

Data Structures and Algorithms

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Binary Search Tree

↳ Left child < Root

AVL -Tree

Strictly Balanced

B-Tree

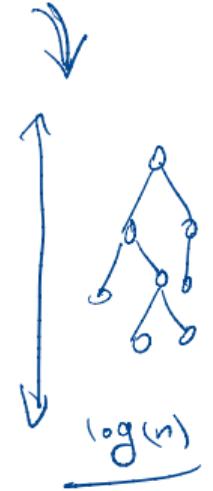
k-ary , perfectly balanced
search tree



2-3-4 Tree



Red-Black tree



Data Structures and Algorithms

Undergraduate course



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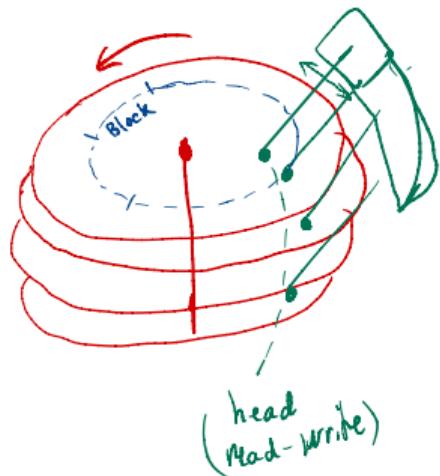


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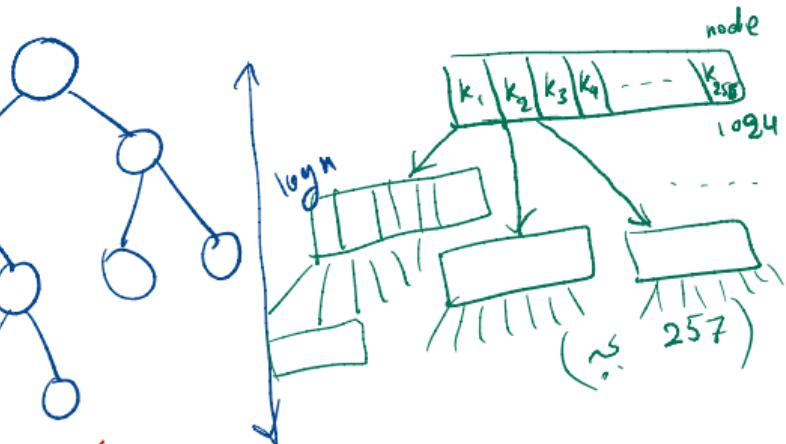
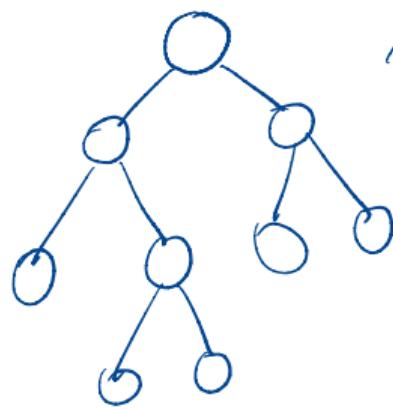
Motivations

ذخیره کم

HARD DISK



* سرعت دسترسی اور میزان ذخیره کم است (HARD DISK)
صوداً ۱۰^۵ بار کمتر از رام
RAM



$256 + 257 \times 256 + 257^2 \times 256$
لذا کمترین تعداد کار برای دسترسی از رام
کم ذخیره ساز است!

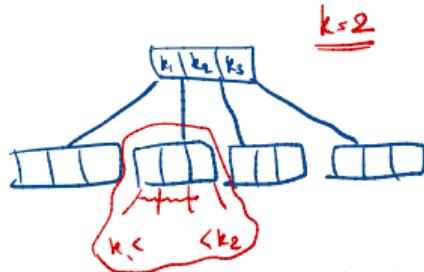
of order $2k$

Basic Definitions

Search tree with the following

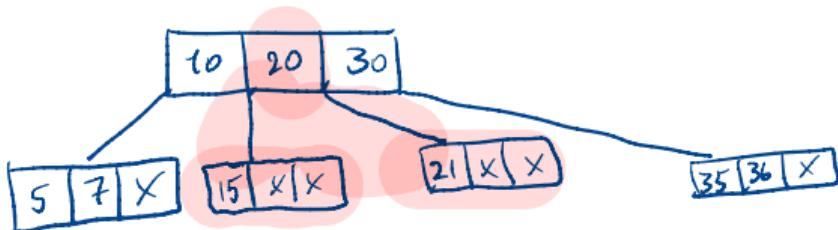
* B-Tree is a self-balancing properties:

- All leaves are at the same level.
- Every node (except the root) must contain at least $k-1$ keys, leading to have at least k children. The root may contain 1 key.
- All nodes (including root) may contain at most $2k-1$ keys, leading to have at most $2k$ children.
- B-Tree grows and shrinks from the root.
- Insertion of a key in B-tree happens at leaf node.
- The time complexity of Search, Insert, and Delete is $O(\log_{2k} n)$

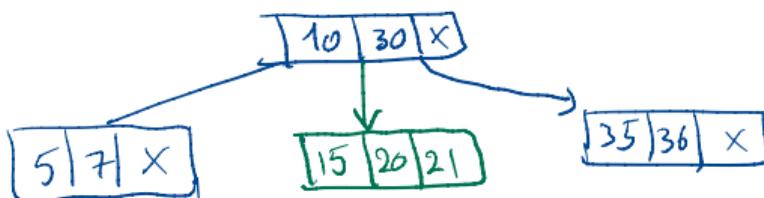


B-Tree Operations

1-Merge : merges two adjacent sibling nodes and the key that separates them from the parent node (the parent node loses one key)



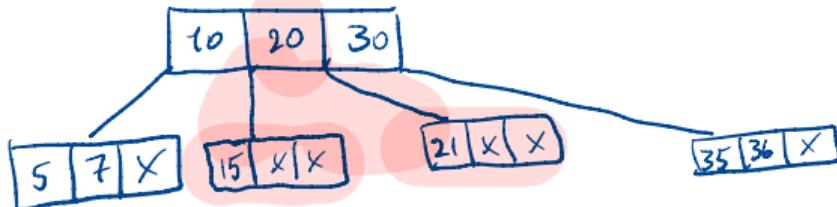
↓ Merge



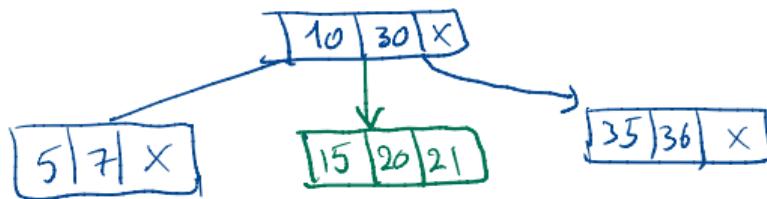
(the reverse of Merge)

B-Tree Operations

2-Split : splits a node into three : a left sibling , a separator key and a right sibling .

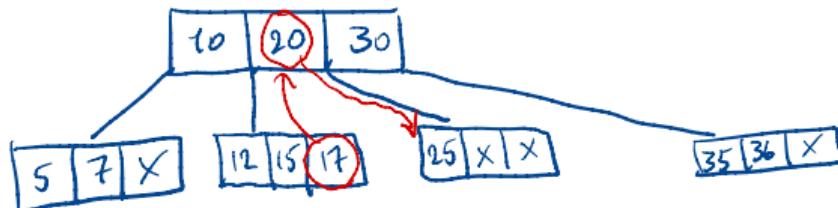


split ↑ ↓ Merge

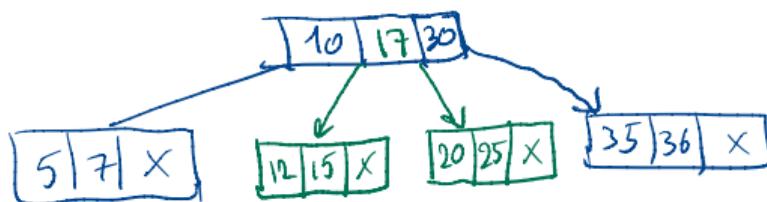


B-Tree Operations

3- Redistribute : redistributes the keys among two adjacent sibling nodes.

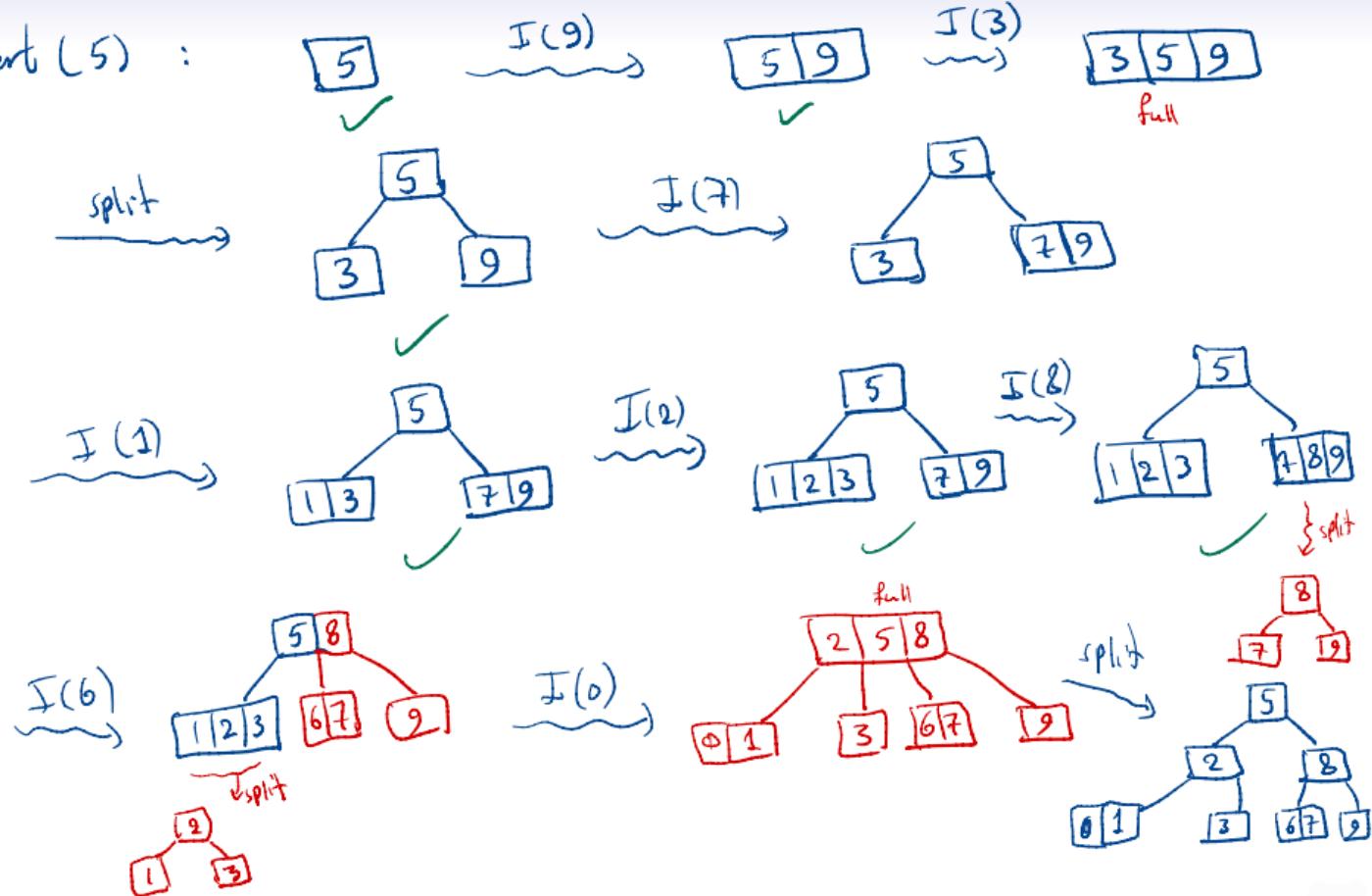


↓ Redistribute

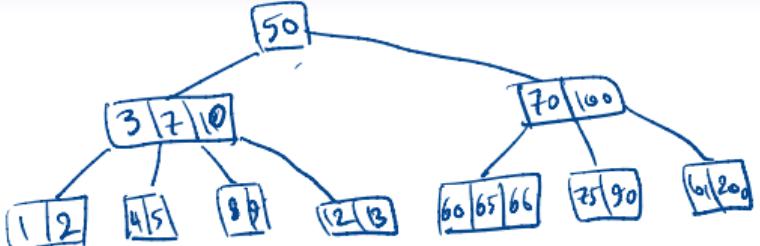


Example : B-Tree of order 4 ($2k$, $k=2$) .

→ Insert (5) :



Delete :



$k=3$
هر کوہ شامل دارا دو کلید است (میز از راست)
هر کوہ شامل تریل دو کلید است (تیس فرنہ)

D(1) ✓
D(7) ?

