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Assignment: 7

Complete & Correct:	45 / 48
Tests:	0 / 0
Format and Comments:	6 / 6
Writeup:	6 / 6
Total Score:	57 / 60

Comments:

1. (-3) incorrect computation (int division) for insert comparison to load factor threshold

Unit test output:

```
==371803== Memcheck, a memory error detector
==371803== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==371803== Using Valgrind-3.15.0 and LibVEX; rerun with -h for copyright info
==371803== Command: ./hw7_test
==371803==
[==========] Running 21 tests from 1 test suite.
[----------] Global test environment set-up.
[----------] 21 tests from BasicHashMapTests
[ RUN      ] BasicHashMapTests.EmptyCheck
[       OK ] BasicHashMapTests.EmptyCheck (13 ms)
[ RUN      ] BasicHashMapTests.InsertCheck
[       OK ] BasicHashMapTests.InsertCheck (3 ms)
[ RUN      ] BasicHashMapTests.RValueAccessCheck
[       OK ] BasicHashMapTests.RValueAccessCheck (4 ms)
[ RUN      ] BasicHashMapTests.LValueAccessCheck
[       OK ] BasicHashMapTests.LValueAccessCheck (4 ms)
[ RUN      ] BasicHashMapTests.SimpleContainsCheck
[       OK ] BasicHashMapTests.SimpleContainsCheck (4 ms)
[ RUN      ] BasicHashMapTests.MoreInvolvedContainsCheck
[       OK ] BasicHashMapTests.MoreInvolvedContainsCheck (2 ms)
[ RUN      ] BasicHashMapTests.EraseCheck
[       OK ] BasicHashMapTests.EraseCheck (6 ms)
[ RUN      ] BasicHashMapTests.KeyRangeCheck
[       OK ] BasicHashMapTests.KeyRangeCheck (8 ms)
[ RUN      ] BasicHashMapTests.SortedKeyCheck
[       OK ] BasicHashMapTests.SortedKeyCheck (10 ms)
[ RUN      ] BasicHashMapTests.InvalidKeyCheck
[       OK ] BasicHashMapTests.InvalidKeyCheck (32 ms)
[ RUN      ] BasicHashMapTests.NextKeyCheck
[       OK ] BasicHashMapTests.NextKeyCheck (7 ms)
[ RUN      ] BasicHashMapTests.PrevKeyCheck
[       OK ] BasicHashMapTests.PrevKeyCheck (7 ms)
[ RUN      ] BasicHashMapTests.ResizeRehashCheck
[       OK ] BasicHashMapTests.ResizeRehashCheck (6 ms)
[ RUN      ] BasicHashMapTests.DestructorCheck
[       OK ] BasicHashMapTests.DestructorCheck (3 ms)
[ RUN      ] BasicHashMapTests.CopyConstructorCheck
[       OK ] BasicHashMapTests.CopyConstructorCheck (7 ms)
[ RUN      ] BasicHashMapTests.CopyAssignmentCheck
```

```
[       OK ] BasicHashMapTests.CopyAssignmentCheck (9 ms)
[ RUN      ] BasicHashMapTests.MoveConstructorCheck
[       OK ] BasicHashMapTests.MoveConstructorCheck (7 ms)
[ RUN      ] BasicHashMapTests.MoveAssignmentCheck
[       OK ] BasicHashMapTests.MoveAssignmentCheck (9 ms)
[ RUN      ] BasicHashMapTests.StatsEmptyCheck
[       OK ] BasicHashMapTests.StatsEmptyCheck (3 ms)
[ RUN      ] BasicHashMapTests.StatsBiasedCheck
[       OK ] BasicHashMapTests.StatsBiasedCheck (3 ms)
[ RUN      ] BasicHashMapTests.StatsRandomCheck
[       OK ] BasicHashMapTests.StatsRandomCheck (3 ms)
[----------] 21 tests from BasicHashMapTests (169 ms total)

[----------] Global test environment tear-down
[==========] 21 tests from 1 test suite ran. (211 ms total)
[  PASSED  ] 21 tests.
==371803==
==371803== HEAP SUMMARY:
==371803==     in use at exit: 0 bytes in 0 blocks
==371803==   total heap usage: 879 allocs, 879 frees, 158,728 bytes allocated
==371803==
==371803== All heap blocks were freed -- no leaks are possible
==371803==
==371803== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
```

Performance test output:

```
# All times in milliseconds (msec)
# Column 1 = input data size
# Column 2 = binsearch map insert
# Column 3 = array map insert
# Column 4 = hash map insert
# Column 5 = binsearch map erase
# Column 6 = array map erase
# Column 7 = hash map erase
# Column 8 = binsearch map contains
# Column 9 = array map contains
# Column 10 = hash map contains
# Column 11 = binsearch map find range
# Column 12 = array map find range
# Column 13 = hash map find range
# Column 14 = binsearch map next key
# Column 15 = array map next key
# Column 16 = hash map next key
# Column 17 = binsearch map sorted keys
# Column 18 = array map sorted keys
# Column 19 = hash map sorted keys
# Column 20 = min chain length
# Column 21 = max chain length
# Column 22 = avg chain length
0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 0 0.00
5000 0.03 0.00 0.00 0.03 0.06 0.00 0.00 0.06 0.00 0.00 0.11 0.00 0.00 0.07 0.06 0.17 1.09 0.90 1 3 1.98
10000 0.04 0.00 0.00 0.03 0.06 0.00 0.00 0.06 0.00 0.00 0.11 0.00 0.00 0.07 0.05 0.17 1.18 0.97 1 2 1.49
15000 0.05 0.00 0.00 0.05 0.10 0.00 0.00 0.09 0.00 0.01 0.16 0.01 0.00 0.12 0.07 0.23 1.85 1.55 1 2 1.85
20000 0.06 0.00 0.00 0.06 0.13 0.00 0.00 0.12 0.00 0.00 0.21 0.01 0.00 0.16 0.12 0.34 2.55 2.01 1 2 1.22
25000 0.08 0.00 0.00 0.07 0.17 0.00 0.00 0.16 0.00 0.01 0.27 0.02 0.00 0.20 0.14 0.44 3.26 2.55 1 2 1.53
30000 0.08 0.00 0.00 0.08 0.20 0.00 0.00 0.19 0.00 0.02 0.31 0.03 0.00 0.25 0.17 0.49 4.03 3.27 1 2 1.83
35000 0.09 0.00 0.00 0.09 0.23 0.00 0.00 0.22 0.00 0.00 0.34 0.01 0.00 0.30 0.25 0.62 4.51 3.77 1 2 1.32
40000 0.10 0.00 0.00 0.10 0.30 0.00 0.00 0.26 0.00 0.02 0.40 0.03 0.00 0.36 0.30 0.69 5.31 4.41 1 2 1.38
45000 0.10 0.00 0.00 0.10 0.30 0.00 0.00 0.28 0.00 0.03 0.45 0.03 0.00 0.42 0.35 0.78 5.84 4.99 1 2 1.46
50000 0.10 0.00 0.00 0.10 0.33 0.00 0.00 0.31 0.00 0.03 0.49 0.03 0.00 0.48 0.31 0.81 6.58 5.38 1 2 1.53
```

```
8.83user 0.00system 0:08.84elapsed 99%CPU (0avgtext+0avgdata 7612maxresident)k
0inputs+24outputs (0major+2667minor)pagefaults 0swaps
```