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[Running] cd "d:\LECS AND MATERIAL\SEMESTER 4\Algorithm Design\Assignment1\" && g++ mergesort_21031_11.cpp -o mergesort_21031_11
41 18467
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 63200 nanoseconds
(1,2,63200ns,2,31600ns)
6334 15724 19169 26500
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 4900 nanoseconds
(2,4,4900ns,8,612ns)
5705 11478 16827 23281 24464 26962 28145 29358
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 5600 nanoseconds
(3,8,5600ns,24,233ns)
Expected value of the Ci's is: 10815 nanoseconds
Variance of the Ci's is: 216032052 nanoseconds

[Done] exited with code=0 in 3.137 seconds

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Q1: Test case 1: k = 3

Q1: Test case 2: k = 5

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[Running] cd "d:\LECS AND MATERIAL\SEMESTER 4\Algorithm Design\Assignment1\" && g++ mergesort_21031_11.cpp -o mergesort_21031_11 && "d:\LECS AND MATERIAL\SEMESTER 4\Algorithm Design\Assignment1\mergesort_21031_11
41 18467
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 32900 nanoseconds
(1,2,32900ns,2,16450ns)
6334 15724 19169 26500
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 2300 nanoseconds
(2,4,2300ns,8,287ns)
5705 11478 16827 23281 24464 26962 28145 29358
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 2700 nanoseconds
(3,8,2700ns,24,112ns)
153 292 491 2995 3902 4827 5436 9961 11942 12382 14604 17421 18716 19718 19895 32391
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 3600 nanoseconds
(4,16,3600ns,64,56ns)
778 1869 3035 4664 5447 6868 7711 8723 9741 9894 11538 12316 12859 14771 15141 17035 17673 19912 20037 21726 23811 25547 25667 26299 27529 27644 28253 28703 30333 31322
32662 32757
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 5800 nanoseconds
(5,32,5800ns,160,36ns)
Expected value of the Ci's is: 3388 nanoseconds
Variance of the Ci's is: 42660469 nanoseconds

[Done] exited with code=0 in 2.908 seconds

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Q1: Test case 3: k = 8

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41 18467
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 43100 nanosechds
(1,2,43100ns,2,21550ns)
6334 15724 19169 26500
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 3100 nanoseconds
(2,4,3100ns,8,387ns)
5705 11478 16827 23281 24464 26962 28145 29358
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 3100 nanoseconds
(3,8,3100ns,24,129ns)
153 292 491 2995 3902 4827 5436 9961 11942 12382 14604 17421 18716 19718 19895 32391
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 4100 nanoseconds
(4,16,4100ns,64,64ns)
778 1869 3035 4664 5447 6868 7711 8723 9741 9894 11538 12316 12859 14771 15141 17035 17673 19912 20037 21726 23811 25547 25667 26299 27529 27644 28253 28703 30333 31322
32662 32757
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 6500 nanoseconds
(5,32,6500ns,160,40ns)
288 1842 2082 2306 3548 4639 4833 4966 5021 5097 5537 5829 6270 6729 7376 8942 9040 9161 9930 11323 11840 12623 13290 13931 13977 15006 15350 15573 15890 16118 16512 16541
16944 18636 18756 19072 19264 19629 19954 21538 22190 22355 22386 22648 22704 22929 23805 23986 24084 24370 24393 24626 24767 26308 26777 26924 27446 28745 29658 30106
31101 31115 31673 32439
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 11400 nanoseconds
(6,64,11400ns,384,29ns)
53 467 900 1150 1587 1655 1999 2421 2634 3093 3195 3430 3602 3728 3788 4031 4041 4596 4734 5249 5844 6038 6191 6224 6359 6422 6483 6617 6618 6900 7448 7616 7958 8281 8909
9374 9503 9514 9758 10291 10383 11008 11020 11337 11511 12052 12287 12292 13030 13458 13966 14309 14310 14343 14798 14893 14945 14989 15281 15457 15574 16202 16413 16519
16941 17410 17451 17807 18007 18127 18190 18538 18588 18762 18935 19156 19589 19668 19796 19815 20055 20472 20485 20537 20580 20600 20798 21548 21724 22483 22798 22813
22888 23199 23622 23655 24021 24179 24221 24272 24350 24484 24648 24946 25200 26418 27157 27348 27350 27506 27595 27624 27753 27938 28009 29168 29314 29657 30191 30303
30523 30836 31107 31556 32209 32591 32609 32702
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 27800 nanoseconds
(7,128,27800ns,896,31ns)
123 140 142 193 235 481 912 1018 1264 1416 1543 1763 1832 1924 1926 2125 2154 2161 2168 2368 2510 2600 2625 2625 2668 2695 2800 3102 3297 3434 3487 3557 3625 3737 3753
4099 4144 4169 4313 4313 4414 4474 4667 4678 4745 4757 4802 4886 5002 5030 5075 5109 5535 5629 5699 5786 6202 6411 6902 7129 7164 7285 7391 7441 7487 7518 7627 7882 7900
8116 8177 8260 8313 8360 8480 8492 9010 9314 9512 9576 9789 9832 9905 10021 10195 10202 10285 10322 10466 10555 10585 10712 10808 11023 11173 11701 11833 12043 12044 12263
12423 12455 12529 12550 12949 13031 13061 13064 13186 13261 13401 13694 13985 14018 14181 14270 14474 14688 14962 15255 16105 16139 16279 16282 16423 16549 16687 17086
17189 17192 17222 17253 17371 17437 17505 17773 17861 17958 18060 18087 18114 18651 18787 18875 18896 19187 19558 19711 19866 19976 20024 20053 20142 20159 20222 20315
20326 20328 20416 20450 20649 20671 20945 21003 21119 21425 21624 21659 21694 21718 21881 22413 22466 22549 22593 22646 22658 22725 22758 23152 23195 23196 23646 23757
23844 23851 24182 24355 24372 24389 24488 24596 25423 25484 25547 25627 25721 25734 25760 25824 25874 25996 26154 26292 26302 26362 26439 26477 26576 26869 27088 27432
27593 27756 27892 27987 28019 28022 28070 28286 28297 28321 28433 28464 28476 28520 28617 28692 29011 29170 29213 29334 29510 29565 29577 29869 29972 30145 30227 30527
30771 30833 30932 30974 31003 31060 31185 31286 31316 31329 31426 31928 31998 32170 32270 32525
Time taken by the Merge Sort procedure for sorting and returning the output of the given array is: 43000 nanoseconds
(8,256,43000ns,2048,20ns)
Expected value of the Ci's is: 2781 nanoseconds
Variance of the Ci's is: 50336749 nanoseconds
2 A 0
Ln 137, Col 11 Spaces 4 UTF-8 CRLF C++ Win32 Background

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Upon observing the results of various test cases for Q1., we can say that as k increases the value of ci fluctuates with less magnitude i.e., ci tends to remain constant. When k = 8, we can see that the value of ci is 20ns, for k = 7 the value of ci is 31ns, and for k = 6, the value of ci is 29ns; thus, the change is extremely small since the time is in the order of 10^{-9} .

Q2: Test case 1: k = 3

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[Running] gcc -O3 -I /usr/include/algorithm/assignment1/ && g++ quicksort_21031_11.cpp -O quicksort_21031_11 && -I /usr/include/algorithm/assignment1/ quicksort_21031_11
41
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 35400 nanoseconds
(1,2,35400ns,2,17700ns)
6334 15724 19169
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2300 nanoseconds
(2,4,2300ns,8,287ns)
5705 11478 16827 23281 24464 26962 28145
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2600 nanoseconds
(3,8,2600ns,24,108ns)
Expected value of the Ci's is: 6031 nanoseconds
Variance of the Ci's is: 68080342 nanoseconds

[Done] exited with code=0 in 3.355 seconds

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[Running] cd "d:\LECS AND MATERIAL\SEMESTER 4\Algorithm Design\Assignment1\" && g++ quicksort_21031_11.cpp -o quicksort_21031_11 && "d:\LECS AND MATERIAL\SEMESTER 4\Algorithm Design\Assignment1\quicksort_21031_11
41
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 29600 nanoseconds
(1,2,29600ns,2,14800ns)
6334 15724 19169
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2100 nanoseconds
(2,4,2100ns,8,262ns)
5705 11478 16827 23281 24464 26962 28145
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2700 nanoseconds
(3,8,2700ns,24,112ns)
153 292 491 2995 3902 4827 5436 9961 11942 12382 14604 17421 18716 19718 19895
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 3900 nanoseconds
(4,16,3900ns,64,60ns)
778 1869 3035 4664 5447 6868 7711 8723 9741 9894 11538 12316 12859 14771 15141 17035 17673 19912 20037 21726 23811 25547 25667 26299 27529 27644 28253 28703 30333 31322
32662
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 5100 nanoseconds
(5,32,5100ns,160,31ns)
Expected value of the Ci's is: 3053 nanoseconds
Variance of the Ci's is: 34504340 nanoseconds

[Done] exited with code 0 in 2.905 seconds

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Q2: Test case 2: k = 5

Q2: Test case 3: k = 8

Upon observing the results of various test cases for Q2., we can say that as k increases the value of ci fluctuates with less magnitude i.e., ci tends to remain constant. When k = 8 we can see that the value of ci is 21ns and for k = 7 the value of ci is 25ns thus, the change is extremely small since the time is in the order of -9.

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41
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 31000 nanoseconds
(1,2,31000ns,2,15500ns)
6334 15724 19169
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2400 nanoseconds
(2,4,2400ns,8,300ns)
5705 11478 16827 23281 24464 26962 28145
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 2700 nanoseconds
(3,8,2700ns,24,112ns)
153 292 491 2995 3902 4827 5436 9961 11942 12382 14604 17421 18716 19718 19895
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 3800 nanoseconds
(4,16,3800ns,64,59ns)
778 1869 3035 4664 5447 6868 7711 8723 9741 9894 11538 12316 12859 14771 15141 17035 17673 19912 20037 21726 23811 25547 25667 26299 27529 27644 28253 28703 30333 31322
32662
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 5200 nanoseconds
(5,32,5200ns,160,32ns)
288 1842 2082 2306 3548 4639 4833 4966 5021 5097 5537 5829 6270 6729 7376 8942 9040 9161 9930 11323 11840 12623 13290 13931 13977 15006 15350 15573 15890 16118 16512 16541
16944 18636 18756 19072 19264 19629 19954 21538 22190 22355 22386 22648 22704 22929 23805 23986 24084 24370 24393 24626 24767 26308 26777 26924 27446 28745 29658 30106
31101 31115 31673
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 9400 nanoseconds
(6,64,9400ns,384,24ns)
53 467 900 1150 1587 1655 1999 2421 2634 3093 3195 3430 3602 3728 3788 4031 4041 4596 4734 5249 5844 6038 6191 6224 6359 6422 6483 6617 6618 6900 7448 7616 7958 8281 8909
9374 9503 9514 9758 10291 10383 11008 11070 11337 11511 12052 12287 12292 13030 13458 13966 14309 14310 14343 14798 14893 14945 14989 15281 15457 15574 16202 16413 16519
16941 17410 17451 17807 18007 18127 18190 18538 18588 18762 18935 19156 19589 19668 19796 19815 20055 20472 20485 20537 20580 20600 20798 21548 21724 22483 22798 22813
22888 23109 23622 23655 24021 24170 24221 24272 24350 24404 24648 24946 25200 26418 27157 27348 27350 27506 27595 27624 27753 27938 28009 29168 29314 29657 30191 30303
30523 30836 31107 31556 32209 32591 32609
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 22700 nanoseconds
(7,128,22700ns,896,25ns)
123 140 142 193 235 481 912 1018 1264 1416 1543 1763 1832 1924 1926 2125 2154 2161 2168 2368 2510 2600 2625 2625 2668 2695 2800 3102 3297 3434 3487 3557 3625 3737 3753
4099 4144 4169 4313 4313 4414 4474 4667 4678 4745 4757 4802 4886 5002 5030 5075 5109 5535 5629 5699 5786 6202 6411 6902 7129 7164 7285 7391 7441 7487 7518 7627 7882 7900
8116 8177 8260 8313 8360 8480 8492 9010 9314 9512 9576 9789 9832 9905 10021 10195 10202 10285 10322 10466 10555 10585 10712 10808 11023 11173 11701 11833 12043 12044 12263
12423 12455 12529 12550 12949 13031 13061 13064 13186 13261 13401 13694 13985 14018 14181 14270 14474 14688 14962 15255 16105 16139 16279 16282 16423 16549 16687 17086
17189 17192 17222 17253 17371 17437 17505 17773 17861 17958 18060 18087 18114 18651 18787 18875 18896 19187 19558 19711 19866 19976 20024 20053 20142 20159 20222 20315
20326 20328 20416 20450 20649 20671 20945 21003 21119 21425 21624 21659 21694 21718 21881 22413 22466 22549 22593 22646 22658 22725 22758 23152 23195 23196 23646 23757
23844 23851 24182 24355 24372 24389 24488 24596 25423 25484 25547 25627 25721 25734 25760 25824 25874 25996 26154 26292 26302 26362 26439 26477 26576 26869 27088 27432
27593 27756 27892 28019 28022 28070 28286 28297 28321 28433 28464 28476 28520 28617 28692 29011 29170 29213 29334 29510 29565 29577 29869 29972 30145 30227 30527
30771 30833 30932 30974 31003 31060 31185 31286 31316 31329 31426 31928 31998 32170 32270
Time taken by the Quick Sort procedure for sorting and returning the output of the given array is: 43500 nanoseconds
(8,256,43500ns,2048,21ns)
Expected value of the Ci's is: 2009 nanoseconds
Variance of the Ci's is: 26008253 nanoseconds

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