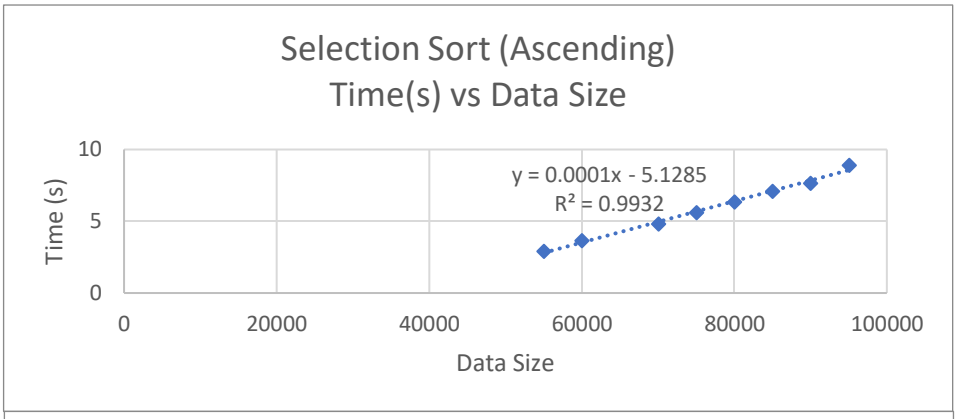
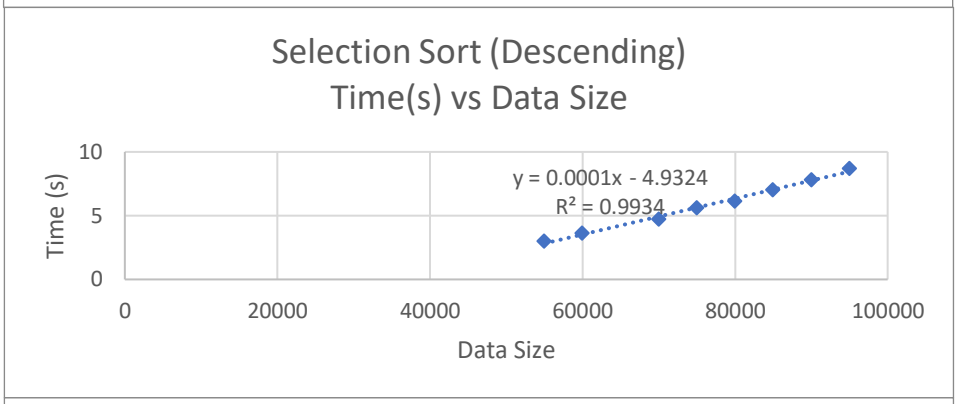
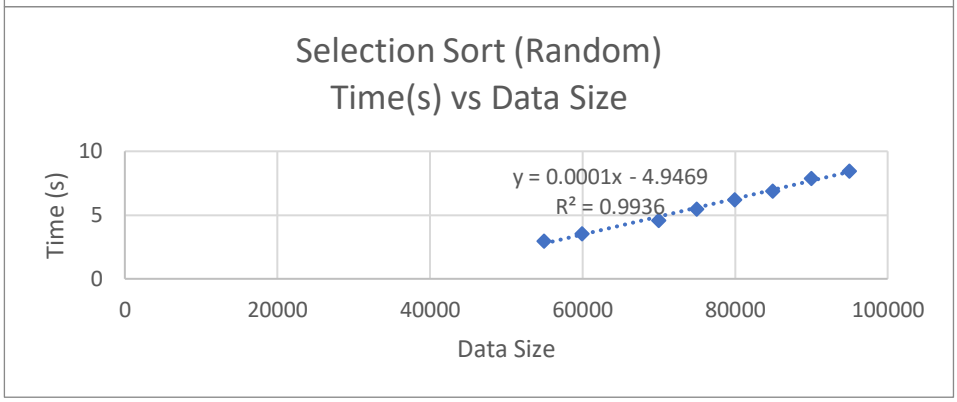
Selection Sort

Ascending	
Size	Time
55000	2.89028
60000	3.63503
70000	4.81375
75000	5.57712
80000	6.34395
85000	7.08844
90000	7.64713
95000	8.88171
Descending	
Size	Time
55000	2.96865
60000	3.63307
70000	4.69902
75000	5.62315
80000	6.14584
85000	6.99502
90000	7.78712
95000	8.68231
Random	
Size	Time
55000	2.97459
60000	3.52
70000	4.61238
75000	5.47753
80000	6.23217
85000	6.91068
90000	7.88286
95000	8.46241







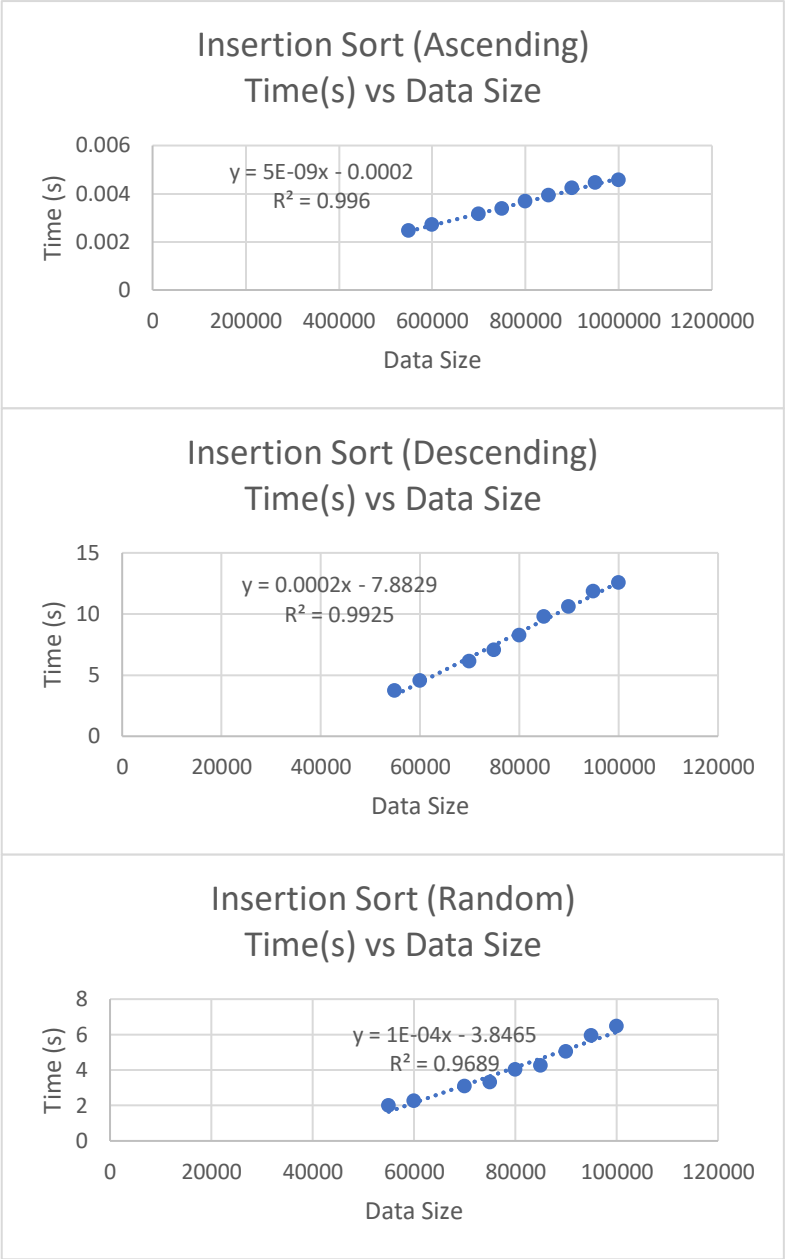
Ascending: $O(n^2)$
Prediction: 994.8 s.
Descending: $O(n^2)$
Prediction: 995.1 s.
Random: $O(n^2)$
Prediction: 995.1 s.

If you add these prediction points to each graph, it will look like an $O(n^2)$ line. As seen in the data, Time rises too much as the input data grows in all of them.

**Note that there is an error since arrays are different and the time complexity for all does vary

Insertion Sort

Ascending	
Size	Time
550000	0.002455
600000	0.002698
700000	0.003131
750000	0.003357
800000	0.003659
850000	0.003925
900000	0.004212
950000	0.004435
Descending	
Size	Time
55000	3.68798
60000	4.53492
70000	6.12165
75000	7.04316
80000	8.24347
85000	9.76839
90000	10.5835
95000	11.828
Random	
Size	Time
55000	1.97923
60000	2.23464
70000	3.08171
75000	3.30119
80000	4.02948
85000	4.24856
90000	5.04435
95000	5.94276



Ascending: O(n) Time grows linearly as data grows.

Prediction: 0.0498 s. If added to the graph it will still behave like an O(n) graph

Descending: $O(n^2)$

Prediction: 1992.1171 s.

Random: $O(n^2)$

Prediction: 996.1535 s.

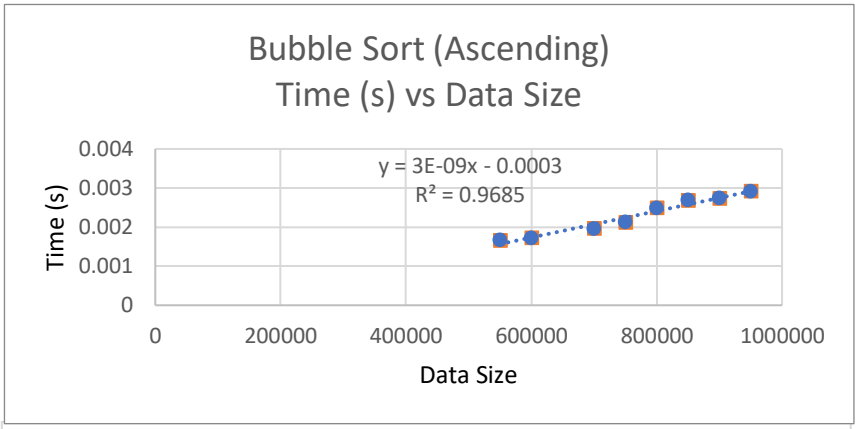
For both random and descending each point grows a lot for each data size, this, making the graph n^2

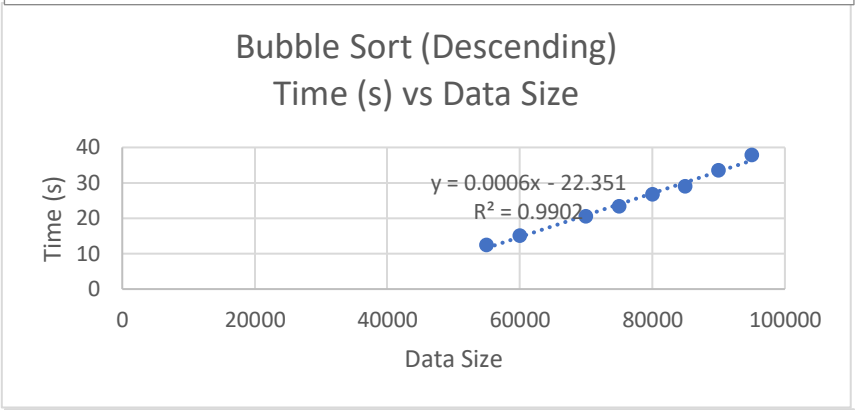
Both predictions if added to the graph still behaves like a n^2 graph.

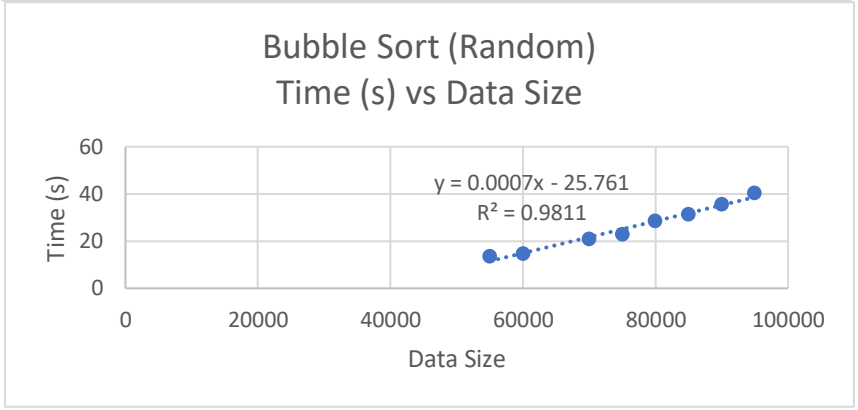
**Note that there is an error since arrays are different and the time complexity for all does vary

Bubble Sort

Ascending	
Size	Time
550000	0.001656
600000	0.001721
700000	0.00196
750000	0.002121
800000	0.002485
850000	0.00268
900000	0.002733
950000	0.00291
Descending	
Size	Time
55000	12.4239
60000	14.9258
70000	20.4532
75000	23.3208
80000	26.6905
85000	28.8372
90000	33.4748
95000	37.7396
Random	
Size	Time
55000	13.4382
60000	14.7141
70000	20.8251
75000	22.9511
80000	28.4963
85000	31.2212
90000	35.5083
95000	40.3142







Ascending: O(n). Time grows linearly as data grows.

Prediction: 0.0297 s. If this is plotted onto the graph, it fits the linear graph, making this prediction close to being right.

Descending: $O(n^2)$.

Prediction: 5977.649 s.

Random: $O(n^2)$.

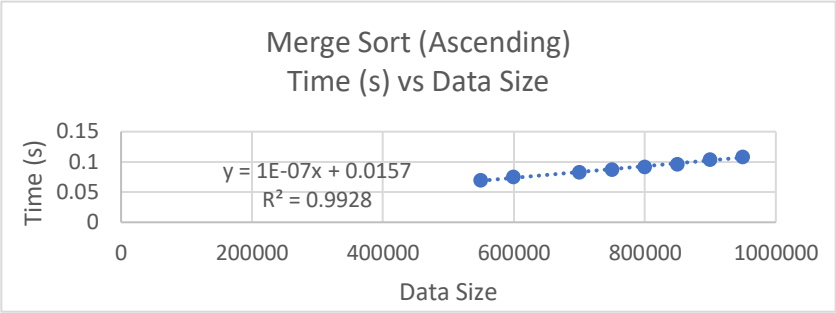
Prediction: 6974.239 s.

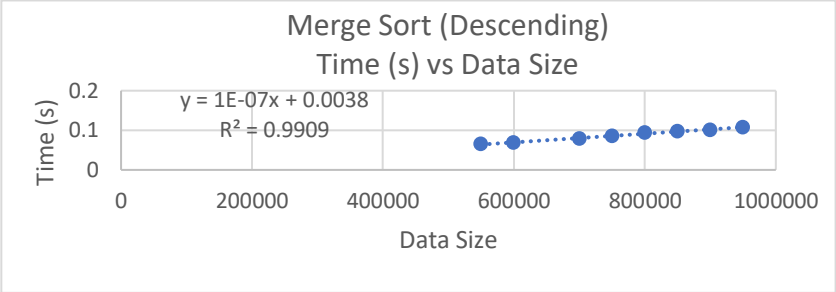
For both random and descending each point grows a lot for each data size, this, making the graph n^2 Both predictions if added to the graph still behaves like a n^2 graph.

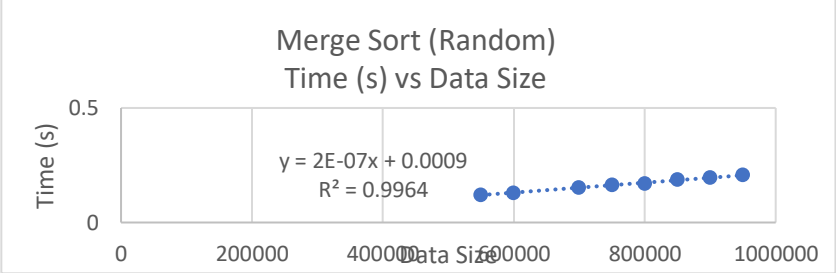
**Note that there is an error since arrays are different and the time complexity for all does vary

Merge Sort

Ascending	
Size	Time
550000	0.068934
600000	0.07471
700000	0.082902
750000	0.087427
800000	0.092063
850000	0.095754
900000	0.103916
950000	0.10845
Descending	
Size	Time
550000	0.064995
600000	0.068479
700000	0.078996
750000	0.085634
800000	0.093978
850000	0.09731
900000	0.100324
950000	0.108203
Random	
Size	Time
550000	0.120834
600000	0.12893
700000	0.153066
750000	0.163133
800000	0.17068
850000	0.18753
900000	0.194689
950000	0.206015







Ascending: O(nlogn). Since every time the list need to get divided and then merged back together it demonstrates an O(N*log(N)) growth.

Prediction: 1.02 s. If this point is added to the ascending graph it will fit similar to a linear graph.

Descending: O(nlogn) Since every time the list need to get divided and then merged back together it demonstrates an O(N*log(N)) growth.

Prediction: 1.003 s. If this point is added to the descending graph it will fit similar to a linear graph.

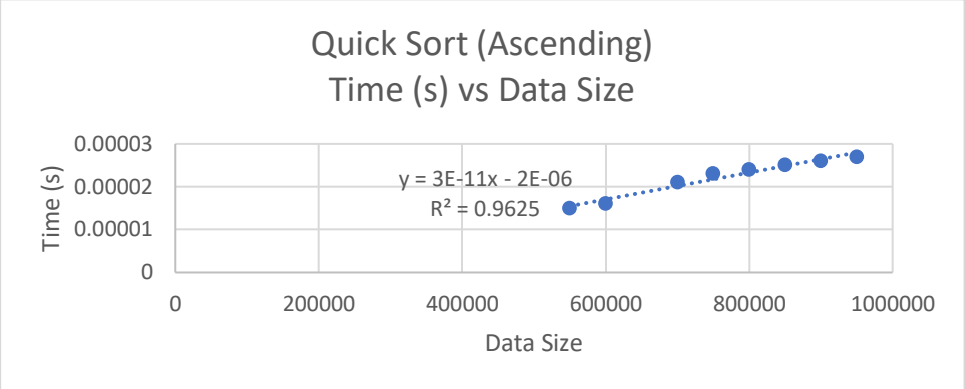
Random: O(nlogn) Since every time the list need to get divided and then merged back together it demonstrates an O(N*log(N)) growth.

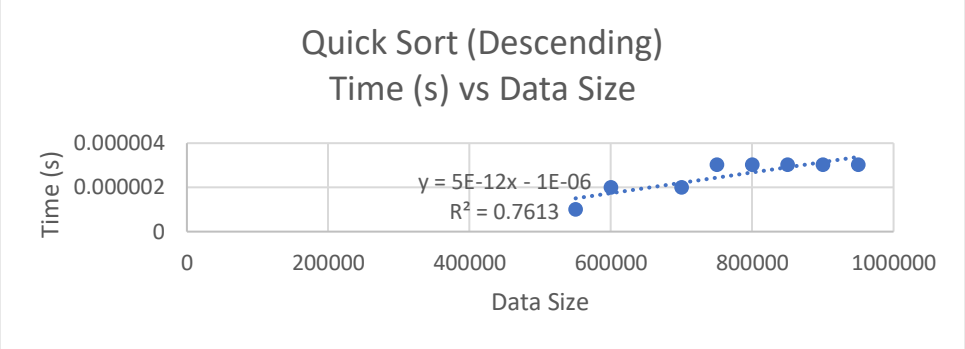
Prediction: 2.001 s. Higher than ascending or descending since the time to calculate greater or lower values is greater than when pre-sorted.

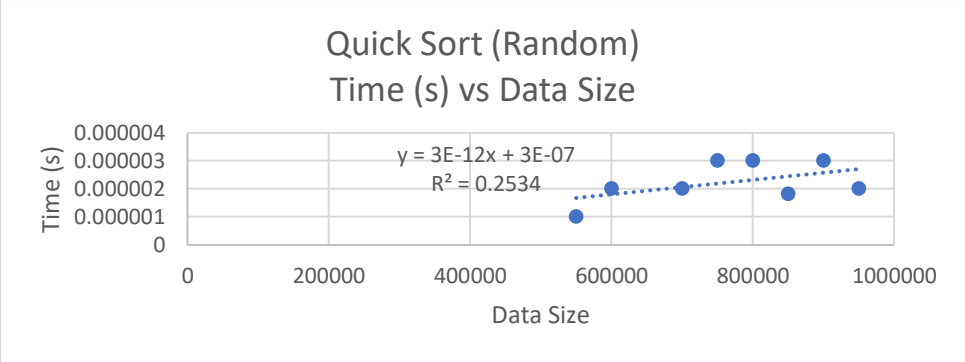
**Note that there is an error since arrays are different and the time complexity for all does vary

Quick Sort

Ascending	
Size	Time
550000	0.000015
600000	0.000016
700000	0.000021
750000	0.000023
800000	0.000024
850000	0.000025
900000	0.000026
950000	0.000027
Descending	
Size	Time
550000	0.000001
600000	0.000002
700000	0.000002
750000	0.000003
800000	0.000003
850000	0.000003
900000	0.000003
950000	0.000003
Random	
Size	Time
550000	0.000001
600000	0.000002
700000	0.000002
750000	0.000003
800000	0.000003
850000	1.80E-06
900000	0.000003
950000	0.000002







Ascending: O(nlogn)

Prediction: 0.000298 s.

Descending: O(n^2)

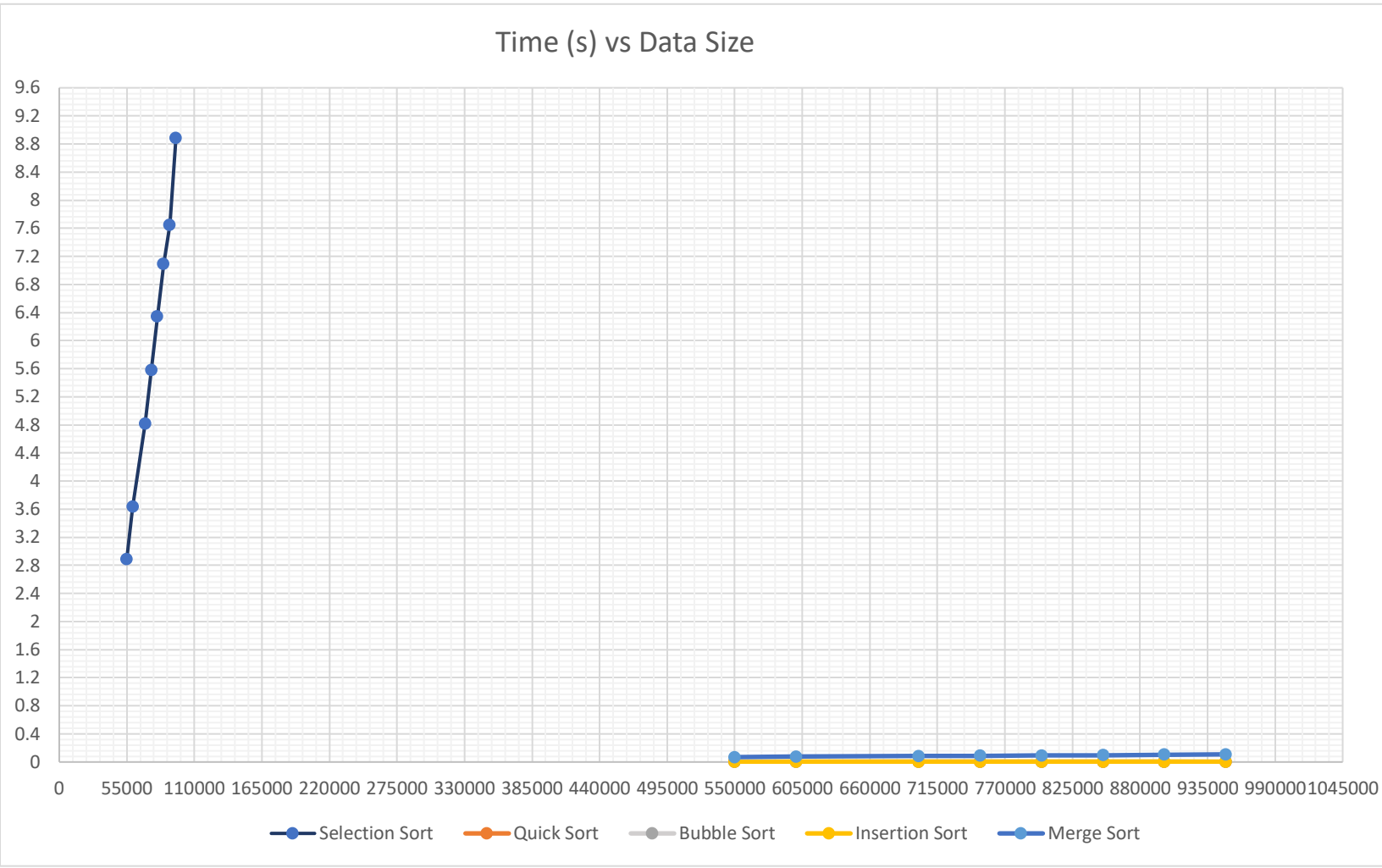
Prediction: 0.00049 s.

Random: O(nlogn)

Prediction: 0.0000303 s.

Ascending and descending behave very similar to a linear line which is why they are both quicker than random. Random behaves like an n^2 line. If the prediction points are added to the graph it will look more like it.

**Note that there is an error since arrays are different and the time complexity for all does vary


Time (s) vs Data Size
9.6
9.2
8.8
8.4
8
7.6
7.2
6.8
6.4
6
5.6
5.2
4.8
4.4
4
3.6
3.2
2.8
2.4
2
1.6
1.2
0.8
0.4
0
0
55000
110000
165000
220000
275000
330000
385000
440000
495000
550000
605000
660000
715000
770000
825000
880000
935000
990000
1045000
Selection Sort
Quick Sort
Bubble Sort
Insertion Sort
Merge Sort