Data Strucutres and Algorithms

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June 27, 2023

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What is Algorithm?

As per Donald Knuth

Algorithm

A definite, effective and finite process that receives input and produces an output

Definite : steps are clear, concise and unambigious

Effective : you can perform each operation precisely

Finite : finite number of steps

Analysis

When two programs solve the same problem, Analysis is finding answer to the question which one is better?

Better on?

- Readability :

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An example : Checking the run time

our first example

Big-O Notation

Requirement

To charactrize an algorithm's efficiency in terms of execution time, independet of any particular program or computer

Solution

To quanitfy the algorithm in terms of number of operations or steps

$T(n)$

$T(n)$ is a function that indicates the time an algorithm takes to solve a problem of size n

Example 1

```
1        def sum_of_n(n):
2            total = 0
3            for i in range(n):
4                total+=i
5            return total
6
7
```

- For sum_of_n, we can take the basic compute step as the assignment operations
- In sum_of_n following are the assignment operations
  - sum $= 0$
  - sum$+ = n$
- $T(n) = n + 1$
- We are only interested in the dominant term in $T(n)$, beacuse as n increases faster compared to other terms, i.e it overpowers the rest

Big-O

The dominant term in $T(n)$, which can be termed as order of magnitude function. Big-O $\implies$ Biggest Order