**Time and Space Complexity Cheatsheet**

Time and Space Complexity are the two factors that determine the effectiveness of an algorithm.

To understand the basics of time and space complexity, best, average and worst cases please go through this article: <https://afteracademy.com/blog/time-and-space-complexity-analysis-of-algorithm>

This article covers the Time and space Big-O complexities of the most commonly used Data Structures and Algorithms!

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| --- | --- | --- | --- |
| ARRAY | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(1) | Θ(1) | O(n) |
| Search | Θ(n) | Θ(n) | O(n) |
| Insertion | Θ(n) | Θ(n) | O(n) |
| Deletion | Θ(n) | Θ(n) | O(n) |
| Quick Sort | Θ(nlog(n)) |  | O(n) |
| Merge Sort | Θ(nlog(n)) | O(nlog(n)) | O(n) |
| Insertion Sort | Θ(n^2) | O(n^2) | O(1) |
| Selection Sort | Θ(n^2) | O(n^2) | O(1) |
| Bubble Sort | Θ(n^2) | O(n^2) | O(1) |
| Shell Sort | Θ((nlog(n))^2) | O(n^2) | O(1) |
| Tree Sort | Θ(nlog(n)) | O(n^2) | O(n) |
| Heap Sort | Θ(nlog(n)) | O(nlog(n)) | O(1) |
| Bucket Sort | Θ(n+k) | O(n^2) | O(n) |
| Radix Sort | Θ(nk) | O(nk) | O(n+k) |
| Cube Sort | Θ(nlog(n)) | O(nlog(n)) | O(n) |
| Counting Sort | Θ(n+k) | O(n+k) | O(k) |
| Tim Sort | Θ(nlog(n)) | O(nlog(n)) | O(n) |

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| --- | --- | --- | --- |
| STACK | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(n) | Θ(n) | Θ(n) |
| Search | Θ(n) | Θ(n) | Θ(n) |
| Insertion | Θ(1) | Θ(1) | Θ(n) |
| Deletion | Θ(1) | Θ(1) | Θ(n) |

|  |  |  |  |
| --- | --- | --- | --- |
| QUEUE | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(n) | Θ(n) | O(n) |
| Search | Θ(n) | Θ(n) | O(n) |
| Insertion | Θ(1) | Θ(1) | O(n) |
| Deletion | Θ(1) | Θ(1) | O(n) |

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| --- | --- | --- | --- |
| Singly Linked List | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(n) | Θ(n) | O(n) |
| Search | Θ(n) | Θ(n) | O(n) |
| Insertion | Θ(1) | Θ(1) | O(n) |
| Deletion | Θ(1) | Θ(1) | O(n) |

|  |  |  |  |
| --- | --- | --- | --- |
| Doubly Linked List | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(n) | Θ(n) | Θ(n) |
| Search | Θ(n) | Θ(n) | Θ(n) |
| Insertion | Θ(1) | Θ(1) | Θ(n) |
| Deletion | Θ(1) | Θ(1) | Θ(n) |

|  |  |  |  |
| --- | --- | --- | --- |
| Skip List | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(log(n)) | Θ(n) | O(n) |
| Search | Θ(log(n)) | Θ(n) | O(n) |
| Insertion | Θ(log(n)) | Θ(n) | O(n) |
| Deletion | Θ(log(n)) | Θ(n) | O(n) |

|  |  |  |  |
| --- | --- | --- | --- |
| Binary Search Tree | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Access | Θ(log(n)) | Θ(n) | O(n) |
| Search | Θ(log(n)) | Θ(n) | O(n) |
| Insertion | Θ(log(n)) | Θ(n) | O(n) |
| Deletion | Θ(log(n)) | Θ(n) | O(n) |

Other resources to refer:

**1**. <https://www.freecodecamp.org/news/time-complexity-of-algorithms/>

2. <https://www.hackerearth.com/practice/basic-programming/complexity-analysis/time-and-space-complexity/tutorial/>

Thank you!

|  |  |  |  |
| --- | --- | --- | --- |
| Hash Table | Time Complexity | | Space Complexity |
| Average | Worst | Worst |
| Search | Θ(1) | Θ(n) | O(n) |
| Insertion | Θ(1) | Θ(n) | O(n) |
| Deletion | Θ(1) | Θ(n) | O(n) |