Scalable Data Management Systems

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Exercise Sheet 1: Storage Management

Problem 1.1 Variants of Slotted Pages

A relational DBMS uses pages with a fixed size of 1024 bytes. Assume that you want to store an `orders` table with three integer attributes (`oid`, `year`, `month`) and one decimal attribute `total`. Both datatypes have a fixed length of 4 bytes.

Answer the following questions for both variants of slotted pages (tuple data at the end of the page only and fixed sized attributes stored directly in a slot) to determine which variant of slotted pages is favourable in this case:

- What is the slot-size in bytes of that variant

- How many bytes are required **in total** for a record?

- How many records can you fit into a page if the header is 64 bytes.

Problem 1.2 LRU - Sequence of evicted pages

Assume a buffer manager with a pool size of 6 frames. A Transaction reads the pages a, b, c, d, e, f, g in the following order:

a, b, c, d, e, f, a, b, c, g, a, b, c, d, e, f, g, e, g, f

Determine the sequence of evicted pages when the LRU eviction policy is used.
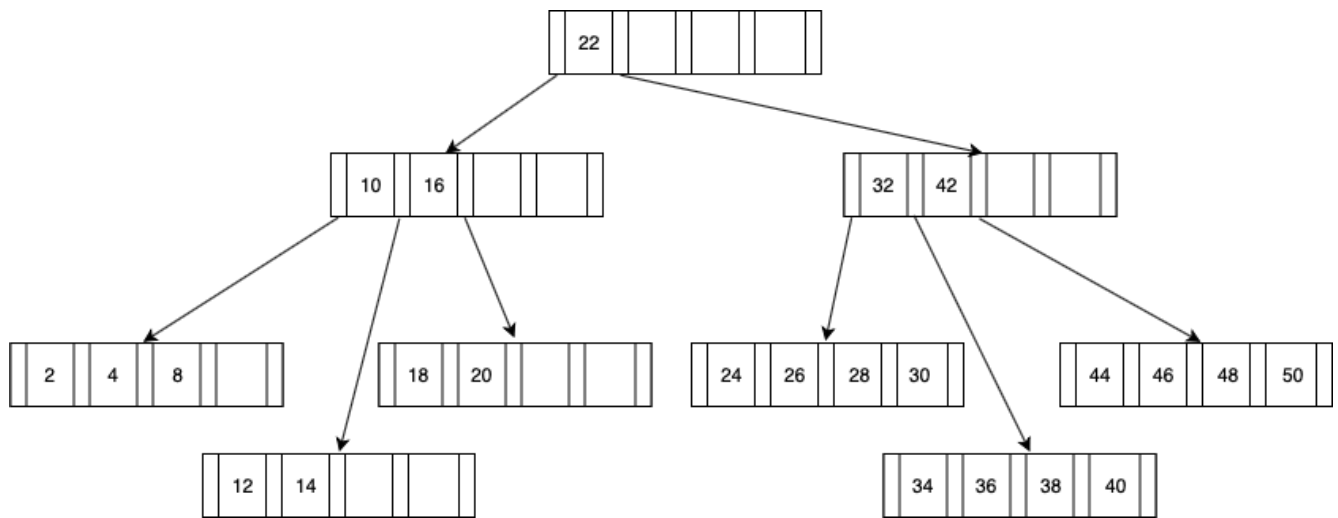
You can assume that a page is requested by a transaction through the `pin()` operation and immediately marked for eviction using the `unpin()` operation. For example: After reading the first page a, it is immediately marked for eviction.

Assume the following B-Tree with **M=2**, meaning every node except the root holds at least $M = 2$ and at most $2 \cdot M = 4$ keys:

For the following questions, draw the changed parts of the B-Tree after the specified operation, starting from this original state. Prefer rotation of keys to merging of nodes!

a) Insert 41 into the original B-Tree.

b) Delete 10 from the original B-Tree.