Exercises and hand-ins

Advanced database technology

April 15, 2003

Hand-in

To be handed in at the latest April 24 at 10.00 AM.

This problem considers range queries in persistent B-trees. You have seen that a persistent B-tree allows search for an element \( x \) at time \( t \) using \( O(\log_B N_t) \) I/Os, where \( N_t \) is the number of elements in the tree at time \( t \) and the degree of the B-tree is \( \Theta(B) \). For ordinary B-trees you have seen that range queries for elements in an interval \([a; b]\) can be performed in \( O(\log_B N_t + Z/B) \) I/Os, where \( Z \) is the number of elements in the interval. This problem considers range queries “at time \( t \)” in a persistent B-tree.

1. What is the problem with using the same solution as in an ordinary B-tree (traversing a linked list of leaves)?

2. Argue that B-tree searches can be performed in \( O(\log_B N_t + Z/B) \) I/Os in a B-tree where leaves are not in a linked list. Conclude that this I/O complexity can also be realized in a persistent B-tree.

3. Consider a static set of \( N \) horizontal line segments (as on page 10 of the slides). Devise a linear space data structure that allows reporting of all \( Z \) line segments crossing a given vertical line segment in \( O(\log_B N + Z/B) \) I/Os.

Other exercises for discussion on April 24

No exercises this week.