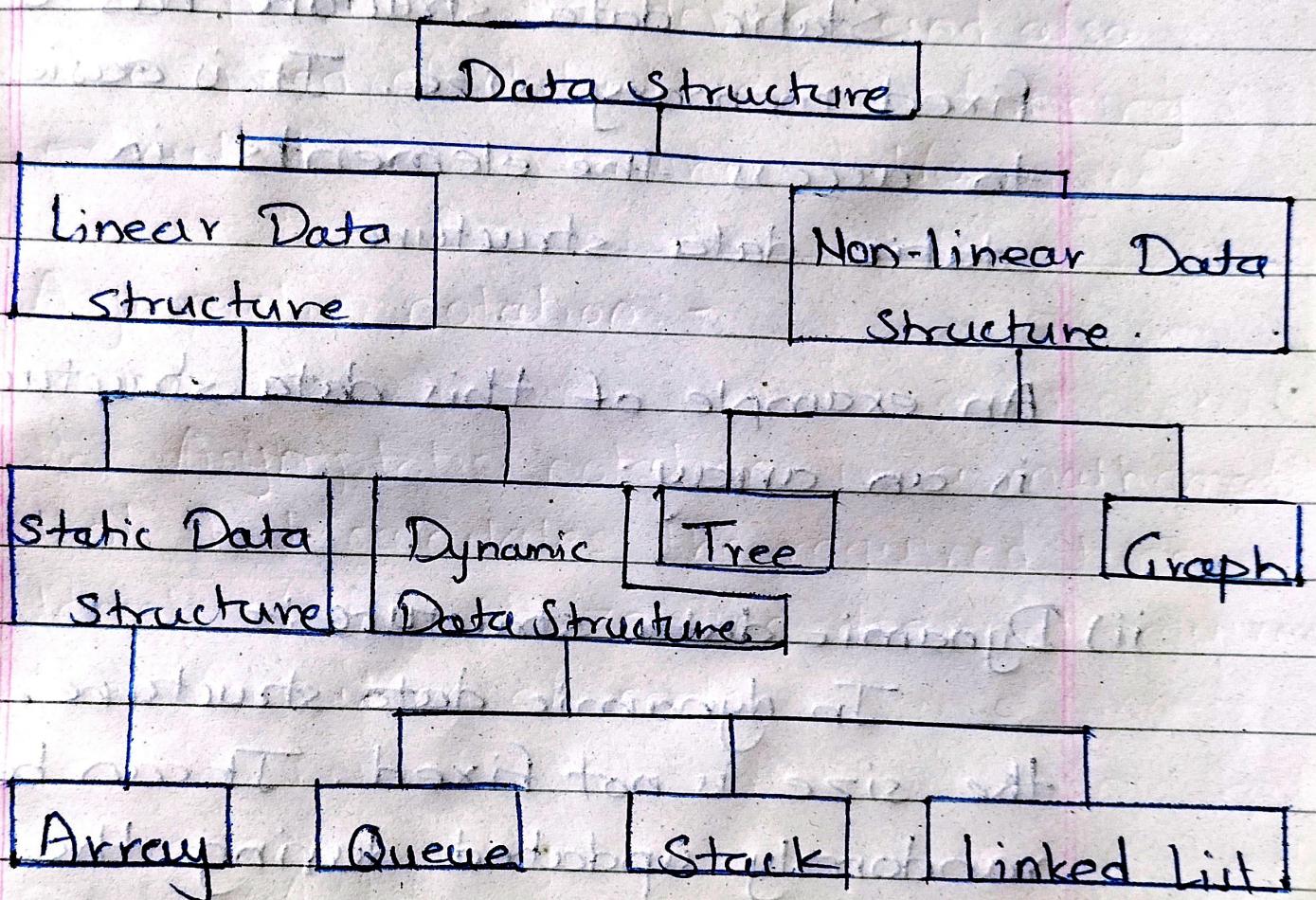
- Omega Notation (Ω):-

Omega(Ω) notation specifically describes the best-case scenario

- Theta Notation (Θ) :-

This notation represents the average complexity of an algorithm.

* Classification of Data Structure



1) Linear Data Structure :-

Data structure in which data elements are arranged sequentially or linearly, where each element is attached to its previous and next adjacent element is called a linear data structure.

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Examples of linear data structures are array, stack, queue, linked list, etc.

i) Static data structure:-

Static data structure has a fixed memory size. It is easier to access the elements in static data structure.

An example of this data structure is an array.

ii) Dynamic data structure :-

In dynamic data structure, the size is not fixed. It can be randomly updated during the runtime which may be considered efficient concerning the memory (space) complexity of the code.

Examples of this data structure are queue, stack, etc.

2] Non-linear data Structure:-

Data structure where data elements are not placed sequentially or linearly are called non-linear data structures.

In non-linear data structure, we can't traverse all the elements in a single run only.

Examples of non-linear data structures are graphs and trees.