

1. Analysis of Algorithms

- $O()$, $\Omega()$, $\Theta()$ def.
- Be able to show that $f(n)$ is $\Theta(g(n))$
- Be able to express the runtime of an algo. in $\Theta()$.

2. Elem DS

- Stack
 - operations
 - implementations using array or linked list
 - complexity of operations
 - resizing and amort. anal. for stack operations
- Queue
- List
 - operations
 - implementation \rightarrow array
 - run-times \rightarrow linked list
- Vector
- Sequence
- Trees
 - traversals
 - preorder
 - postorder
 - representations/implementation
 - linked structures
- Binary trees
 - inorder traversal
 - Euler tour
 - representation/implementation
 - linked structure
 - array
- Priority Queues
 - operations
 - implementation and run-times
 - sequence based
 - sorted
 - unsorted
 - sorting using PQ
 - selection sort
 - insertion sort
- Heaps and PQs
 - def. of a heap \rightarrow $key(v) \geq key(\text{par}(v))$
 - height of a heap \rightarrow complete Bin. tree
 - operations and run-time
 - insert
 - remove min
 - heap sort
 - vector based implementation of a heap
 - bottom-up heap constr.

FILE

• Dictionaries

- operations
 - log-file (unsorted seq. impl.)
 - hash tables
 - hash functions
 - hash code map
 - Compression map
 - collision handling
 - linear probing
 - chaining
 - double hashing
 - performance / runtimes (no universal hashing)
 - def. of universal hashing proof
 - binary search
 - look-up table (sorted seq. impl.)

3. Search

- Binary Search Trees
 - def.
 - operations
 - insert
 - find
 - remove
 - performance
- Balanced Binary Search Trees
 - Red-Black trees
 - def. \rightarrow BST
 - \rightarrow root prop.
 - \rightarrow Ext. prop.
 - \rightarrow int. prop.
 - \rightarrow depth prop.
 - height of a red-black tree
 - operations and run-times
 - insert
 - delete
 - find

4.1. Sorting and selection

- Merge-sort
 - divide & conquer techn.
 - merging 2 sorted lists
 - algorithm, analysis $O(n \log n)$
(run on an input seq.)
- Quick-sort
 - pivot, partition
 - algorithm, analysis $(O(n^2) w_i, O(n \log n) \text{ exp.})$
- Comparison of sorting algorithms
- lower bound on sorting
- set data structure
 - operat.
 - impl using merge idea
 - run-times
- Bucket and radix-sort
 - bucket-sort algor. (stable), runtime
 - lexicographic sort
 - radix-sort algor., runtime
- Selection
 - problem formulation
 - quick-select algor.
 - expected run-time

