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

2. Elem DS
   - Stack
     - operations
       - implementations using array or linked list
       - complexity of operations
     - resizing and amortanal. for stack operations
   - Queue
     - List
     - Vector
     - Sequence
       - operations
         - implementation using array
         - linked list
         - run-times
   - Trees
     - traversals
       - preorder
       - postorder
   - Binary trees
     - inorder traversal
     - Euler tour
     - representation/implementations
     - linked structures
   - Priority Queues
     - operations
     - implementation and run-times
       - sequence-based
         - sorted
         - unsorted
     - sorting using PA
       - selection sort
       - insertion sort
   - Heaps and PQs
     - key(a) = key(p(a))
     - def. a-heap = complete bin. tree
     - height of a heap
     - operations and run-time
       - insert
       - remove-min
     - heap-sort
     - vector-based implementation of a heap
     - bottom-up heap constr.
3. Search

3.1. Binary Search Trees

3.1.1. Definition

3.1.2. Operations
- Insert
- Find
- Remove

3.1.3. Performance

3.2. Balanced Binary Search Trees

3.2.1. Red-Black Trees

3.2.1.1. Definition

3.2.1.2. Properties
- Root property
- Ext. prop.
- Int. prop.
- Depth prop.

3.2.1.3. Height of a Red-Black Tree

3.2.1.4. Operations and Run-times
- Insert
- Delete
- Find
II. Sorting and Selection

- Merge-sort
  - divide & conquer tech
  - merging 2 sorted lists
    - algorithm, analysis $O(n \log n)$
    - (run on an input seq.)
  - Quick-sort
    - pivot, partition
    - algorithm, analysis $O(n \log n)$
      - (w. exp.)
- Comparison of sorting algorithms
- Lower bound on sorting
- Set data structure
  - operator
  - 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