Module 5: Disk-based Index Structures

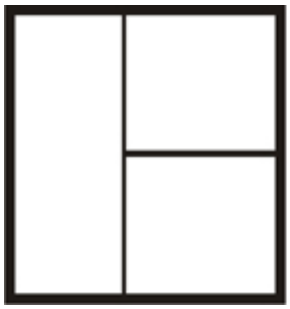
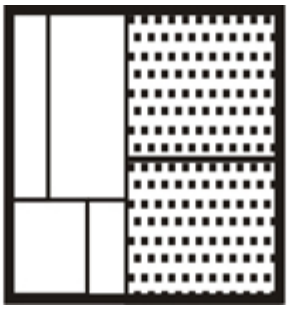
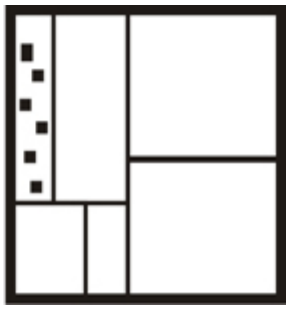
Lecture 17: Disk-based Index Structures

The Lecture Contains:

- K-d-B tree
  - Algorithms
- Distance from a point to an MBR
- Distance from an MBR to another MBR

K-d-B tree

- Bucket version of K-d trees
- Combine multi-dimensional search effciency of K-d trees with disk I/O effciency of B-tree
- Balanced
- Point pages: Leaf nodes
    - All data are in the leaf nodes
- Region pages: Internal nodes
    - Contains region keys
    - Region splits (hyperplanes) need not alternate
- Under flow restriction of B-trees is relaxed (B'-tree)
    - Space utilization is low

Algorithms

- Insertion
  - If no space in leaf bucket, choose a split line and create two buckets
    - Cycle through dimensions.
    - Dimension with largest range.
  - Corresponding bucket entries are updated in parent
  - May lead to parent over flow and so on
  - Height increased only at root
- Deletion
  - Many deletions may result in very low space utilization
  - Find another page that is joinable
    - Same parent.
    - Forms a hyper-rectangle.
    - Does not over flow
- Point queries
  - Recursively nd child region, starting from root

Distance from a point to an MBR

- Euclidean distance

$$d = \left(\sum_{i=1}^{k} \Delta_i^2 \right)^{1/2}$$

- Minimum distance of point p to MBR r

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