

CSE 5311 - 002 - Project 1

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1. Time Complexity:

Insertion Sort:

- Worst Case: $O(n^2)$
- Best Case: $O(n)$

Merge Sort:

- Worst Case: $O(n*\log n)$
- Best Case: $O(n*\log n)$

Quick Sort:

- Worst Case: $O(n^2)$
- Best Case: $O(n*\log n)$

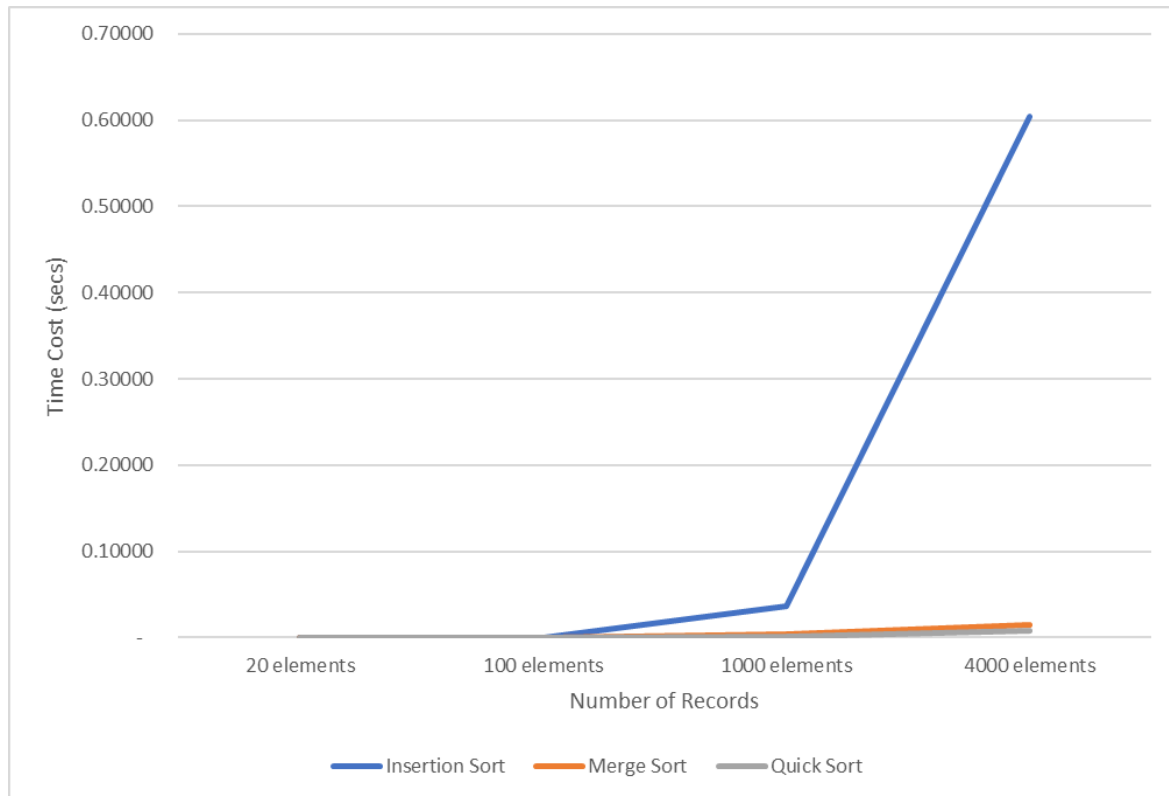
2. Experimental Results: (best performer highlighted in **bold**.)

	20 elements	100 elements	1000 elements	4000 elements
Insertion Sort	0.00002 sec	0.00029 sec	0.03308 sec	0.57203 sec
Merge Sort	0.00004 sec	0.00021 sec	0.00294 sec	0.01366 sec
Quick Sort	0.00002 sec	0.00008 sec	0.00146 sec	0.00720 sec

3. Observations:

Comparing the results of the experiment, we observe the following:

- For smaller input data sizes, insertion sort performs better than the other two.
- However, as the size of data grows, i.e. n takes values 100, 1000. And 4000; Quicksort performs significantly better than the other two for larger input data sizes. The same can be graphically described in the below trend line:



4. List of input arrays

- For $n = 20$, the array is as follows:

[4940, 12, 2307, 1527, 2724, 2010, 4377, 4831, 171, 3169, 1189, 2569, 1284, 5980, 5407, 1244, 1297, 5989, 1843, 5568]

- For $n = 100$, the array is as follows:

[191, 1024, 1936, 5515, 639, 1003, 2021, 4488, 1087, 64, 4151, 2328, 940, 5775, 907, 1434, 4616, 3102, 4298, 234, 724, 79, 2320, 5751, 2471, 5109, 3156, 4925, 2290, 1794, 5598, 1056, 1606, 1108, 1072, 2618, 5103, 33, 2157, 2825, 1788, 3848, 4152, 3653, 5131, 2345, 2336, 5448, 1200, 3187, 2669, 81, 108, 4885, 812, 3216, 3721, 5833, 3366, 4223, 2427, 5586, 3478, 1132, 1741, 3146, 241, 4948, 440, 802, 5103, 491, 2867, 5558, 5086, 46, 3871, 3986, 1532, 734, 4173, 2596, 1381, 2806, 664, 756, 5957, 3411, 4168, 2456, 3315, 4438, 699, 1279, 602, 3501, 4202, 4990, 2476, 3814]

- For $n = 1000$, the array is as follows:

[2682, 811, 35, 217, 4751, 4639, 1464, 5694, 1105, 81, 3480, 1474, 4827, 1353, 2124, 5939, 88, 2578, 1433, 1024, 1087, 961, 1734, 3602, 1192, 5194, 1928, 4543, 2173, 1312, 5387, 5675, 1415, 942, 3828, 4128, 6000, 5916, 2752, 179, 4594, 131, 3449, 1902, 5765, 3140, 2407, 2134, 5491, 247, 5185, 828, 1488, 2875, 2438, 1003, 626, 2760, 5290, 3423, 3097, 668, 3617, 498, 4316, 1613, 5970, 4049, 2261, 332, 4446, 607, 1778, 4844, 1393, 1988, 807, 1881, 1383, 3954, 3761, 5981, 4752, 5176, 2122, 4868, 1788, 3868, 436, 4190, 3965, 2583, 5385, 44, 2620, 4430, 303, 380, 1891, 4444, 5371, 2892, 5980, 4663, 446, 1765, 5005, 1956, 1985, 225, 545, 1183, 3985, 2868, 862, 3602, 4349, 4395, 869, 3290, 5418, 1221, 2828, 979, 3450, 4455, 4543, 640, 2033, 2185, 5830, 1732, 1926, 5434, 2799, 2940, 5259, 5638, 582, 4406, 5257, 2791, 3852, 4948, 1779, 5556, 658, 5643, 2614, 3120, 2027, 3182, 1878, 3116, 1379, 2651, 5701, 2560, 2902, 2993, 2536, 3712, 4366, 1889, 3683, 1383, 1824, 1624, 4094, 3631, 2865, 5607, 4826, 614, 3391, 4571, 1869, 84, 1540, 398, 5378, 2373, 4791, 1185, 1726, 2724, 4078, 1620, 1913, 1117, 5963, 4921, 5229, 147, 2992, 1762, 3694, 2551, 4908, 1290, 3638, 2853, 2791, 1208, 2947, 2042, 917, 5534, 242, 1616, 627, 2039, 3942, 3499, 2783, 4795, 2409, 4321, 3130, 5216, 4305, 2691, 1724, 5772, 416, 4620, 2512, 3145, 3942, 3751, 4347, 3792, 586, 2599, 2062, 1892, 4778, 1734, 3065, 2918, 2240, 4148, 415, 3077, 3252, 5321, 2609, 1133, 3199, 5952, 1459, 1444, 1142, 2326, 4583, 4150, 3421, 1097, 5901, 4736, 839, 2672, 1188, 4807, 5607, 316, 4722, 3750, 4460, 5550, 1942, 1184, 909, 4724, 5805, 4788, 1638, 539, 4367, 5366, 312, 1748, 553, 2395, 542, 3190, 4291, 3860, 5153, 4393, 3247, 2043, 2251, 4973, 5721, 4476, 3568, 4865, 1621, 4628, 1438, 4485, 2275, 5976, 213, 3741, 4159, 4084, 323, 3009, 3559, 4782, 1036, 5947, 2174, 4772, 343, 3921, 5005, 106, 3717, 4840, 612, 1260, 1065, 750, 111, 1010, 462, 2689, 3295, 5492, 3924, 4531, 4423, 1515, 2759, 5013, 4963, 1573, 2259, 3651, 374, 4393, 3212, 4954, 1523, 1241, 4519, 1322, 2744, 2902, 498, 3971, 3823, 5695, 1586, 4500, 1687, 138, 311, 5041, 4202, 5848, 4156, 1923, 1115, 4513, 3027, 3720, 5009, 4440, 189, 1089, 1061, 1898, 4895, 3774, 1871, 4598, 113, 4456, 1341, 2466, 1600, 1621, 2383, 5692, 2010, 3895, 3804, 5568, 5894, 870, 3979, 4147, 1891, 1568, 3721, 5509, 2384, 3991, 2305, 4131, 5049, 1306, 5035, 1155, 5641, 4760, 1875, 4195, 1278, 1722, 5905, 333, 3282, 2254, 2855, 1985, 5566, 2687, 5479, 4382, 3809, 2469, 5926, 1754, 5688, 3832, 1687, 5034, 1272, 5947, 5668, 3297, 1674, 5796, 1838, 4496, 979, 2423, 1189, 3457, 2581, 2783, 51, 5937, 4576, 4213, 2409, 5057, 5091, 689, 4607, 2169, 835, 3233, 5552, 2200, 2057, 5778, 1997, 2468, 1894, 3572, 2821, 4468, 67, 1899, 5829, 5049, 5798, 5444, 5415, 1103, 415, 1960, 1641, 2214, 3280, 1385, 1233, 3864, 2840, 4375, 5827, 1212, 4593, 3292, 357, 5330, 910, 4300, 2525, 1845, 1774, 2700, 3170, 1771, 4113, 2341, 2108, 4711, 5428, 708, 5610, 1470, 2476, 3417, 5528, 3943, 3828, 4402, 3883, 3377, 3986, 1560, 5444, 5379, 2680, 2258, 4955, 4319,

1733, 3459, 5569, 5890, 859, 1136, 1275, 4802, 1086, 564, 2684, 89, 3849, 61, 4294, 4364, 2676, 1718, 2387, 1721, 4711, 1110, 3044, 2289, 1253, 4577, 1762, 2236, 1261, 4342, 4594, 820, 4340, 874, 2792, 3842, 3389, 2116, 5309, 755, 4972, 5888, 4728, 760, 5795, 1442, 5854, 5287, 511, 3165, 1864, 3879, 1317, 4222, 4004, 668, 467, 4403, 2258, 2129, 987, 2348, 167, 3854, 946, 1282, 4538, 2737, 4786, 4809, 707, 2629, 1426, 2521, 469, 4891, 5766, 65, 2280, 3393, 4529, 5110, 1612, 2165, 1527, 4215, 3212, 4951, 3189, 721, 4232, 856, 5649, 3456, 4746, 4688, 3677, 3401, 3866, 5590, 2296, 5036, 2613, 822, 4269, 1477, 4472, 3150, 3465, 5147, 1484, 5717, 1952, 384, 2878, 3971, 862, 4053, 4966, 348, 2241, 5288, 3962, 4209, 4741, 764, 4974, 5556, 2657, 1653, 441, 1441, 1178, 5901, 2361, 3163, 461, 997, 2583, 1949, 5942, 1631, 562, 207, 1238, 2255, 4875, 252, 1717, 5773, 1041, 5273, 1999, 5148, 389, 711, 3440, 2026, 826, 2596, 1289, 441, 324, 23, 4177, 5762, 4111, 3082, 2944, 5028, 400, 5771, 3203, 3953, 215, 5595, 1682, 4547, 5871, 1682, 5069, 4856, 4713, 1075, 5396, 1725, 1393, 2548, 712, 2725, 3312, 2825, 3076, 5814, 4358, 4309, 5942, 3788, 4556, 1280, 4864, 3572, 5353, 1140, 1359, 2521, 4758, 4415, 3252, 338, 2169, 4922, 2468, 3487, 137, 4442, 3632, 1142, 980, 905, 5981, 2566, 3767, 4936, 3217, 2606, 34, 44, 5459, 5607, 1032, 290, 400, 2042, 372, 1578, 5904, 5026, 2154, 5582, 2415, 5315, 2868, 3791, 1511, 3968, 5956, 4544, 5730, 1289, 3132, 3765, 1641, 1785, 5352, 4510, 2189, 4665, 2229, 5067, 2538, 4157, 45, 1589, 4590, 166, 209, 1870, 1047, 4409, 5054, 1737, 1053, 1666, 5238, 917, 4944, 1278, 5550, 5100, 1525, 2815, 1333, 861, 3125, 1479, 3899, 4526, 5678, 4806, 3081, 4079, 1541, 2773, 1914, 5880, 3686, 4370, 5953, 4366, 3427, 3388, 2855, 4092, 499, 2634, 2200, 840, 3406, 1775, 5293, 2372, 5801, 3770, 5392, 4973, 156, 507, 1825, 2427, 4096, 4048, 5139, 365, 788, 2727, 1527, 1253, 521, 3198, 5389, 1524, 1316, 5994, 5025, 2676, 2188, 4794, 4666, 1295, 3069, 1789, 438, 866, 1279, 1033, 3128, 2038, 5891, 5492, 2220, 872, 1298, 357, 2397, 3710, 1227, 1040, 1175, 4040, 3879, 5936, 4527, 639, 1534, 799, 1346, 1412, 5034, 1991, 4789, 2843, 5297, 706, 969, 1652, 1466, 4306, 196, 4588, 3826, 3542, 3305, 5887, 4822, 3399, 2108, 3282, 1358, 806, 3182, 2866, 1238, 4718, 884, 2744, 1949, 2359, 4099, 2505, 5281, 1989, 3247, 1636, 1407, 5079, 2880, 2023, 2079, 5433, 2032, 1052, 3564, 2629, 4100, 129, 4596, 1688, 3431, 4088, 2467, 5291, 65, 632, 919, 2298, 5874, 5201, 5028, 4728, 112, 4924, 724, 4238, 3253, 2902, 5198, 1490, 4596, 5078, 1662, 265, 5903, 2032, 3099, 557, 5745, 4507, 2762, 3117, 402, 1057, 4297, 2069, 986, 5695, 4012, 4688, 1310, 596, 1447, 4486, 328, 3465, 1236, 2535, 5200, 1684, 3319, 1059, 3005, 2295, 816, 4919, 622, 645]

- For $n = 4000$, the array is as follows:

[1924, 5686, 113, 2862, 864, 4302, 4622, 774, 820, 4978, 1711, 2668, 1989, 732, 3323, 4425, 2462, 3473, 886, 2032, 4313, 4129, 5536, 912, 3786, 1089,

3258, 3043, 4865, 3283, 2074, 3344, 2572, 3365, 858, 1850, 2533, 5127,
1934, 3494, 4333, 3388, 1669, 2332, 732, 4000, 532, 2532, 5923, 1002, 2060,
900, 2111, 2061, 4503, 629, 3341, 4285, 2516, 2483, 5860, 4479, 4940, 2514,
2708, 2831, 1381, 4836, 5856, 396, 3045, 971, 689, 2000, 3523, 2732, 303,
1891, 183, 506, 4989, 2435, 647, 5701, 4565, 57, 3884, 359, 320, 2953, 10,
5796, 665, 1109, 2180, 4660, 148, 4907, 2142, 2803, 2478, 675, 145, 4075,
3117, 3352, 1307, 5574, 448, 4419, 1362, 1281, 125, 2841, 4109, 1156, 1288,
3680, 2546, 796, 757, 5697, 708, 5193, 2900, 3868, 2338, 1832, 2400, 1124,
3697, 3745, 5130, 284, 2217, 5331, 1020, 3719, 2245, 1567, 4576, 2541,
5058, 201, 4033, 4333, 2555, 4132, 761, 3418, 461, 2068, 2281, 176, 3698,
1745, 5841, 3219, 3868, 5305, 2743, 2238, 1467, 3980, 3039, 3659, 5399,
843, 214, 2870, 5162, 4412, 3126, 2268, 4847, 5327, 2715, 1412, 3251, 5014,
605, 10, 5164, 4505, 4536, 1410, 2024, 1617, 5340, 3220, 4488, 2224, 3715,
861, 4982, 1055, 3108, 4993, 3998, 4496, 703, 3999, 1567, 3, 3347, 4840,
1343, 780, 5301, 4812, 2852, 1627, 3178, 4979, 1890, 3548, 3229, 1172, 35,
2954, 2356, 2385, 2599, 333, 602, 1814, 234, 5643, 5805, 2168, 2839, 553,
149, 5831, 1931, 2430, 1400, 4112, 362, 743, 4012, 4000, 3494, 5710, 3054,
749, 538, 5934, 1883, 4931, 2708, 1259, 2951, 153, 2845, 1456, 933, 3608,
2312, 4173, 5666, 982, 1674, 5651, 5028, 2321, 526, 4464, 1989, 2417, 4836,
1169, 1491, 1825, 5756, 2057, 3548, 3206, 6000, 5682, 1815, 983, 4233,
1902, 329, 4622, 2911, 5474, 4769, 4565, 1310, 1809, 2184, 2085, 3959, 538,
2898, 5238, 374, 1775, 4528, 1393, 3313, 5315, 3049, 5293, 1292, 2936, 831,
5486, 4638, 118, 4420, 1820, 2336, 1480, 4159, 5319, 1313, 4241, 4937,
3397, 4332, 3615, 5107, 3680, 786, 5567, 5064, 3009, 3148, 613, 4219, 800,
4782, 5078, 2907, 4862, 2203, 3628, 3928, 1127, 3667, 3053, 2028, 219,
4813, 4890, 1617, 1622, 3523, 4282, 3711, 596, 2964, 221, 2374, 4602, 4200,
1400, 4085, 1237, 1386, 4949, 2053, 1465, 4904, 4548, 4468, 3319, 2721,
2871, 3958, 535, 5287, 1480, 2280, 2448, 3583, 5201, 3445, 5591, 2047, 651,
3115, 4305, 1296, 5265, 5318, 4407, 1682, 4643, 3278, 5800, 5591, 2015,
1493, 3993, 2790, 3904, 5599, 1849, 3318, 3719, 1229, 4380, 1110, 1071,
212, 5567, 2179, 5735, 2821, 5153, 4509, 4011, 5831, 2322, 5752, 5643,
3050, 2539, 5631, 4041, 4001, 5415, 4364, 584, 147, 310, 3838, 925, 3137,
5797, 5645, 2149, 5699, 1994, 4531, 782, 5910, 2422, 1148, 450, 1217, 2148,
1152, 1265, 3208, 2727, 5110, 535, 2907, 2712, 3302, 2948, 2171, 5233,
4336, 4535, 929, 4367, 1199, 609, 5918, 989, 1665, 4557, 590, 2719, 1286,
1291, 1482, 1534, 621, 1405, 1575, 149, 1526, 4563, 3812, 1947, 3468, 2756,
1977, 1611, 3028, 1411, 5796, 156, 3066, 1189, 2335, 3331, 361, 4436, 1559,
1427, 1628, 3643, 1318, 3091, 5939, 4679, 2905, 1256, 883, 3015, 3765,
4402, 1249, 879, 1755, 5436, 3633, 3203, 3164, 2017, 1285, 5561, 744, 2540,
3225, 3347, 1591, 1026, 4312, 4687, 1827, 2623, 255, 696, 1743, 5577, 3819,
3695, 4335, 4763, 5509, 3683, 5295, 1211, 4597, 1883, 948, 5384, 14, 717,
5831, 3658, 4639, 885, 5211, 3844, 1766, 3897, 203, 2466, 2436, 3546, 2401,
919, 2830, 3606, 5816, 2056, 972, 1105, 888, 2940, 3872, 2153, 3019, 2497,
584, 5019, 5157, 4670, 3472, 1245, 4329, 3036, 4388, 1004, 4487, 2059,

4328, 4970, 3416, 1526, 4026, 3191, 1226, 5837, 1217, 4756, 5495, 1531,
2943, 937, 630, 1803, 5766, 3029, 1533, 3203, 814, 5379, 5327, 5660, 375,
1327, 2169, 697, 5927, 4384, 1035, 3261, 5029, 2027, 2595, 2587, 1269, 749,
5084, 612, 2881, 2870, 3910, 4501, 1427, 1112, 2969, 306, 2655, 5890, 5956,
1441, 2912, 2072, 3019, 3216, 2019, 1174, 1571, 2962, 3565, 1703, 2203,
2983, 3632, 4265, 2471, 5577, 3039, 627, 3968, 5677, 5422, 5474, 2460,
3968, 1504, 3912, 3071, 137, 5650, 3601, 2500, 5756, 4992, 4358, 2585,
2823, 1728, 2429, 5933, 1971, 519, 703, 3885, 1518, 2507, 1871, 4193, 2219,
2138, 3796, 27, 196, 3556, 1867, 4483, 829, 1908, 4317, 4334, 3286, 3414,
2875, 4949, 3035, 558, 5874, 3467, 1129, 5105, 3728, 3636, 685, 858, 1586,
5439, 3268, 3465, 222, 5184, 4063, 3264, 995, 3395, 2513, 3269, 768, 2776,
5259, 4680, 1376, 3708, 1061, 4652, 355, 4555, 1705, 933, 4792, 865, 559,
3741, 3844, 3611, 2251, 3346, 5832, 2358, 977, 1340, 10, 3243, 1099, 499,
2421, 340, 5908, 1933, 1929, 1629, 3130, 63, 4715, 2119, 905, 2261, 4436,
1685, 3269, 4484, 193, 4928, 4760, 1704, 1583, 1446, 4169, 2839, 3982,
2071, 1004, 3584, 1245, 387, 5391, 3847, 565, 4479, 1499, 527, 4743, 3738,
5490, 4691, 3664, 3944, 908, 1914, 3458, 4285, 3246, 607, 4015, 160, 203,
4711, 700, 1802, 5855, 4133, 5711, 727, 4012, 2598, 5793, 2508, 4556, 4196,
5412, 2912, 111, 153, 3898, 3193, 4575, 5272, 416, 2822, 369, 3312, 2175,
4031, 3000, 5230, 2028, 3537, 4969, 5991, 1706, 3407, 1435, 5090, 1688,
5456, 3782, 5634, 5539, 583, 5053, 5786, 4988, 4275, 1895, 5081, 5878,
1036, 526, 2214, 5138, 3348, 2144, 3966, 3062, 5805, 3328, 5872, 1580,
3156, 1797, 4088, 3473, 5044, 1704, 4784, 640, 2290, 359, 3922, 1640, 5686,
4457, 554, 1891, 4122, 5945, 199, 1770, 3675, 3800, 1493, 4392, 482, 747,
5831, 5021, 2947, 287, 4250, 287, 4476, 4939, 214, 2229, 4041, 5248, 520,
4060, 2268, 2448, 4254, 2792, 4611, 3262, 5650, 4292, 2596, 1591, 3812,
3430, 1503, 1693, 2498, 4514, 933, 3828, 3862, 1816, 3609, 5364, 4805,
5303, 5728, 1577, 1571, 408, 612, 1759, 1247, 1051, 4754, 3213, 609, 5538,
4490, 3881, 4634, 2299, 4976, 1341, 544, 508, 2538, 3668, 1255, 3807, 352,
2670, 5383, 5456, 4476, 3621, 111, 2391, 3898, 354, 2918, 4421, 4307, 2167,
2192, 550, 2566, 4461, 801, 358, 4517, 1279, 4733, 3001, 1016, 3329, 2780,
5076, 3753, 4773, 3487, 222, 887, 3812, 2149, 3880, 3147, 3826, 48, 3573,
3977, 4583, 2452, 5945, 2343, 3410, 5989, 3150, 2377, 2850, 4904, 776,
3565, 2811, 4270, 1613, 2732, 5733, 205, 3188, 3241, 1219, 4419, 1851,
5309, 1377, 1662, 4507, 5007, 561, 5747, 2773, 4379, 2255, 1156, 15, 1961,
263, 1072, 2853, 2540, 3630, 5013, 2736, 1759, 136, 4640, 1746, 4074, 795,
5245, 251, 1085, 2399, 2301, 3608, 4274, 2943, 1075, 2467, 801, 1468, 3797,
124, 3016, 48, 5816, 3544, 5234, 4515, 5689, 2400, 4797, 1123, 1799, 4521,
217, 1558, 1271, 2362, 3503, 5854, 5828, 5758, 1740, 4581, 5839, 5032,
2174, 237, 4586, 545, 4234, 1061, 2283, 848, 4372, 2174, 4025, 5538, 2887,
5426, 3722, 2163, 468, 3351, 4471, 5709, 2010, 3742, 3130, 5894, 4697,
5890, 2997, 5566, 3124, 5510, 1688, 4224, 5135, 5285, 1064, 4712, 4008,
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1182, 4868, 5562, 3964, 4413, 4276, 4444, 2110, 1890, 1334, 2115, 5907,
260, 1594, 1004, 1703, 2141, 2695, 3479, 3446, 4659, 1950, 5188, 5281,
1697, 3073, 1949, 1297, 4419, 5373, 124, 1431, 2299, 4000, 789, 545, 2154,
5248, 3642, 3590, 3413, 3822, 4825, 2746, 2662, 1819, 740, 2617, 3972,
2349, 1449, 823, 4770, 2394, 3769, 4429, 4772, 808, 2343, 5613, 1929, 1091,
247, 5171, 4774, 4054, 2132, 2254, 5947, 1569, 4629, 3001, 2589, 2036,

1785, 4674, 554, 3305, 3785, 5606, 3720, 2288, 2574, 3371, 4803, 84, 530, 3190, 1983, 3329, 851, 469, 4804, 4976, 3763, 857, 927, 3448, 5949, 3428, 3608, 5951, 4019, 4769, 5416, 1645, 2092, 1913, 1746, 432, 2203, 5339, 3372, 4826, 271, 1618, 4364, 4687, 1794, 4389, 345, 3443, 3442, 4335, 3761, 5779, 3432, 2461, 5493, 5531, 3111, 573, 859, 425, 4478, 2841, 4303, 3923, 4668, 71, 1538, 34, 2887, 2714, 1762, 3244, 765]

5. References:

- <https://docs.python.org/3/library/random.html>
- <https://www.tutorialspoint.com/generating-random-number-list-in-python>
- <https://www.kite.com/python/answers/how-to-write-a-list-to-a-file-in-python>
- https://www.w3schools.com/python/python_file_write.asp
- <https://www.geeksforgeeks.org/python-initializing-multiple-lists/>
- <https://www.geeksforgeeks.org/python-program-for-quicksort/?ref=lbp>
- https://www.w3schools.com/python/python_functions.asp
- https://www.w3schools.com/python/python_file_open.asp
- <https://stackoverflow.com/questions/14622314/python-inserting-variable-string-as-file-name>
- <https://www.statology.org/python-read-text-file-into-list/>
- <https://pynative.com/python-file-objects/>
- <https://www.codevscolor.com/python-read-all-numbers-from-file>
- <https://www.geeksforgeeks.org/precision-handling-python/>
- <https://www.codegrepper.com/code-examples/python/how+to+record+execution+time+in+python>
- <https://stackabuse.com/insertion-sort-in-python/>
- <https://en.wikipedia.org/wiki/Quicksort>
- https://rosettacode.org/wiki/Sorting_algorithms/Quicksort
- <https://stackoverflow.com/questions/25732203/quicksort-clrs-implementation-in-python>
- <https://note.nkmk.me/en/python-list-clear-pop-remove-del/>
- <https://codefather.tech/blog/write-list-to-a-file-in-python/>
- <https://www.programiz.com/dsa/merge-sort>
- <https://betterprogramming.pub/4-ways-to-remove-elements-from-a-list-in-python-3b8f4afd1b83>
- <https://www.geeksforgeeks.org/python-program-for-merge-sort/>
- <https://www.geeksforgeeks.org/insertion-sort/>
- <https://stackoverflow.com/questions/12056912/how-to-implement-merge-sort-from-the-introduction-to-algorithms-by-cormen-and>
- <http://www.richardssoftware.net/Home/Post/79>

6. Roles and Responsibilities:

- Madhav - Generated data files, implemented Insertion sort, and merge sort
- Akash - Implemented Quicksort, and prepared the report

7. Honor Code:

HONOR CODE

I pledge, on my honour, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will only submit work that I personally create or that I contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standard of integrity and uphold the spirit of the honour code.

I will not participate in any form of cheating/sharing the questions/answers/solutions.

Madhav

4th March 2022

HONOR CODE

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or that I contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor code.

I will not participate in any form of cheating/sharing the questions/solutions.

Akash

Akash Raju Gangaraju

03/04/2022