CSED 2014

B+ Indexing

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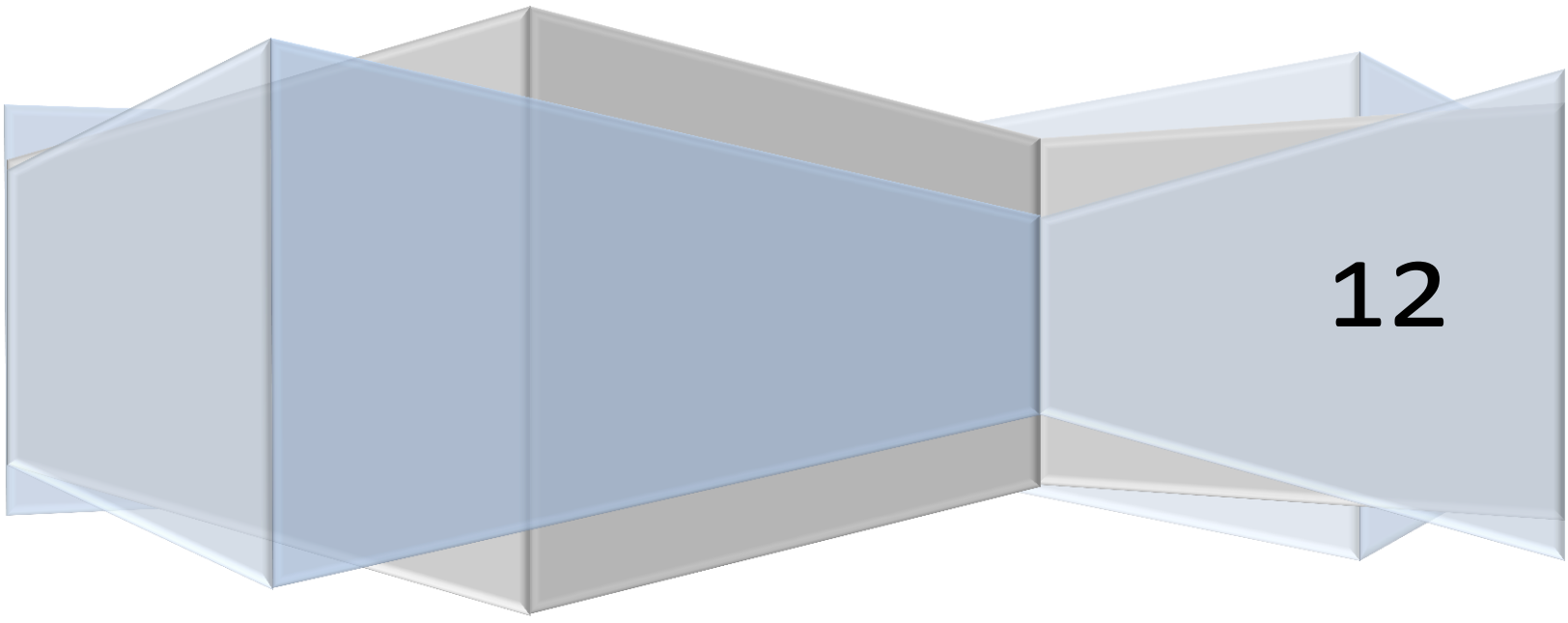

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Problem Statement

1. implementation a B+ tree in which leaf level pages contain entries of the form *<key, rid of a data record>*
2. implementation the full search and insert algorithms as discussed in class.
3. implement two page-level classes, **BTIndexPage** and **BTLeafPage.**

Implementation Issues

One of the issues we met is how to organize the header page to carry some information about the B+ tree. The Header page is a HFPage organized as follow:

- nextPage = Root page
- first record = Key type
- Second record = key size
- Third record = delete fashion

Pseudo code

Scan class

Algorithm : BTFileScan (header, lower, upper)

```
{
        Page ← root //get it from header page
        If (lower = null) // it means to start with the first entry
                Traverse down the tree to get the leftmost leaf node
                Set the rid with the first record in this page
        Else if (lower > upper)
                Swap lower with the upper
        If (page is index)
                While (page!= leaf)
                        Traverse this index page to get a link to next level
        // now page is leaf
        Traverse the page until holding the right record
}
```

Algorithm : get_next()

```
{
        If (rid == null)  // no more records in the current page
                leaf ← next leaf page
                Rid ← page.first Rec
        If (upperkey = null && rid = null)
                return null //all range is covered
        Else (current keyData entry  > upper)
        Return null // all range is covered
```

Return current keyDataEntry (dEntry)

}

Algorithm : KeySize()

{

Return the key size from the header page ;

Second record in the header page represents the key size ;

}

Algorithm : delete_current()

{

Deletes the current page by calling the .deleteEntry(rid) of the current leaf page using the current rid

}

BTreeFile class

Algorithm insert: insert (nodepointer, entry, newchildentry)

proc / / Inserts entry into subtree of *nodepointer; degree is d;
/ /'newchildentry' null initially, and null on return unless child is split
if *nodepointer is a non-leaf node, say N,
then
find'i such that k(i) S entry's key value < J(i+1); / / choose subtree
insert(.R;, entry, newchildentry); / / recursively, insert entry
if newchildentry is null,
then
return; / / usual case; didn't split child
else, / / we split child, must insert *newchildentry in N
if N has space, / / usual case
then

put *newchildentry on it, set newchildentry to null, return;
else,
split N: / / 2d + 1 key values and 2d + 2 nodepointers
first d key values and d + 1 nodepointers stay,
last d keys and d + 1 pointers move to new node, N2;
/ / *newchildentry set to guide searches between Nand N2
newchildentry = & ((smallest key value on N2,
pointer to N2));
end if;
end if;
if N is the root, / / root node was just split
then
create new node with (pointer to N, *newchildentry);
make the tree's root-node pointer point to the new node;
return;
end if;
else //*nodepointer is a leaf node, say L,
if L has space, / / usual case
then
put entry on it, set newchildentry to null, and return;
else, / / once in a while, the leaf is full
split L: first d entries stay, rest move to brand new node L2;
newchildentry = & ((smallest key value on L2, pointer to L2));
set sibling pointers in Land L2;
return;
end if;
end if;
endproc

Algorithm :Delete(key,rid)

traverse the tree recursively to get the suitable leaf page
remove the record from this leaf page