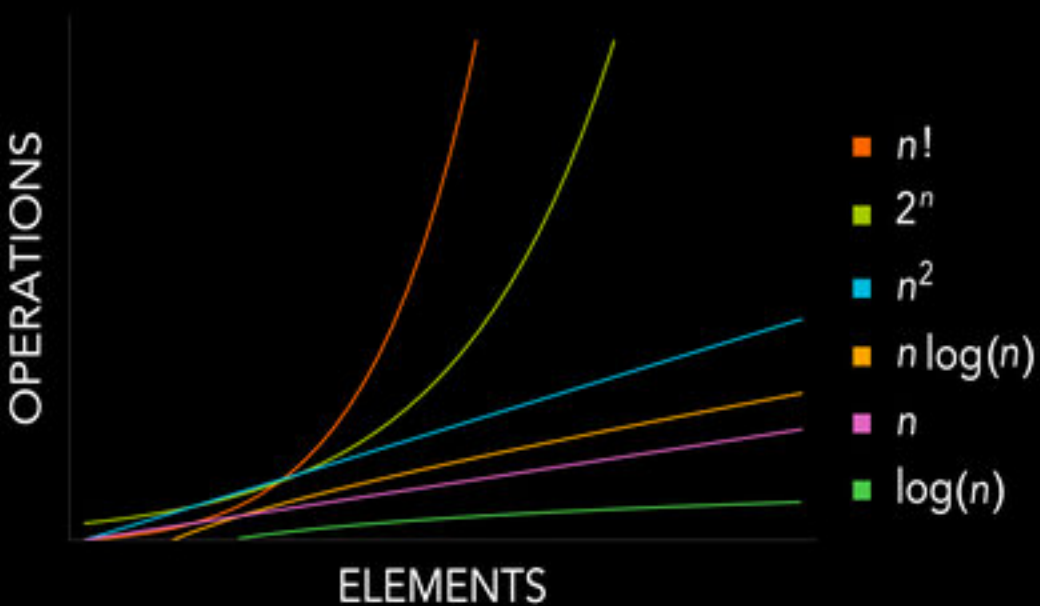


Complexity Cheatsheet

www.mikesollami.com



LEGEND

Time & Space	Ω best	Θ avg	O worst
--------------	------------------	-----------------	--------------

Θ average	O worst
---------------------	--------------

If not in the above format, assume worst case; adjacent duplicates are ellided as follows:

$x \mid x \rightarrow x$

Colors

Bad			Good
-----	--	--	------

Data Structures

	Access	Search	Insertion	Deletion	Space
Array	1			n	
Stack		n		1	n
Queue		n		1	n
1-Linked List		n		1	n
2-Linked List		n		1	n
Skiplist			$\log$ n		$n \log$
Hash Table			1 n		n
BST			$\log$ n		n
Cartesian Tree			1 n		n
B-Tree			$\log$		n
Red Black Tree			$\log$		n
Splay Tree			$\log$		n
AVL Tree			$\log$		n
KD Tree			$\log$ n		n

Sorting

	Time Complexity	Space
Quicksort	$n \log$ n^2	$\log$
Mergesort	$n \log$	n
Timsort	n $n \log$	1
Heapsort	$n \log$	1
Insertion Sort	n n^2	1
Selection Sort	n^2	1
Tree Sort	$n \log$ n^2	n
Shell Sort	$n \log$ $n \log^2$	1
Bucket Sort	$n + k$ n^2	n
Radix Sort	nk	$n + k$
Counting Sort	$n + k$	k
Cube Sort	n $n \log$	n

Common Operations

	Time Complexity	Space	Algorithm
Linear Search	1 n	1	
Binary Search	1 $\log$	1	
Int Multiplication	$n^{1.585}$	1	Karatsuba
Matrix Multiplication	$n^{2.373}$	1	Coppersmith–Winograd
2D Convolution	n^4		
3D Convolution	n^6		
2D FFT	$n^2 \log^2$		
3D FFT	$n^3 \log^3$		
Graph Walking	$v + e$		BFS/DFS
Max Clique	1.188^n		Robson
Shortest Paths	$e \log v$ v^2	$v + e$	Dijkstra
Min Spanning Tree	$e \log v$ v^2	$v + e$	Prim
Topological Sort	$v + e$ $v + e$	$v + e$	Kahn