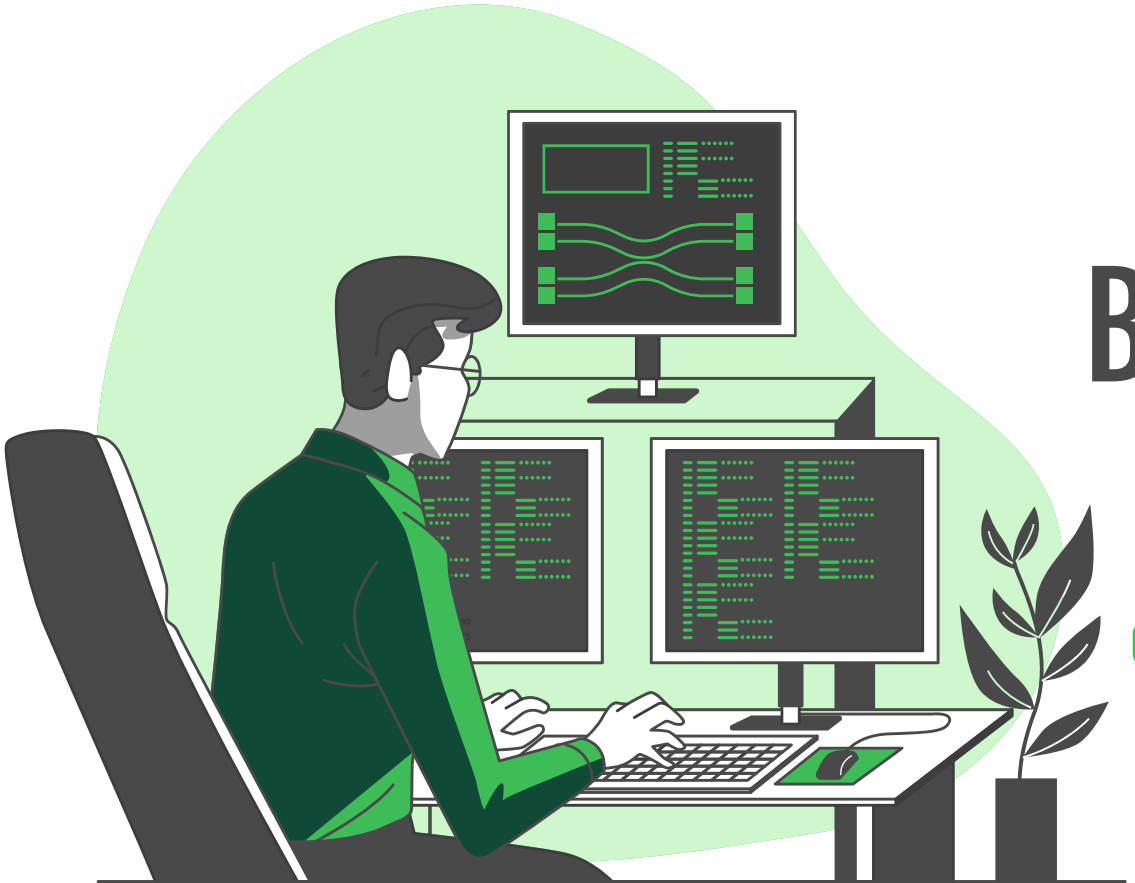

Bintree and K-D Tree

CS 251 - Data Structures and Algorithms

Note:
Slides complement the discussion in class

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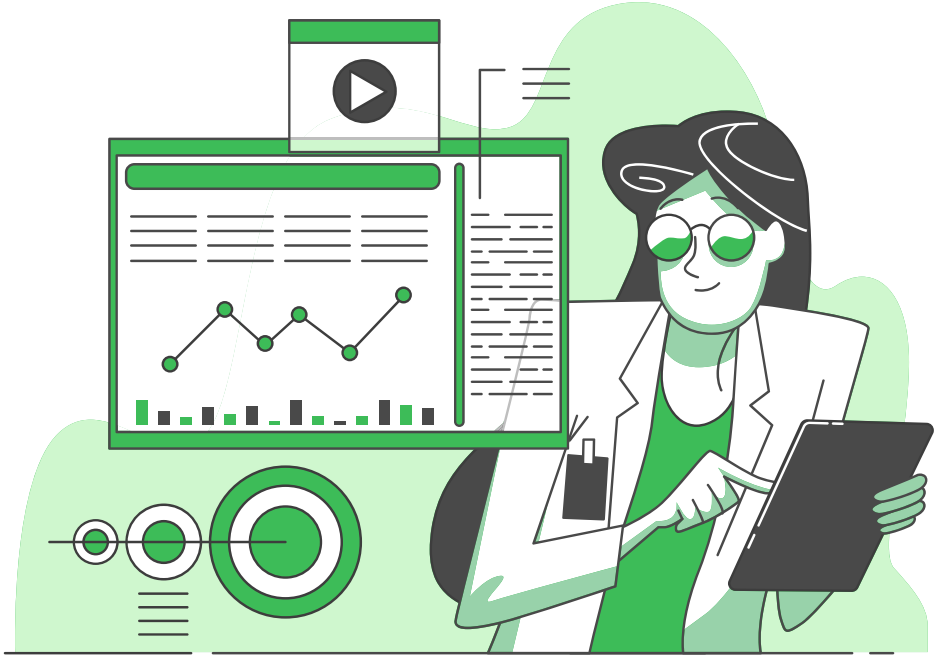
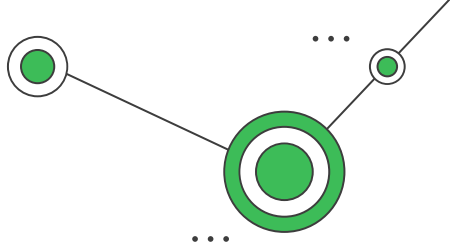


01

Bintree

Splitting multidimensional keys into equal halves

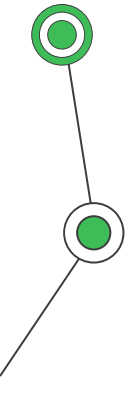
Bintrees



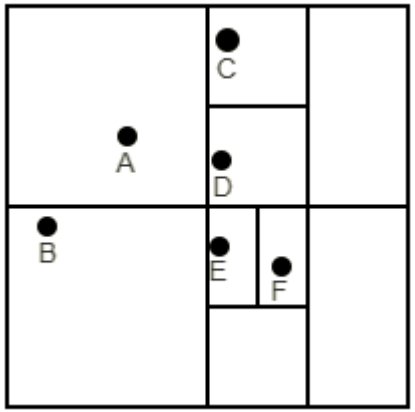
Think about it as BSTs for multiple keys.

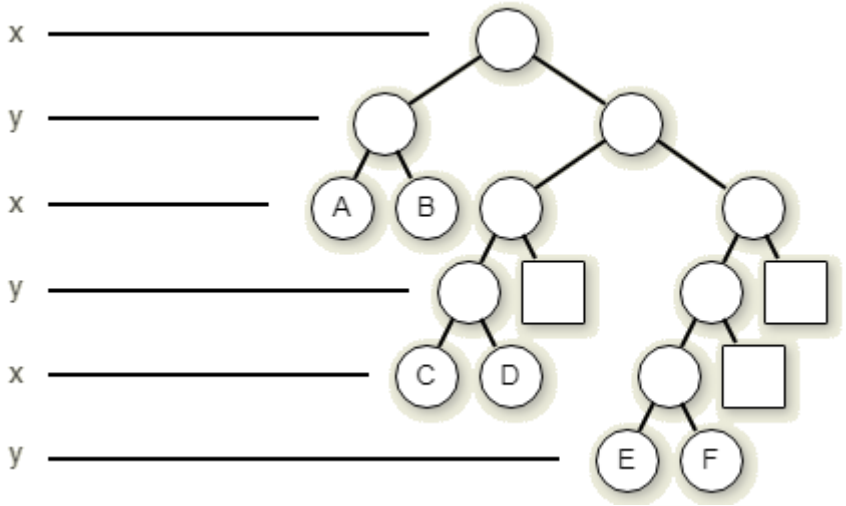
That is, at each level, the branching happens with respect to a particular key associated with the level (aka. discriminator).

Split each space into equal halves rather than splitting at the key value.



Bintree Example





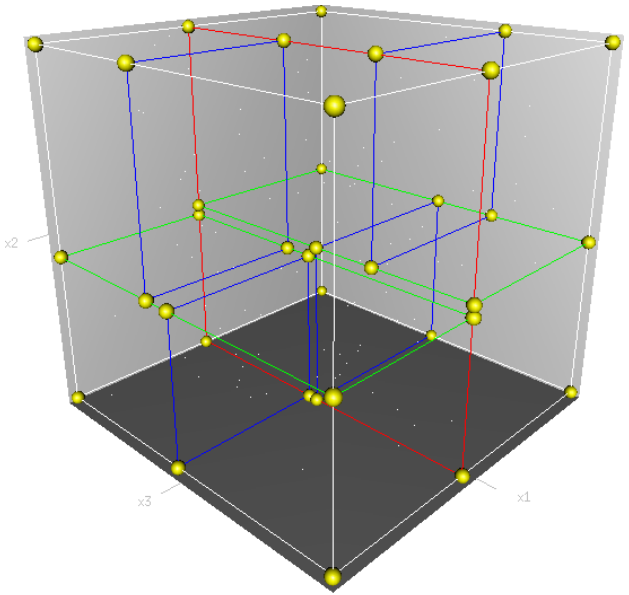
15.5. The Bintree — CS3 Data Structures & Algorithms (vt.edu)

02

K-d Tree

Binary Search Trees for
multidimensional keys

K-d Trees



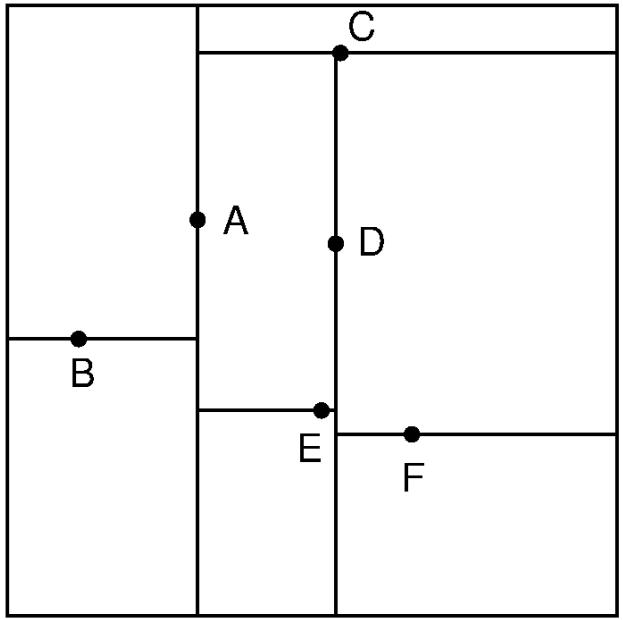
Think about it as BSTs for multiple keys.

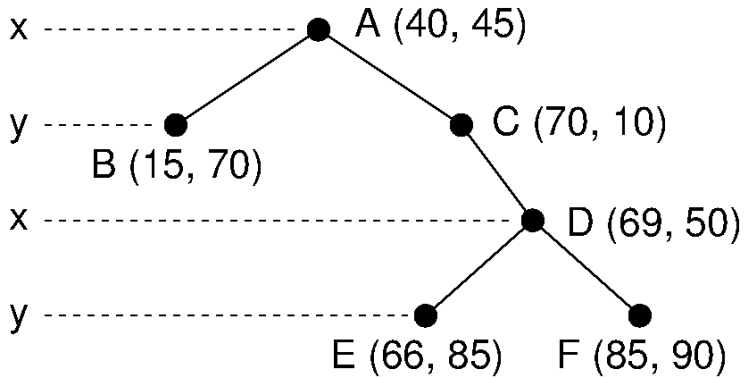
That is, at each level, the branching happens with respect to a particular key associated with the level (aka. discriminator).

Every node is a k-dimensional point.

Every non-leaf splits the space into half-spaces.

K-d Tree Example





15.4. KD Trees – CS3 Data Structures & Algorithms (vt.edu)

Single Search In K-d Trees

Let P be a point in a K-d Tree.

Searching a K-d Tree for the record with a specified xy-coordinate is like searching a BST, except that each level of the K-d tree is associated with a particular discriminator.

15.4. KD Trees – CS3 Data Structures & Algorithms (vt.edu)

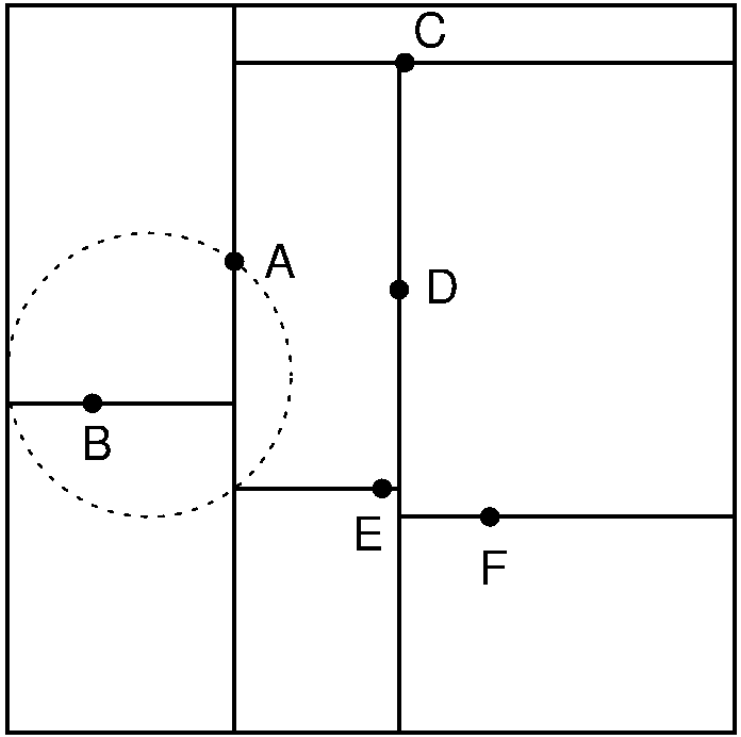
Region Search In K-d Trees

To locate all points within radius r of query point P:

- Use the Euclidean distance $d(P, N) = \sqrt{(P_x - N_x)^2 + \left(P_x - N_y\right)^2}$
- Reached a node with key value more than d above the value of the corresponding discriminator? Then no point in the respective right subtree is within range.
- Reached a node with key value less than d below the value of the corresponding discriminator? Then no point in the respective left subtree is within range.

15.4. KD Trees – CS3 Data Structures & Algorithms (vt.edu)

Region Search in K-d Tree Example



15.4. KD Trees – CS3 Data Structures & Algorithms (vt.edu)

Done!

Do you have any questions?