**DSA TAG CLUB CHEAT SHEET**

Sorting-

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Algorithm** | **In place** | **Stable** | **Best**  **Case** | **Average Case** | **Worst Case** |
| Selection | Yes | No | (n^2)/2 | (n^2)/2 | (n^2)/2 |
| Insertion | Yes | Yes | n | (n^2)/4 | (n^2)/2 |
| Bubble | Yes | Yes | n | (n^2)/2 | (n^2)/2 |
| Shellsort | Yes | No | n log3 n | ----------- | ---------- |
| Mergesort | No | Yes | (nlgn)/2 | n lgn | n lgn |
| Quicksort | Yes | No | n lgn | 2n ln(n) | (n^2)/2 |
| Heapsort | Yes | No | n logn | 2n lgn | 2n lgn |

Priority Queues-

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **DATA STRUCTURE** | **INSERT** | **DEL-MIN** | **MIN** | **DEC-KEY** | **DELETE** | **MERGE** |
| **array** | 1 | *n* | *n* | 1 | 1 | *n* |
| **binary heap** | log *n* | log *n* | 1 | log *n* | log *n* | *n* |
| ***d*-way heap** | log*d* *n* | *d* log*d* *n* | 1 | log*d* *n* | *d* log*d* *n* | *n* |
| **binomial heap** | 1 | log *n* | 1 | log *n* | log *n* | log *n* |
| **Fibonacci heap** | 1 | log *n* † | 1 | 1 † | log *n* † | 1 |
|  |  |  |  |  | † amortized guarantee | |

Symbol Tables-

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **worst case** | | | **average case** | | |
| **DATA STRUCTURE** | **SEARCH** | **INSERT** | **DELETE** | **SEARCH** | **INSERT** | **DELETE** |
| **sequential search** (in an unordered list) | *n* | *n* | *n* | *n* | *n* | *n* |
| **binary search** (in a sorted array) | log *n* | *n* | *n* | log *n* | *n* | *n* |
| **binary search tree** (unbalanced) | *n* | *n* | *n* | log *n* | log *n* | sqrt(*n*) |
| **red-black BST** (left-leaning) | log *n* | log *n* | log *n* | log *n* | log *n* | log *n* |
| **AVL** | log *n* | log *n* | log *n* | log *n* | log *n* | log *n* |
| **hash table** (separate-chaining) | *n* | *n* | *n* | 1 † | 1 † | 1 † |
| **hash table** (linear-probing) | *n* | *n* | *n* | 1 † | 1 † | 1 †/ |
|  |  |  |  | † uniform hashing assumption | | |

Graph Processing-

|  |  |  |  |
| --- | --- | --- | --- |
| **PROBLEM** | **ALGORITHM** | **TIME** | **SPACE** |
| **path** | DFS | *E* + *V* | *V* |
| **shortest path (fewest edges)** | BFS | *E* + *V* | *V* |
| **cycle** | DFS | *E* + *V* | *V* |
| **directed path** | DFS | *E* + *V* | *V* |
| **shortest directed path (fewest edges)** | BFS | *E* + *V* | *V* |
| **directed cycle** | DFS | *E* + *V* | *V* |
| **topological sort** | DFS | *E* + *V* | *V* |
| **bipartiteness / odd cycle** | DFS | *E* + *V* | *V* |
| **connected components** | DFS | *E* + *V* | *V* |
| **strong components** | Kosaraju–Sharir | *E* + *V* | *V* |
| **strong components** | Tarjan | *E* + *V* | *V* |
| **strong components** | Gabow | *E* + *V* | *V* |
| **Eulerian cycle** | DFS | *E* + *V* | *E* + *V* |
| **directed Eulerian cycle** | DFS | *E* + *V* | *V* |
| **transitive closure** | DFS | *V* (*E* + *V*) | *V*2 |
| **minimum spanning tree** | Kruskal | *E* log *E* | *E* + *V* |
| **minimum spanning tree** | Prim | *E* log *V* | *V* |
| **minimum spanning tree** | Boruvka | *E* log *V* | *V* |
| **shortest paths (nonnegative weights)** | Dijkstra | *E* log *V* | *V* |
| **shortest paths (no negative cycles)** | Bellman–Ford | *V* (*V* + *E*) | *V* |
| **shortest paths (no cycles)** | topological sort | *V* + *E* | *V* |
| **all-pairs shortest paths** | Floyd–Warshall | *V*3 | *V*2 |
| **maxflow–mincut** | Ford–Fulkerson | *E* *V* (*E* + *V*) | *V* |
| **bipartite matching** | Hopcroft–Karp | *V*½ (*E* + *V*) | *V* |
| **assignment problem** | successive shortest paths | *n*3 log *n* | *n*2 |

References- <https://algs4.cs.princeton.edu/cheatsheet/>