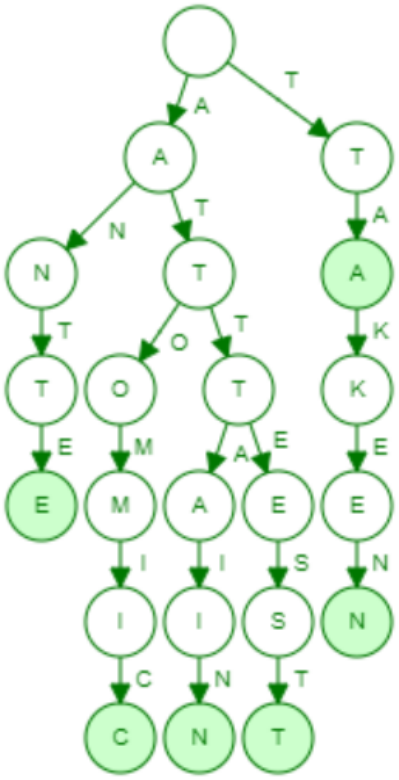
CS 61BL Summer 2021

K-d Trees and Tries

Quiz 8: Friday July 23, 2021

1 Trie Me

For this question we will reference the following trie. Green nodes correspond to terminal nodes.



(a) Which of the following words are contained within the trie?

[ ] ant
[ ] a
[ ] atomic
[ ] atom
[ ] attest
[ ] ta
[ ] taken
[ ] attain
[ ] an
[ ] ante

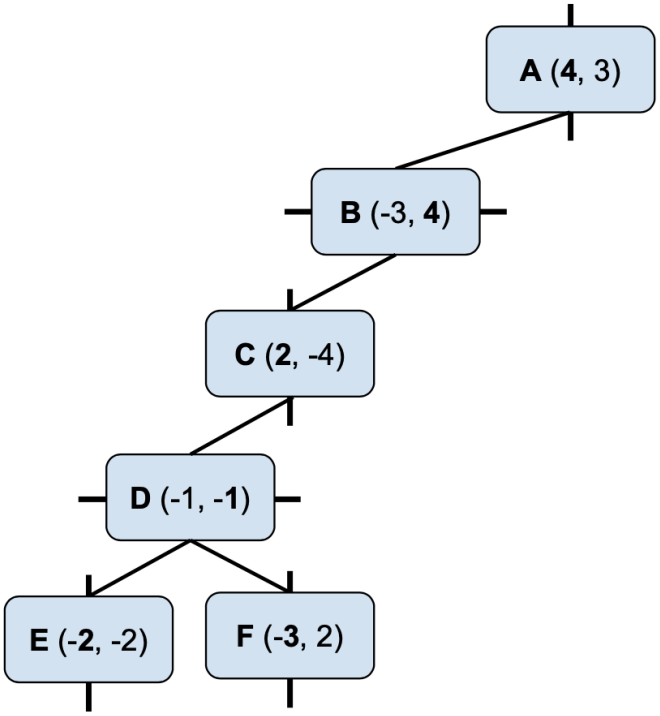
(b) If we wanted to insert the string "attack" how many new nodes would we have to create?

(c) If we wanted to insert the string "take" how many new nodes would we have to create?

(d) In total, how many **strings** could be encoded in this trie without having to create any new nodes? Note that this part is independent of the previous.

2 k-d Tree

The first two parts will refer to the following k-d tree. We highly recommend drawing the k-d tree spatially on the coordinate plane, as shown on this slide.



(a) If we wanted to check if the point $(3, 3)$ was contained in the tree, what is the path we would traverse through the tree?

Please specify the path using the corresponding ***uppercase*** *letters to each node without any spacing between them. (e.g. if you thought the path through the tree was node B, then node F, then node E your answer would be* `BFE`*).*

(b) If we run nearest on the point $(3, 3)$, which vertices are **never** visited, i.e. pruned?

Solution:

[ ] A
[ ] B
[ ] C
[ ] D
[ ] E
[ ] F

(c) Suppose we have the following list of labelled points:

$A : (-4, 8)$ $B : (0, -5)$ $C : (8, 8)$ $D : (9, -7)$ $E : (-1, -6)$ $F : (-7, 2)$ $G : (9, -6)$

If we want to make a perfectly balanced tree which node(s) could we choose as the root? Assume that we continue the pattern from lecture and lab where

we split on x values at the root.

We will define perfectly balanced as containing the same number of elements in the left and right subtrees.

[ ] A
[ ] B
[ ] C
[ ] D
[ ] E
[ ] F
[ ] G