

Name: *Jonathan Smoley*

Assignment: 4

Complete & Correct:	34 / 42
Tests:	6 / 6
Format and Comments:	6 / 6
Writeup:	6 / 6

Total Score:	52 / 60
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Comments:

1. (-6) On line 682 (which is the recursive call in your quick sort random function) you are not calling your random quick sort function!
2. (-2) After changing your quick sort call to quick sort random, two unit tests fail
3. Note that these issues could have been identified by going back over your code (like editing an essay)

Unit test output:

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==689921== Memcheck, a memory error detector
==689921== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==689921== Using Valgrind-3.15.0 and LibVEX; rerun with -h for copyright info
==689921== Command: ./hw4_test
==689921==
[=====] Running 36 tests from 4 test suites.
[-----] Global test environment set-up.
[-----] 15 tests from BasicArraySeqTests
[ RUN      ] BasicArraySeqTests.EmptySeqMergeSort
[      OK  ] BasicArraySeqTests.EmptySeqMergeSort (11 ms)
[ RUN      ] BasicArraySeqTests.OneElemMergeSort
[      OK  ] BasicArraySeqTests.OneElemMergeSort (4 ms)
[ RUN      ] BasicArraySeqTests.TwoElemInOrderMergeSort
[      OK  ] BasicArraySeqTests.TwoElemInOrderMergeSort (5 ms)
[ RUN      ] BasicArraySeqTests.TwoElemReverseMergeSort
[      OK  ] BasicArraySeqTests.TwoElemReverseMergeSort (3 ms)
[ RUN      ] BasicArraySeqTests.ThreeElemMergeSortCases
[      OK  ] BasicArraySeqTests.ThreeElemMergeSortCases (4 ms)
[ RUN      ] BasicArraySeqTests.EmptySeqQuickSort
[      OK  ] BasicArraySeqTests.EmptySeqQuickSort (1 ms)
[ RUN      ] BasicArraySeqTests.OneElemQuickSort
[      OK  ] BasicArraySeqTests.OneElemQuickSort (2 ms)
[ RUN      ] BasicArraySeqTests.TwoElemInOrderQuickSort
[      OK  ] BasicArraySeqTests.TwoElemInOrderQuickSort (4 ms)
[ RUN      ] BasicArraySeqTests.TwoElemReverseQuickSort
[      OK  ] BasicArraySeqTests.TwoElemReverseQuickSort (3 ms)
[ RUN      ] BasicArraySeqTests.ThreeElemQuickSortCases
[      OK  ] BasicArraySeqTests.ThreeElemQuickSortCases (3 ms)
[ RUN      ] BasicArraySeqTests.EmptySeqRandQuickSort
[      OK  ] BasicArraySeqTests.EmptySeqRandQuickSort (3 ms)
[ RUN      ] BasicArraySeqTests.OneElemRandQuickSort
[      OK  ] BasicArraySeqTests.OneElemRandQuickSort (2 ms)
[ RUN      ] BasicArraySeqTests.TwoElemInOrderRandQuickSort

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[      OK ] BasicArraySeqTests.TwoElemInOrderRandQuickSort (4 ms)
[ RUN      ] BasicArraySeqTests.TwoElemReverseRandQuickSort
[      OK ] BasicArraySeqTests.TwoElemReverseRandQuickSort (3 ms)
[ RUN      ] BasicArraySeqTests.ThreeElemRandQuickSortCases
[      OK ] BasicArraySeqTests.ThreeElemRandQuickSortCases (4 ms)
[-----] 15 tests from BasicArraySeqTests (72 ms total)

[-----] 15 tests from BasicLinkedSeqTests
[ RUN      ] BasicLinkedSeqTests.EmptySeqMergeSort
[      OK ] BasicLinkedSeqTests.EmptySeqMergeSort (2 ms)
[ RUN      ] BasicLinkedSeqTests.OneElemMergeSort
[      OK ] BasicLinkedSeqTests.OneElemMergeSort (3 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemInOrderMergeSort
[      OK ] BasicLinkedSeqTests.TwoElemInOrderMergeSort (4 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemReverseMergeSort
[      OK ] BasicLinkedSeqTests.TwoElemReverseMergeSort (3 ms)
[ RUN      ] BasicLinkedSeqTests.ThreeElemMergeSortCases
[      OK ] BasicLinkedSeqTests.ThreeElemMergeSortCases (4 ms)
[ RUN      ] BasicLinkedSeqTests.EmptySeqQuickSort
[      OK ] BasicLinkedSeqTests.EmptySeqQuickSort (1 ms)
[ RUN      ] BasicLinkedSeqTests.OneElemQuickSort
[      OK ] BasicLinkedSeqTests.OneElemQuickSort (2 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemInOrderQuickSort
[      OK ] BasicLinkedSeqTests.TwoElemInOrderQuickSort (4 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemReverseQuickSort
[      OK ] BasicLinkedSeqTests.TwoElemReverseQuickSort (3 ms)
[ RUN      ] BasicLinkedSeqTests.ThreeElemQuickSortCases
[      OK ] BasicLinkedSeqTests.ThreeElemQuickSortCases (4 ms)
[ RUN      ] BasicLinkedSeqTests.EmptySeqRandQuickSort
[      OK ] BasicLinkedSeqTests.EmptySeqRandQuickSort (1 ms)
[ RUN      ] BasicLinkedSeqTests.OneElemRandQuickSort
[      OK ] BasicLinkedSeqTests.OneElemRandQuickSort (2 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemInOrderRandQuickSort
[      OK ] BasicLinkedSeqTests.TwoElemInOrderRandQuickSort (4 ms)
[ RUN      ] BasicLinkedSeqTests.TwoElemReverseRandQuickSort
[      OK ] BasicLinkedSeqTests.TwoElemReverseRandQuickSort (3 ms)
[ RUN      ] BasicLinkedSeqTests.ThreeElemRandQuickSortCases
[      OK ] BasicLinkedSeqTests.ThreeElemRandQuickSortCases (4 ms)
[-----] 15 tests from BasicLinkedSeqTests (54 ms total)

[-----] 3 tests from AddedArraySeqTests
[ RUN      ] AddedArraySeqTests.FourElemMergeSort
[      OK ] AddedArraySeqTests.FourElemMergeSort (3 ms)
[ RUN      ] AddedArraySeqTests.FourElemQuickSort
[      OK ] AddedArraySeqTests.FourElemQuickSort (3 ms)
[ RUN      ] AddedArraySeqTests.FourElemRandQuickSort
[      OK ] AddedArraySeqTests.FourElemRandQuickSort (3 ms)
[-----] 3 tests from AddedArraySeqTests (10 ms total)

[-----] 3 tests from AddedLinkedSeqTests
[ RUN      ] AddedLinkedSeqTests.FourElemMergeSort
[      OK ] AddedLinkedSeqTests.FourElemMergeSort (3 ms)
[ RUN      ] AddedLinkedSeqTests.FourElemQuickSort
[      OK ] AddedLinkedSeqTests.FourElemQuickSort (3 ms)
[ RUN      ] AddedLinkedSeqTests.FourElemRandQuickSort
[      OK ] AddedLinkedSeqTests.FourElemRandQuickSort (3 ms)
[-----] 3 tests from AddedLinkedSeqTests (10 ms total)

[-----] Global test environment tear-down
[=====] 36 tests from 4 test suites ran. (188 ms total)
[ PASSED ] 36 tests.
==689921==

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==689921== HEAP SUMMARY:
==689921==      in use at exit: 0 bytes in 0 blocks
==689921==    total heap usage: 1,074 allocs, 1,074 frees, 177,520 bytes allocated
==689921==
==689921== All heap blocks were freed -- no leaks are possible
==689921==
==689921== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)

==689923== Memcheck, a memory error detector
==689923== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==689923== Using Valgrind-3.15.0 and LibVEX; rerun with -h for copyright info
==689923== Command: ./hw4_test_extra
==689923==
[=====] Running 6 tests from 2 test suites.
[-----] Global test environment set-up.
[-----] 3 tests from ExtraArraySeqTests
[ RUN      ] ExtraArraySeqTests.MergeSortThenAddAndErase
[      OK   ] ExtraArraySeqTests.MergeSortThenAddAndErase (21 ms)
[ RUN      ] ExtraArraySeqTests.QuickSortThenAddAndErase
[      OK   ] ExtraArraySeqTests.QuickSortThenAddAndErase (8 ms)
[ RUN      ] ExtraArraySeqTests.QuickSortRandomThenAddAndErase
[      OK   ] ExtraArraySeqTests.QuickSortRandomThenAddAndErase (10 ms)
[-----] 3 tests from ExtraArraySeqTests (48 ms total)

[-----] 3 tests from ExtraLinkedSeqTests
[ RUN      ] ExtraLinkedSeqTests.MergeSortThenAddAndErase
[      OK   ] ExtraLinkedSeqTests.MergeSortThenAddAndErase (11 ms)
[ RUN      ] ExtraLinkedSeqTests.QuickSortThenAddAndErase
[      OK   ] ExtraLinkedSeqTests.QuickSortThenAddAndErase (8 ms)
[ RUN      ] ExtraLinkedSeqTests.QuickSortRandomThenAddAndErase
[      OK   ] ExtraLinkedSeqTests.QuickSortRandomThenAddAndErase (8 ms)
[-----] 3 tests from ExtraLinkedSeqTests (29 ms total)

[-----] Global test environment tear-down
[=====] 6 tests from 2 test suites ran. (117 ms total)
[ PASSED   ] 6 tests.
==689923==
==689923== HEAP SUMMARY:
==689923==      in use at exit: 144 bytes in 9 blocks
==689923==    total heap usage: 360 allocs, 351 frees, 127,305 bytes allocated
==689923==
==689923== LEAK SUMMARY:
==689923==    definitely lost: 144 bytes in 9 blocks
==689923==    indirectly lost: 0 bytes in 0 blocks
==689923==    possibly lost: 0 bytes in 0 blocks
==689923==    still reachable: 0 bytes in 0 blocks
==689923==          suppressed: 0 bytes in 0 blocks
==689923== Rerun with --leak-check=full to see details of leaked memory
==689923==
==689923== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)

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Performance test output:

```

# All times in milliseconds (msec)
# Column 1 = input data size
# Column 2 = avg time array merge sort, reversed
# Column 3 = avg time array merge sort, shuffled
# Column 4 = avg time array quick sort, reversed
# Column 5 = avg time array quick sort, shuffled
# Column 6 = avg time array quick sort random, reversed
# Column 7 = avg time array quick sort random, shuffled

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# Column 8 = avg time linked merge sort, reversed
# Column 9 = avg time linked merge sort, shuffled
# Column 10 = avg time linked quick sort, reversed
# Column 11 = avg time linked quick sort, shuffled
# Column 12 = avg time linked quick sort random, reversed
# Column 13 = avg time linked quick sort random, shuffled
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
1500 0.00 0.00 6.00 0.00 0.00 0.00 0.00 0.00 6.00 0.00 4.00 0.00
3000 0.00 0.00 14.00 0.00 0.00 0.00 0.00 0.00 44.00 1.00 20.00 0.00
4500 0.00 0.00 33.00 0.00 0.00 0.00 0.00 0.00 100.00 3.00 93.00 2.00
6000 0.00 0.00 109.00 1.00 0.00 0.00 0.00 0.00 190.00 4.00 139.00 4.00
7500 0.00 0.00 93.00 0.00 0.00 0.00 0.00 0.00 285.00 7.00 236.00 6.00
9000 0.00 0.00 135.00 1.00 0.00 1.00 0.00 0.00 460.00 14.00 248.00 10.00
10500 1.00 1.00 334.00 2.00 1.00 1.00 0.00 1.00 625.00 19.00 444.00 14.00
12000 1.00 1.00 436.00 2.00 1.00 2.00 0.00 1.00 831.00 25.00 544.00 18.00
13500 2.00 2.00 564.00 3.00 1.00 2.00 0.00 1.00 1044.00 41.00 760.00 25.00
15000 2.00 2.00 685.00 3.00 2.00 2.00 0.00 1.00 1292.00 49.00 1366.00 28.00

```