

Write Up for acmdb-lab2

在 lab2 中，我们实现了数据库中页的置换算法，以及通过 B+树实现的 index 功能。

Exercise 1 (Page eviction)

lab 并未给出对具体的 eviction policy 的要求，此处实现的是 LRU 页面置换算法。因此在 LRUCache.java 中定义了该类，其主体为一个双向链表。

Exercise 2 (Search in B+ Tree)

这个 exercise 实现的功能是在 B+树中搜索，其逻辑为不断向左或向右寻找，直到找到索引符合的节点。

在 BTreeFile 中，主要有以下几个结点类：BTreeRootPtrPage 为 B+树的根节点，BTreeInternalPage 为 B+树的内部节点，BTreeLeafPage 为 B+树的叶子节点，BTreeHeaderPage 用于记录整个 B+树中的一个页面的使用情况。

Exercise 3 (Insert in B+ Tree)

B+树的插入流程主要如下：如果为空树则直接插入，否则找到插入结点的位置，并在叶子结点中插入值。如果当前结点的 key 过大，则均分成两个叶子结点，并添加中间结点的 key 加入父结点，这一操作需要递归执行。

Exercise 4 (Delete in B+ Tree)

B+树的删除逻辑主要如下：删除叶子结点，如果能从其兄弟结点那里偷窃，则偷窃过来并将兄弟结点的第一个数据作为父结点，如果此时结点能够与其兄弟结点合并，那么合并并删除兄弟结点，并删除其父结点指向该兄弟结点的部分，如果不能则检查父结点能否与其兄弟结点合并，递归执行。

Exercise 5 (Merging Pages)

合并的逻辑相对来说较为简单，在此不做赘述。

总结

lab2 实现的东西都是相对技术性较强的内容，需要对于其中的算法逻辑有一定的理解才能完成，在明白了其逻辑之后，编程相对来说会简单一些。此次 lab2 也让我对于这些数据结构有了更加深刻的体会。

```

yuchen@yuchen-virtual-machine:~/Desktop/acmdb-lab2$ ant runsystest -Dtest=EvictionTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runsystest:
[junit] Running simpledb.systemtest.EvictionTest
[junit] Testsuite: simpledb.systemtest.EvictionTest
[junit] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 1.072 sec
[junit] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 1.072 sec
[junit] ----- Standard Output -----
[junit] EvictionTest creating large table
[junit] EvictionTest scanning large table
[junit] EvictionTest scan complete, testing memory usage of scan
[junit] -----
[junit] Testcase: testHeapFileScanWithManyPages took 1.062 sec

BUILD SUCCESSFUL

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BUILD SUCCESSFUL
Total time: 2 seconds
yuchen@yuchen-virtual-machine:~/Desktop/acmdb-lab2$ ant runtest -Dtest=PredicateTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runtest:
[junit] Running simpledb.PredicateTest
[junit] Testsuite: simpledb.PredicateTest
[junit] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.021 sec
[junit] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.021 sec
[junit] Testcase: filter took 0.012 sec

BUILD SUCCESSFUL
Total time: 1 second
yuchen@yuchen-virtual-machine:~/Desktop/acmdb-lab2$

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ReadTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runtest:
[junit] Running simpledb.BTreeFileReadTest
[junit] Testsuite: simpledb.BTreeFileReadTest
[junit] Tests run: 7, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.20
5 sec
[junit] Tests run: 7, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.20
5 sec
[junit]
[junit] Testcase: indexIterator took 0.107 sec
[junit] Testcase: testIteratorBasic took 0.019 sec
[junit] Testcase: testIteratorClose took 0.022 sec
[junit] Testcase: getTupleDesc took 0.003 sec
[junit] Testcase: numPages took 0.005 sec
[junit] Testcase: readPage took 0.006 sec
[junit] Testcase: getId took 0.017 sec

BUILD SUCCESSFUL
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```
yuchen@yuchen-virtual-machine:~/Desktop/acmdb-lab2$ ant runsystest -Dtest=BTreeScanTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runsystest:
[junit] Running simpledb.systemtest.BTreeScanTest
[junit] Testsuite: simpledb.systemtest.BTreeScanTest
[junit] Tests run: 4, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 1.52
5 sec
[junit] Tests run: 4, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 1.52
5 sec
[junit]
[junit] Testcase: testRewindPredicates took 0.104 sec
[junit] Testcase: testRewind took 0.014 sec
[junit] Testcase: testReadPage took 0.192 sec
[junit] Testcase: testSmall took 1.196 sec

BUILD SUCCESSFUL
Total time: 2 seconds
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```
Total time: 2 seconds
yuchen@yuchen-virtual-machine:~/Desktop/acmdb-lab2$ ant runtest -Dtest=BTreeFile
InsertTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runtest:
[junit] Running simpledb.BTreeFileInsertTest
[junit] Testsuite: simpledb.BTreeFileInsertTest
[junit] Tests run: 3, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.29
5 sec
[junit] Tests run: 3, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.29
5 sec
[junit]
[junit] Testcase: testReusePage took 0.085 sec
[junit] Testcase: testSplitLeafPages took 0.015 sec
[junit] Testcase: testSplitInternalPages took 0.184 sec

BUILD SUCCESSFUL
Total time: 0 seconds
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```
ileInsertTest
Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runsystemtest:
[junit] Running simpledb.systemtest.BTreeFileInsertTest
[junit] Testsuite: simpledb.systemtest.BTreeFileInsertTest
[junit] Tests run: 5, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 2.34
6 sec
[junit] Tests run: 5, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 2.34
6 sec
[junit]
[junit] Testcase: testSplitRootPage took 1.954 sec
[junit] Testcase: testSplitInternalPage took 0.272 sec
[junit] Testcase: testSplitLeafPage took 0.009 sec
[junit] Testcase: addDuplicateTuples took 0.077 sec
[junit] Testcase: addTuple took 0.017 sec

BUILD SUCCESSFUL
Total time: 2 seconds
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compile:

testcompile:

runtest:

[junit] Running simpledb.BTreeFileDeleteTest

[junit] Testsuite: simpledb.BTreeFileDeleteTest

[junit] Tests run: 7, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.51

6 sec

[junit] Tests run: 7, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.51

6 sec

[junit]

[junit] Testcase: testStealFromRightLeafPage took 0.052 sec

[junit] Testcase: testMergeLeafPages took 0.028 sec

[junit] Testcase: testStealFromLeftInternalPage took 0.133 sec

[junit] Testcase: testStealFromRightInternalPage took 0.108 sec

[junit] Testcase: testMergeInternalPages took 0.155 sec

[junit] Testcase: testStealFromLeftLeafPage took 0.011 sec

[junit] Testcase: deleteTuple took 0.017 sec

BUILD SUCCESSFUL

Total time: 1 second

Buildfile: /home/yuchen/Desktop/acmdb-lab2/build.xml

compile:

testcompile:

runsystemtest:

[junit] Running simpledb.systemtest.BTreeFileDeleteTest

[junit] Testsuite: simpledb.systemtest.BTreeFileDeleteTest

[junit] Tests run: 6, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 3.38

6 sec

[junit] Tests run: 6, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 3.38

6 sec

[junit]

[junit] Testcase: testDeleteRootPage took 0.077 sec

[junit] Testcase: testReuseDeletedPages took 0.072 sec

[junit] Testcase: testRedistributeInternalPages took 2.858 sec

[junit] Testcase: testDeleteInternalPages took 0.327 sec

[junit] Testcase: testMergeLeafPages took 0.009 sec

[junit] Testcase: testRedistributeLeafPages took 0.018 sec

BUILD SUCCESSFUL

Total time: 4 seconds