CheatSheet INF102

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Contents

1 Sorting Algorithms

1.1 Selection sort

Time Complexity = $O(n^2)$
Sorts an array by repeatedly selecting the smallest or largest element from the unsorted portion and swapping it with the first unsorted element. Continues until list is sorted.

1.2 Insertion sort

Time Complexity = $O(n^2)$
Simple sorting algorithm that works by iteratively inserting each element of an unsorted list into its correct position in a sorted portion of the list. The same algorithm you use when sorting playing cards. You pick a card and insert it into the correct relative position.

1.3 Bubble sort

Time Complexity = $O(n^2)$
Works by repeatedly swapping the adjacent elements if they are in the wrong order. Continues this process until it has a pass with know swaps.

1.4 Quick sort

Worst Case = $O(n^2)$ Occures with poor pivot.
Average Case = $\theta(nlog(n))$
Based on divide and conquer, picks an element that is used as a pivot and partitions the array by moving all elements greater then pivot to the right of pivot and elements less than pivot on the left side. Calls the same algorithm to the know two sub-arrays and repeats the process.

1.5 Merge sort

Average Case = $(nlog(n))$
Divide the list into two smaller sublists, continues on dividing until list has size 1. Merges each of the smaller lists in correct order until everything is sorted.

1.6 Bucket sort

Average Case = $(nlog(n))$
Worsk if you have repeated elements in a list. Adds elements into different groups based on size. Sort each bucket on it own afterwards.

1.7 Radix sort

2 ArrayList vs. LinkedList

- *O(1) in amortized time (when resizing is not needed)

3 ArrayList vs. LinkedList (Queue/Stack)

- *O(1) in amortized time (when resizing is not needed)

Operation	ArrayList	LinkedList
size()	O(1)	O(1)
add()	O(n)*	O(1)
contains(obj)	O(n)	O(n)
remove(obj)	O(n)	O(n)
toArray()	O(n)	O(n)
indexOf(obj)	O(n)	O(n)
get(int i)	O(1)	O(n)
set(int i, E e)	O(1)	O(n)

	ArrayList		LinkedList	
	Queue	Stack	Queue	Stack
offer / push	O(n)	O(n)*	O(1)	O(1)
poll / pop	O(1)	O(1)	O(1)	O(1)
peek	O(1)	O(1)	O(1)	O(1)

4 PriorityQueue

4.1 PriorityQueue - SortedList

Operation	Time Complexity
add(T element)	O(n)
T findMin()	O(1)
T removeMin()	O(1)

4.2 PriorityQueue - LinkedList

Operation	Time Complexity
add(T element)	O(1)
T findMin()	O(n)
T removeMin()	O(n)

5 HashSet vs. TreeSet

Operation	HashSet	TreeSet
add()	O(1)*	O(log(n))
remove()	O(1)*	O(log(n))
contains(obj)	O(1)*	O(log(n))
findMin	O(n)	O(log(n))
findMax	O(n)	O(log(n))

- *HashSet har O(1) i snitt, men O(n) i worst case

6 Heap runtime

Operation	Time Complexity
add(T element)	O(log(n))
T peekMin()	O(1)
T removeMin()	O(log(n))
Construct heap	O(n)

7 Graph Datastructures

7.1 EdgeList

Metode	Kjøretid
Adjacent	O(M)*
Vertices	O(M)
Edges	O(N)
Neighbours	O(M)*
AddVertex	O(1)*
AddEdge	O(1)*

7.2 Adjacency Set

Metode	Kjøretid
Adjacent	O(1)*
Vertices	O(1)
Edges	O(M)
Neighbours	O(1)*
AddVertex	O(1)*
AddEdge	O(1)*

7.3 Adjacency List

Method	Runtime
Adjacent	O(degree)
Vertices	O(1)
Edges	O(M)
Neighbours	O(1)*
addVertex	O(N)
addEdge	O(degree)

7.4 Adjacency Matrix

Method	Runtime
Adjacent	$O(1)$
Vertices	$O(1)$
Edges	$O(N^2)$
Neighbours	$O(N)$
addVertex	$O(N^2)$ or $O(N)$
addEdge	$O(1)$

8 Summary of Graph Algorithms

Algorithm	Graph Type	Time Complexity
BFS	Unweighted	$O(m+n)$
DFS	Unweighted	$O(m+n)$
Dijkstra	Positive weights	$O(m \log m)$
Bellman-Ford	Negative weights, no negative cycle	$O(n \cdot m)$
Brute-Force	Negative weights	$2^{O(n)}$
A^*	Weighted	$mlog(n)$
Kruskal's	Weighted	$O(m \log n)$
Prim's	Weighted	$O(m \log n)$
Union-Find		$O(m \log n)^*$

Table 1: Summary of Graph Algorithms