Jessica Cvetkovska - Task 1 and 2
Mitchell Koski - Task 2 and 3
Dhruv Pandey - *radio silent*

Explanation of Task 2 - Mitchell
Screenshots: - times are in Nanoseconds

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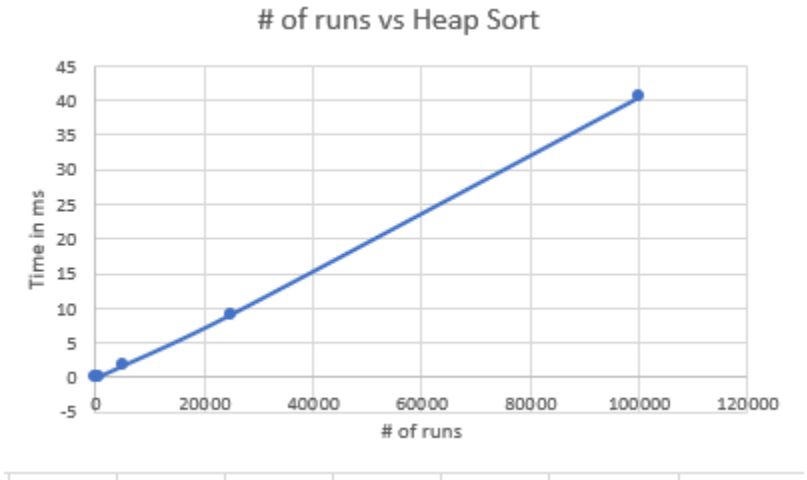
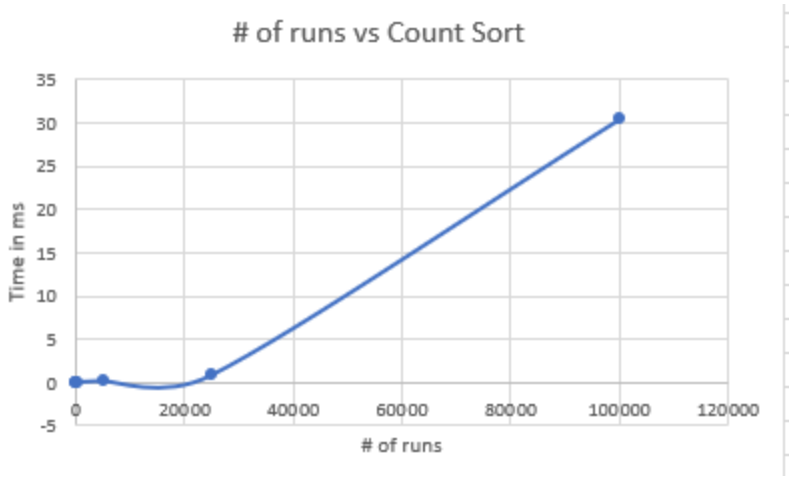
Time in Nanoseconds
Sizes:          10      100     500     5000            25000           100000

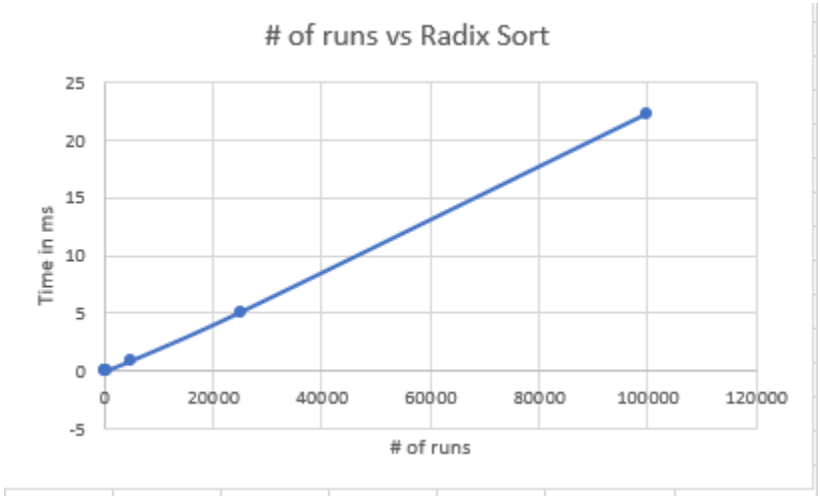
Bubble Sort:    650     38930   751850  83775660        1810408170      34421942950
Insert Sort:    2100    11040   165820  19297310        452549440       7133319750
Quick Sort:     2680    11520   68370   1199360         4322410         18274880
Merge Sort:     4600    57670   232790  3203370         20404480        79219800
Count Sort:     1170    6680    15130   146100          772900          3044810
Radix Sort:     3470    15110   74390   921480          5106380         22313770
Heap Sort:      880     16710   112360  1708950         9167840         40580920
```

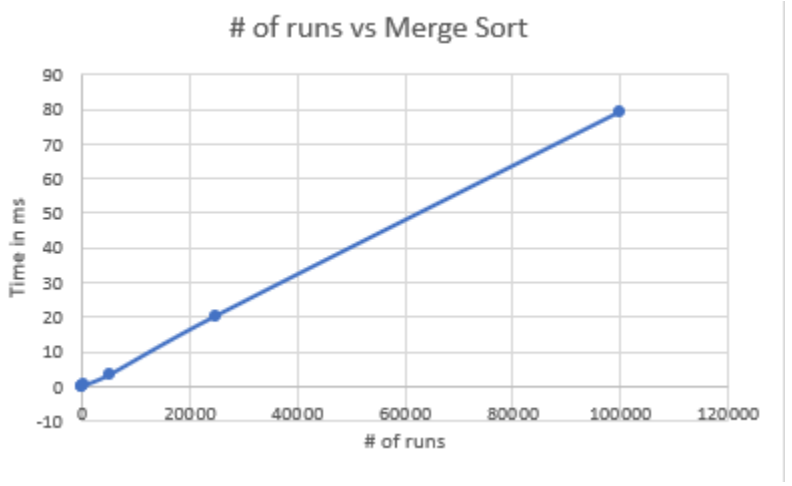
Table in MS:

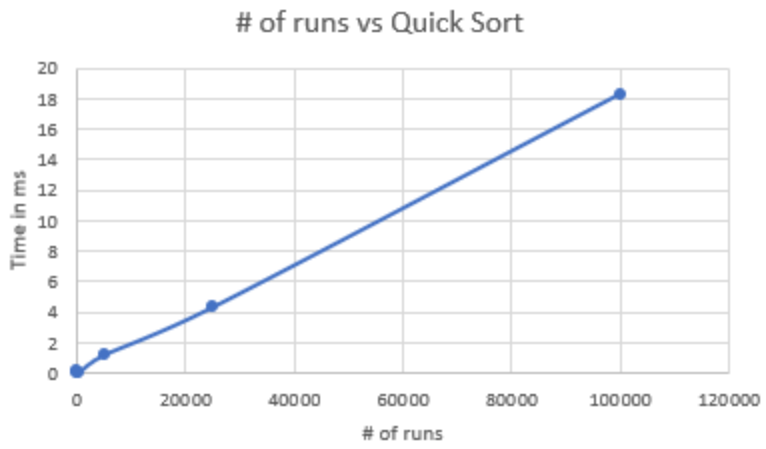
# of runs	10	100	500	5000	25000	100000
Bubble	0.00065	0.03893	0.75185	83.77566	1810.40817	34421.94295
Insert	0.0021	0.01104	0.16582	19.29731	452.54944	7133.31975
Quick	0.00268	0.1152	0.06837	1.19936	4.32241	18.27488
Merge	0.0046	0.05767	0.23279	3.20337	20.40448	79.2198
Count	0.00117	0.00668	0.01513	0.1461	0.7729	30.4481
Radix	0.00347	0.01511	0.07439	0.92148	5.10638	22.31377
Heap	0.00088	0.01671	0.11236	1.70895	9.16784	40.58092
Time in ms						

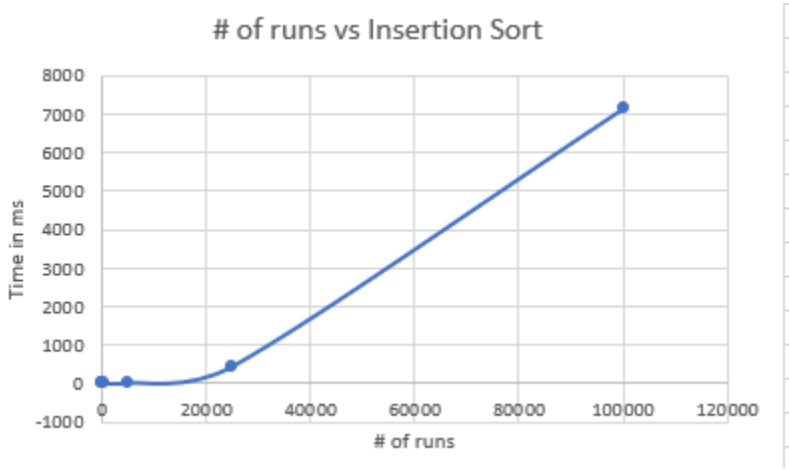


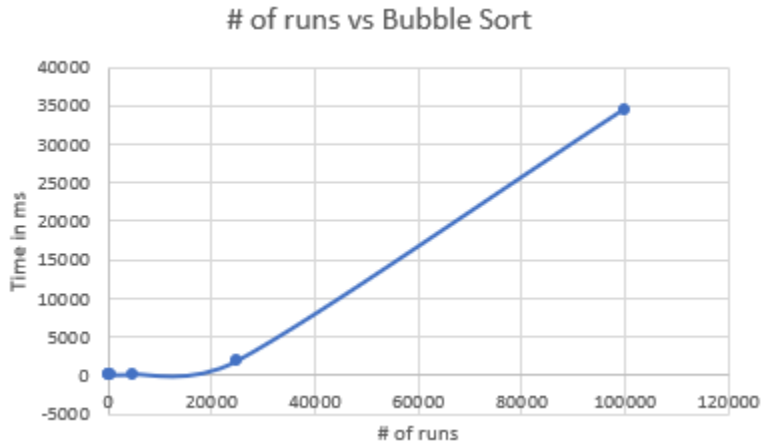

# of runs vs Count Sort
Time in ms
35
30
25
20
15
10
5
0
-5
0
20000
40000
60000
80000
100000
120000
# of runs


# of runs vs Radix Sort
Time in ms
25
20
15
10
5
0
-5
0
20000
40000
60000
80000
100000
120000
# of runs


# of runs vs Merge Sort
Time in ms
90
80
70
60
50
40
30
20
10
0
-10
0
20000
40000
60000
80000
100000
120000
# of runs







1) Explain the results based on their big N notation
    a) Bubble sort: Average/Worst Case Performance - O(N^2)
        i) From the graph above we can see that as we added more elements to the sorting algorithm, the larger the graph looks like a parabolic curve representing N^2. The results look a little higher than expected as the algorithm added more elements the slower the time became.

b) Insertion Sort: Average case O(n^2).
    i) As we increase the amount in the sort the time is about 2-4 times faster than the bubble sort but it still has around the same shape. Performed as expected.
c) Quick Sort: Performance - O(nlogn)
    i) For this it was actually less than expected as the graph is basically a flat line as perform faster than bubble sort and insertion sort.
d) Merge sort: Performance - O(nlogn)
    i) The merge sort performed as expected and while less than what we discussed in class I believe that a computer's hardware does affect the final outcome.
e) Heap sort: Performance - O(nlogn)
    i) As the number of tests becomes greater the line starts to increase almost exponentially but still follows the predicted path. Performed as expected
f) Counting Sort: Performance - O(2n+k)
    i) As the value we input into counting sort is random we cannot predict the outcome however as there may be duplicates so the number could be smaller than the expected.
g) Radix-Sort: performance O(d*n)
    i) The result is very linear and thus meets the required parameters for the class. Meets the expected performance for the class.

2) What did we expect for time for each of the array sizes based on the results for array size of 10?

Time in ms	10	100 (estimate)	500 (estimate)	5000 (estimate)	25000 (estimate)	100000 (estimate)
Bubble	0.00065	0.01	0.025	25	625	10000
Insertion	0.0021	0.01	0.025	25	625	10000
Merge	0.0046	0.0002	0.0013	0.01849	0.1099	0.5
Quick	0.00268	0.0002	0.0013	0.01849	0.1099	0.5
Counting	0.00117	0.0004	0.002	0.02	0.1	0.4
Radix	0.00347	0.01	0.25	25	625	10000
Heap	0.00088	0.0002	0.0013	0.01849	0.1099	0.5

Calculations above were done with respective time complexities