Big-O Cheat Sheet

In this appendix, we will list the complexities of the algorithms we implemented in this book.

Data structures

We have covered some of the most used data structures in this book. The following table presents the big-O notation for the insert, delete, and search operations of the data structures:

Data Structure	**Average cases**			**Worst cases**		
	Insert	**Delete**	**Search**	**Insert**	**Delete**	**Search**
Array/stack/queue	O(1)	O(1)	O(n)	O(1)	O(1)	O(n)
Linked list	O(1)	O(1)	O(n)	O(1)	O(1)	O(n)
Doubly linked list	O(1)	O(1)	O(n)	O(1)	O(1)	O(n)
Hash table	O(1)	O(1)	O(1)	O(n)	O(n)	O(n)
Binary search tree	O(log(n))	O(log(n))	O(log(n))	O(n)	O(n)	O(n)

Graphs

In *Chapter 9*, *Graphs*, we mentioned two different ways of representing a graph regarding its adjacency. The following table presents the big-O notation for its storage size, adding a vertex and adding an edge, removing a vertex and removing an edge, and also querying a vertex:

Node/edge management	Storage size	Add vertex	Add edge	Remove vertex	Remove edge	Query
Adjacency list	O (|V| + |E|)	O(1)	O(1)	O (|V| + |E|)	O(|E|)	O(|V|)
Adjacency matrix	$O(\|V\|^2)$	$O(\|V\|^2)$	O(1)	$O(\|V\|^2)$	O(1)	O(1)

Sorting algorithms

In *Chapter 10*, *Sorting and Searching Algorithms*, we covered some of the most used sorting algorithms. The following table presents the big-O notation for the sorting algorithms' best, average, and worst cases:

Algorithm (applied to an array)	Time complexity		
	Best cases	**Average cases**	**Worst cases**
Bubble Sort	O(n)	$O(n^2)$	$O(n^2)$
Selection Sort	$O(n^2)$	$O(n^2)$	$O(n^2)$
Insertion Sort	O(n)	$O(n^2)$	$O(n^2)$
Merge Sort	O(n log(n))	O(n log(n))	O(n log(n))
Quick Sort	O(n log(n))	O(n log(n))	$O(n^2)$

Searching algorithms

The following table presents the big-O notation for the searching algorithms covered in this book, including the graph traversal algorithms:

Algorithm	Data structure	Worst case
Sequential search	Array and linked list	O(n)
Binary search	Sorted array and binary search tree	O(log(n))
Depth-first search (DFS)	Graph of |V| vertices and |E| edges	O(|V| + |E|)
Breadth-first search (BFS)	Graph of |V| vertices and |E| edges	O(|V| + |E|)