

# Module 4 - Dictionaries and Balanced Search Trees

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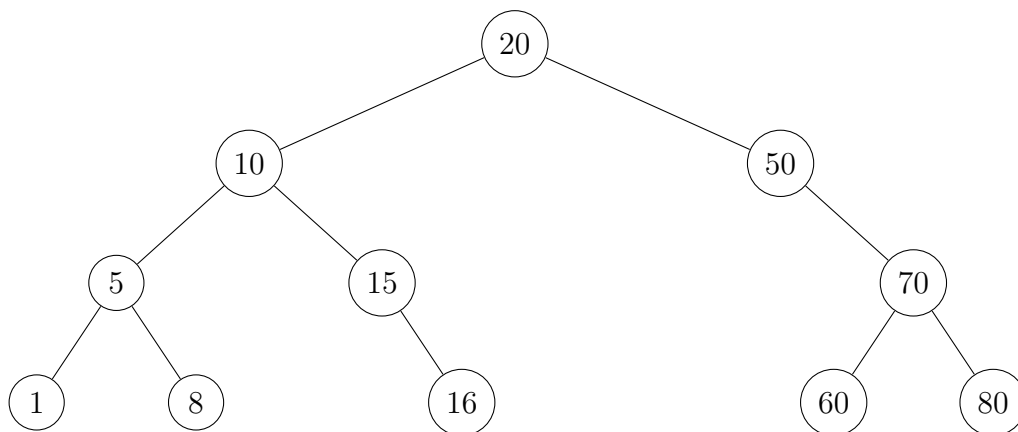
## Dictionaries

- An ADT
- Data (key, value) pairs
- operations: search, insert, delete

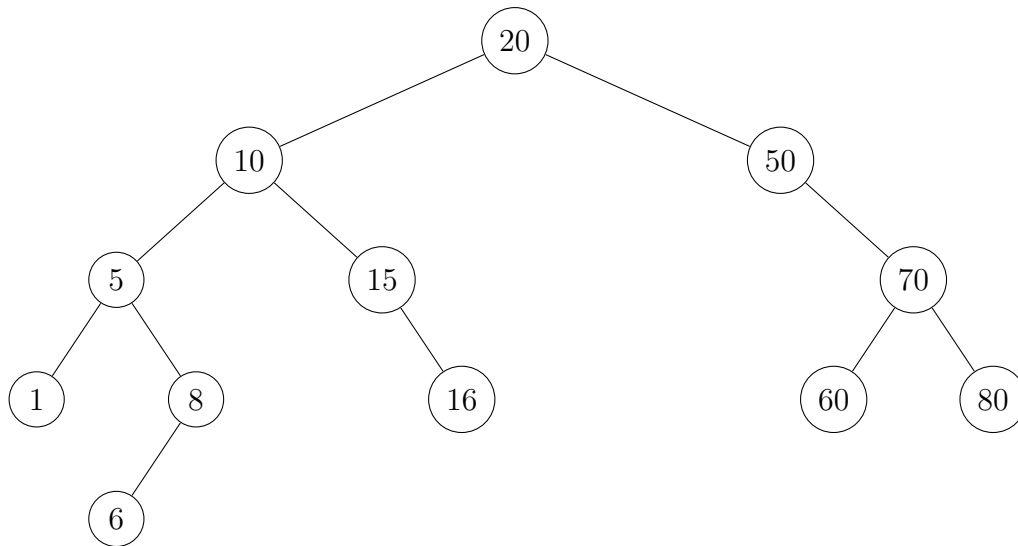
Data Structures for Dictionaries:

- unsorted array or linked list
  - search:  $O(n)$
  - insert:  $O(1)$
  - Delete:  $O(n)$
- sorted array
  - search - binary search  $O(\log n)$
  - insert  $O(n)$
  - delete  $O(n)$

### 0.1 BST



Insert 6



Delete in a BST

- if n is a leaf - just delete it
- if n is a node with one child, replace it with its child
- if n has two children, replace with the predecessor (rightmost on the left) or successor (left most)