

Cheat Sheet

This is a compilation of worst-case complexities for various data-structures and algorithms.

Data-Structures

Data Structure	Worst Case Complexity		Notes					
Array	<table><tr><td>Insert</td><td>$O(1)$</td></tr><tr><td>Retrieve</td><td>$O(1)$</td></tr></table>	Insert	$O(1)$	Retrieve	$O(1)$			
Insert	$O(1)$							
Retrieve	$O(1)$							
Linked List	<table><tr><td>Insert at Tail</td><td>$O(n)$</td></tr><tr><td>Insert at Head</td><td>$O(1)$</td></tr><tr><td>Retrieve</td><td>$O(n)$</td></tr></table>	Insert at Tail	$O(n)$	Insert at Head	$O(1)$	Retrieve	$O(n)$	Note that if new elements are added at the head of the linkedlist then insert becomes a $O(1)$ operation.
Insert at Tail	$O(n)$							
Insert at Head	$O(1)$							
Retrieve	$O(n)$							
Binary Tree		In worst case, the						

Dynamic Array	<table><tr><td>Insert</td><td>$O(n)$</td></tr><tr><td>Retrieve</td><td>$O(n)$</td></tr></table>	Insert	$O(n)$	Retrieve	$O(n)$	binary tree becomes a linked-list.
	Insert	$O(n)$				
Retrieve	$O(n)$					
	<table><tr><td>Insert</td><td>$O(1)$</td></tr><tr><td>Retrieve</td><td>$O(1)$</td></tr></table>	Insert	$O(1)$	Retrieve	$O(1)$	Note by retrieving it is implied we are retrieving from a specific index of the array.
	Insert	$O(1)$				
Retrieve	$O(1)$					
Stack	<table><tr><td>Push</td><td>$O(1)$</td></tr><tr><td>Pop</td><td>$O(1)$</td></tr></table>	Push	$O(1)$	Pop	$O(1)$	There are no complexity trick questions asked for stacks or queues. We only mention them here for completeness. The two data-structures are more important from a last-in last-out (stack) and first in first out (queue) perspective.
Push	$O(1)$					
Pop	$O(1)$					
Queue	<table><tr><td>Enqueue</td><td>$O(1)$</td></tr><tr><td>Dequeue</td><td>$O(1)$</td></tr></table>	Enqueue	$O(1)$	Dequeue	$O(1)$	
Enqueue	$O(1)$					
Dequeue	$O(1)$					

Priority Queue
(binary heap)

Insert	$O(\lg n)$
Delete	$O(\lg n)$
Get Max/M in	$O(1)$

Hashtable

Insert	$O(n)$
Retrieval	$O(n)$

Be mindful that a hashtable's average case for insertion and retrieval is $O(1)$

B-Trees

Insert	$O(\log n)$
Retrieval	$O(\log n)$

Red-Black Trees

Insert	$O(\log n)$
Retrieval	$O(\log n)$

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Algorithms

Category	Worst Case Complexity		Notes
Sorting	Bubble Sort	$O(n^2)$	<p>Note, even though worst case quicksort performance is $O(n^2)$ but in practice quicksort is often used for sorting since its average case is $O(n \lg n)$.</p>
	Insertion Sort	$O(n^2)$	
	Selection Sort	$O(n^2)$	
	Quick Sort	$O(n^2)$	
	Merge Sort	$O(n \lg n)$	
			<p>n is the total number of nodes in the tree. Most tree-traversal algorithms will end up seeing every node in the tree and their complexity in the worst case is thus $O(n)$.</p>
	Depth First Search	$O(n)$	
	Breadth First Search	$O(n)$	
	Pre-order	$O(n)$	

	<div>In- order, Post- order Traver sals</div>	
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