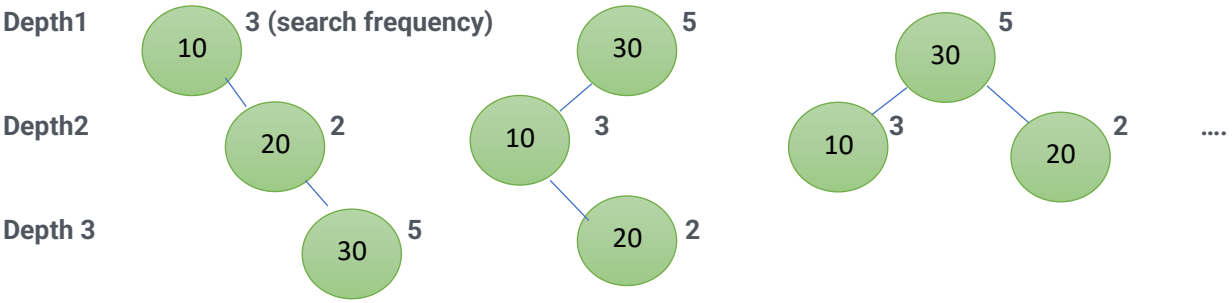
Optimal BST

Every key has a different probability to be searched for.



Brute force solution: build all tree configurations that contain the keys and see which is best.

Efficient solution: Dynamic Programming

B-Tree

How can we store a tree into a file?

There are two definitions of a B-tree:

Knuth Order (Order) is used by Knuth's definition. The Knuth order m is the maximum number of children. A Knuth order of m means every node must have a max = m, and a min = ceil(m/2) children.

CLRS Degree (Degree) is used in the definition in Cormen et al in Introduction to Algorithms (CLRS). The CLRS degree t is the minimum number of children. A CLRS degree of t means every node must have a min = t and a max = 2t children. Link to the book: *https://edutechlearners.com/download/Introduction_to_algorithms-3rd%20Edition.pdf*

The number of keys in both cases is equal to the number of children minus one.

!!! Attention: You will find a lot of examples with 'order' of B-Tree, order! = degree

Example:

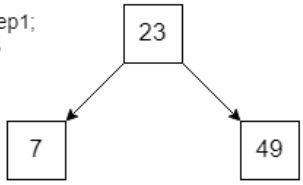
B-tree of order 5 OR m=5	B-tree of degree 5 OR t=5
max children = m = 5	max children = 2t = 10
min children = ceil(m/2) = 3	min children = t = 5
max keys = m-1 = 4	max keys = 2t-1 = 9
min keys = ceil(m/2)-1 = 2	min keys = t-1 = 4

Ex1: Efficient B-Tree insert

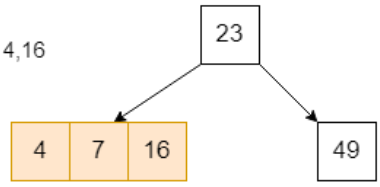
t=2; Insert: 49, 7, 23, 4, 16, 9, 51, 28

Step1: insert 49, 7 ,23

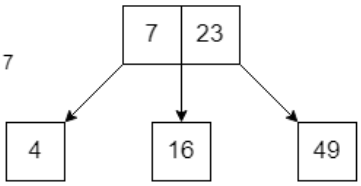
Step2: full node from step1; split and promote 23



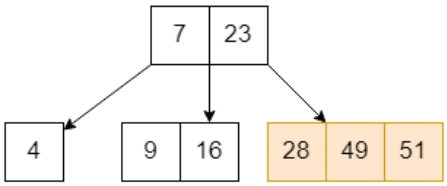
Step3: insert 4,16



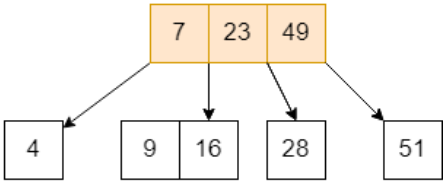
Step4: full node from step3; split and promote 7



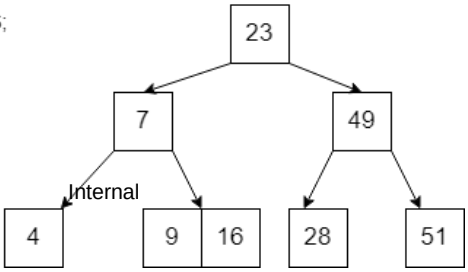
Step5: insert 9,51



Step6: full node from step5; split and promote 49



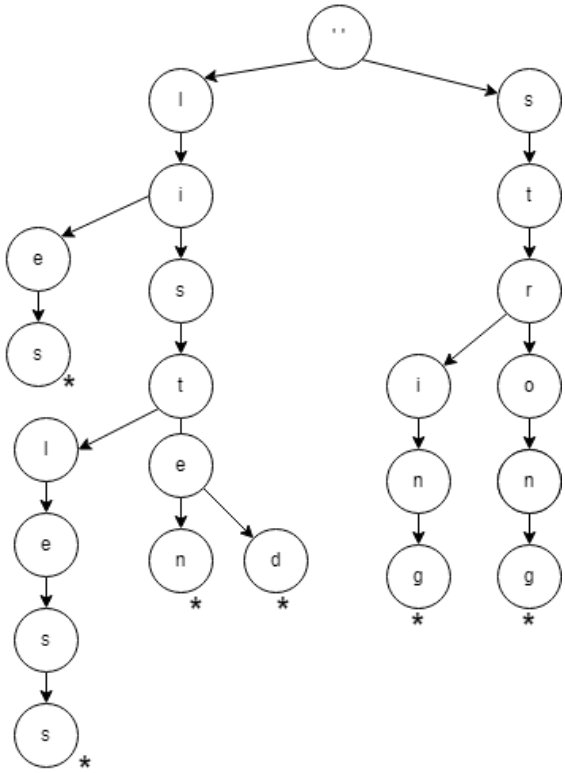
Step7: full node from step6; split and promote 23



Trie tree

Trie tree insert:
-listen
-listless
-lies
-lists
-listed
-strong
-string

Find listening?



Homework:

1. Build a B-Tree with min degree t=2 (each node can contain 1-3 keys) by inserting in order following keys: 35, 2, 1, 89, 4, 33, 24, 6, 7, 88, 14, 23, 22

2. Build a B-Tree with min degree t=3 (each node can contain 2-5 keys) by inserting in order following keys: 35, 2, 1, 89, 4, 33, 24, 6, 7, 88, 14, 23, 22,19

3. Implement a trie tree data structure and add operations to:

- add a new word to the trie tree
- print (in alphabetical order) all the words contained in the trie tree

TEST!!!