**Understand Asymptotic Notation**

**What is Big O Notation?**

**Big O** describes how the **runtime or space grows** with input size n.

It helps compare algorithm **efficiency**, especially as data grows large.

**Common Big O Examples:**

| **Notation** | **Meaning** | **Example** |
| --- | --- | --- |
| O(1) | Constant time | HashMap lookup |
| O(n) | Linear time | Linear Search |
| O(log n) | Logarithmic time | Binary Search |
| O(n²) | Quadratic time | Nested loops |

**Best, Average, and Worst Case for Search:**

| **Case** | **Linear Search** | **Binary Search** |
| --- | --- | --- |
| **Best** | O(1) – First match | O(1) – Middle match |
| **Average** | O(n/2) ≈ O(n) | O(log n) |
| **Worst** | O(n) – Last/no match | O(log n) – Not found |