ASYMPTOTIC COMPLEXITY CLASSES

After studying asymptotic notation in summarize that:

$$\underbrace{\mathbf{1} < \log(\boldsymbol{n}) < \sqrt{\boldsymbol{n}}}_{\text{Lower Bound}} < \underbrace{\boldsymbol{n}}_{\text{Average Bound}} < \underbrace{\boldsymbol{nlogn} < \boldsymbol{n}^{2} < \boldsymbol{n}^{3} < \cdots < \mathbf{2}^{\boldsymbol{n}} < \mathbf{3}^{\boldsymbol{n}} < \cdots < \boldsymbol{n}^{\boldsymbol{n}}}_{\text{Upper Bound}}$$

A group of algorithms that share the same time complexity are called asymptotic complexity classes.

Two algorithms are said to be same class if the rate of growth of these algorithms is similar. Based on this, the asymptotic classes that are possible have been constructed, as shown in Table:

ASYMPTOTIC CLASS	REMARKS
$O(1)$	*Constant algorithm.*
$O(\log n)$	*Logarithmic algorithms.*
$O((\log n)^k)$	*Poly − logarithmic algorithms*
$O(n)$	*Linear Algorithms.*
$O(n^2)$	*Quadratic algorithms*
$O(n^3)$	*Cubic Algorithms.*
$O(n^k)$	*Polynomial Algorithms.*
$O(k^n)$	*Exponential Algorithms.*
$O(n!)$	*Factorial Algorithms.*

Super Polynomial Algorithm

An algorithm that grows faster than any power of n is called a super polynomial algorithm.

Sub Exponential Algorithm

A function that grows slower than an exponential function.

Therefore, we can say,

Algorithm A that grows slower than algorithm B can be written as

$$A < B.$$

Similarly, this can also be written as $A \subset B$ using set notation. Then the following order is prevalent:

$$O(1) \subset O(logn) \subset O(n) \subset O(nlogn) \subset O(n^2) \subset O(n^3) \subset O(n^k) \subset O(2^k) \subset O(n!)$$

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