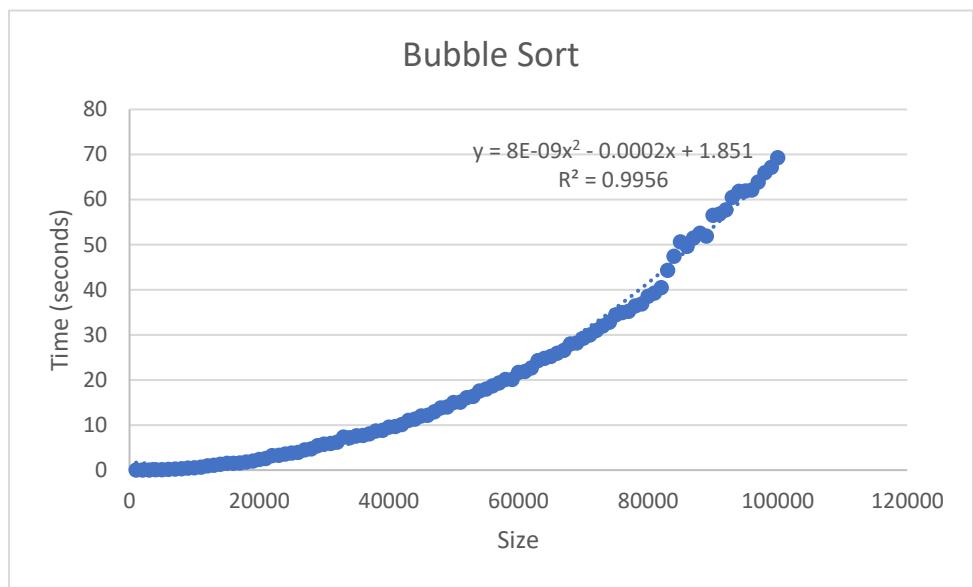


## BUBBLE SORT

Size	Time (seconds)
1000	0.015625
2000	0.046875
3000	0.03125
4000	0.078125
5000	0.140625
6000	0.171875
7000	0.25
8000	0.3125
9000	0.4375
10000	0.546875
11000	0.671875
12000	0.96875
13000	1.10938
14000	1.28125
15000	1.5
16000	1.5
17000	1.5625
18000	1.84375
19000	2.01562
20000	2.375
21000	2.60938
22000	3.21875
23000	3.29688
24000	3.57812
25000	3.82812
26000	3.96875
27000	4.53125
28000	4.75
29000	5.4375
30000	5.78125
31000	5.92188
32000	6.23438
33000	7.3125
34000	7.1875
35000	7.625
36000	7.67188
37000	8.07812
38000	8.70312
39000	8.8125

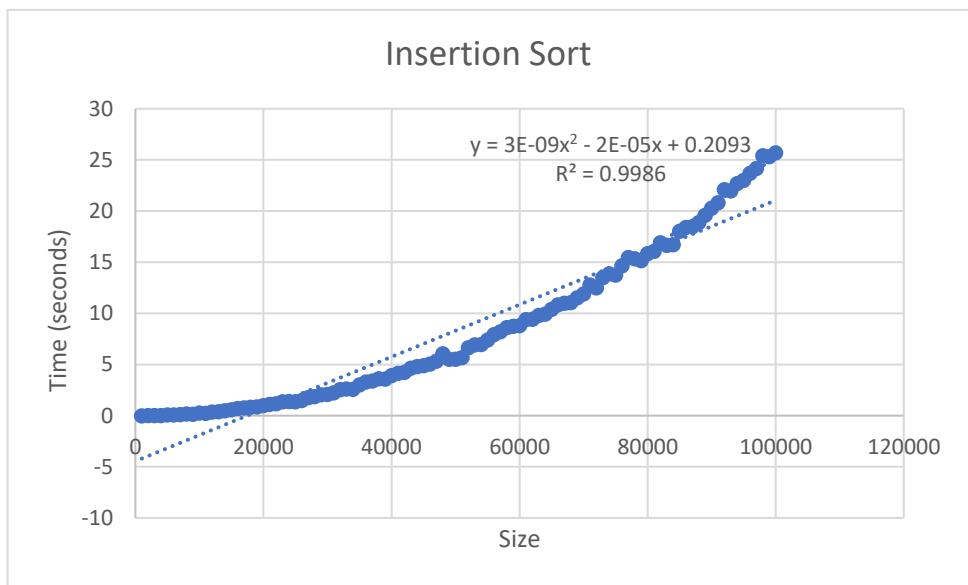


40000	9.57812
41000	9.6875
42000	10.125
43000	11.0469
44000	11.3125
45000	12.0625
46000	12.2031
47000	12.9219
48000	13.7969
49000	13.9844
50000	14.9844
51000	15.0625
52000	16.0469
53000	16.375
54000	17.5781
55000	17.9688
56000	18.7188
57000	19.375
58000	20.1562
59000	20.1562
60000	21.7188
61000	21.875
62000	22.6719
63000	24.2969
64000	24.7812
65000	25.2188
66000	25.9375
67000	26.5469
68000	27.9688
69000	28.1875
70000	29.25
71000	29.9531
72000	30.9688
73000	31.9688
74000	32.8125
75000	34.4531
76000	34.9375
77000	35.25
78000	36.4375
79000	36.875
80000	38.5781
81000	39.3125
82000	40.5

83000	44.3438
84000	47.4219
85000	50.6562
86000	49.6719
87000	51.4688
88000	52.5781
89000	51.9375
90000	56.5469
91000	56.8281
92000	57.7656
93000	60.5
94000	61.875
95000	61.9375
96000	62.1406
97000	63.9375
98000	65.9375
99000	67.1562
100000	69.2812

## INSERTION SORT

1000	0
2000	0.015625
3000	0.03125
4000	0.03125
5000	0.078125
6000	0.09375
7000	0.109375
8000	0.171875
9000	0.15625
10000	0.28125
11000	0.25
12000	0.359375
13000	0.390625
14000	0.484375
15000	0.578125
16000	0.703125
17000	0.765625
18000	0.828125
19000	0.859375
20000	1
21000	1.10938
22000	1.17188
23000	1.35938
24000	1.39062
25000	1.375
26000	1.48438
27000	1.76562
28000	1.875
29000	2.0625
30000	2.09375
31000	2.23438
32000	2.5625
33000	2.60938
34000	2.57812
35000	3.03125
36000	3.3125
37000	3.40625
38000	3.60938
39000	3.57812
40000	3.92188

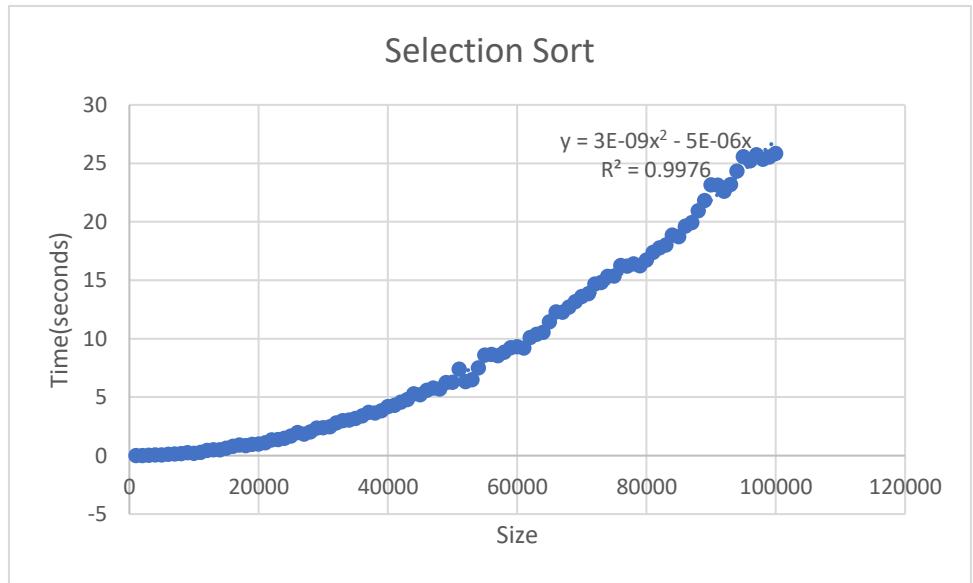


41000	4.14062
42000	4.23438
43000	4.64062
44000	4.79688
45000	4.90625
46000	5.04688
47000	5.32812
48000	6.04688
49000	5.51562
50000	5.51562
51000	5.67188
52000	6.64062
53000	6.92188
54000	6.95312
55000	7.40625
56000	7.9375
57000	8.20312
58000	8.625
59000	8.75
60000	8.79688
61000	9.39062
62000	9.4375
63000	9.79688
64000	9.92188
65000	10.4062
66000	10.8438
67000	10.9844
68000	11.0625
69000	11.5312
70000	11.8906
71000	12.7812
72000	12.4844
73000	13.4844
74000	13.875
75000	13.7344
76000	14.6719
77000	15.4844
78000	15.3594
79000	15.1719
80000	15.8594
81000	16.0781
82000	16.9062
83000	16.6719

84000	16.7344
85000	18.0312
86000	18.4062
87000	18.4844
88000	18.875
89000	19.6094
90000	20.2969
91000	20.8281
92000	22.1094
93000	21.9844
94000	22.6875
95000	23.0156
96000	23.7031
97000	24.1719
98000	25.4062
99000	25.3125
100000	25.6875

## SELECTION SORT

1000	0
2000	0
3000	0.03125
4000	0.046875
5000	0.0625
6000	0.109375
7000	0.140625
8000	0.171875
9000	0.25
10000	0.1875
11000	0.28125
12000	0.4375
13000	0.484375
14000	0.484375
15000	0.640625
16000	0.796875
17000	0.90625
18000	0.84375
19000	0.96875
20000	0.984375
21000	1.10938
22000	1.34375
23000	1.375
24000	1.48438
25000	1.67188
26000	1.98438
27000	1.82812
28000	2.03125
29000	2.34375
30000	2.375
31000	2.45312
32000	2.78125
33000	3
34000	3.03125
35000	3.17188
36000	3.40625
37000	3.70312
38000	3.64062
39000	3.84375
40000	4.1875
41000	4.29688

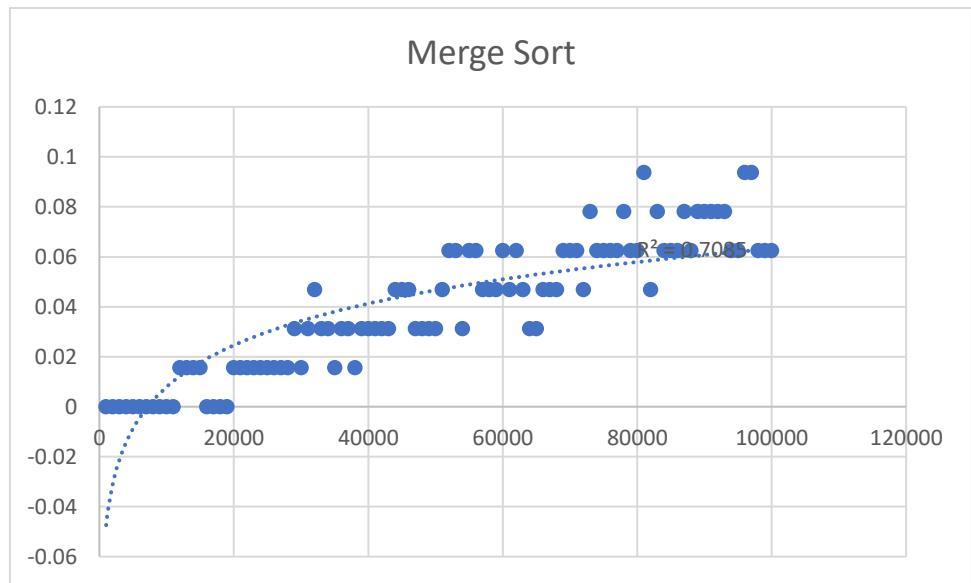


42000	4.57812
43000	4.78125
44000	5.29688
45000	5.20312
46000	5.57812
47000	5.78125
48000	5.6875
49000	6.23438
50000	6.28125
51000	7.40625
52000	6.3125
53000	6.48438
54000	7.5
55000	8.60938
56000	8.65625
57000	8.53125
58000	8.84375
59000	9.23438
60000	9.29688
61000	9.20312
62000	10.0938
63000	10.375
64000	10.5469
65000	11.4531
66000	12.2812
67000	12.2656
68000	12.7031
69000	13.1719
70000	13.6094
71000	13.8594
72000	14.6719
73000	14.7969
74000	15.3281
75000	15.3594
76000	16.25
77000	16.2031
78000	16.4062
79000	16.2344
80000	16.7188
81000	17.375
82000	17.7656
83000	18
84000	18.8594

85000	18.7344
86000	19.625
87000	19.9375
88000	20.9375
89000	21.8281
90000	23.1562
91000	23.125
92000	22.6094
93000	23.1719
94000	24.3438
95000	25.5625
96000	25.2031
97000	25.7188
98000	25.3438
99000	25.5312
100000	25.8281

## MERGE SORT

1000	0
2000	0
3000	0
4000	0
5000	0
6000	0
7000	0
8000	0
9000	0
10000	0
11000	0
12000	0.015625
13000	0.015625
14000	0.015625
15000	0.015625
16000	0
17000	0
18000	0
19000	0
20000	0.015625
21000	0.015625
22000	0.015625
23000	0.015625
24000	0.015625
25000	0.015625
26000	0.015625
27000	0.015625
28000	0.015625
29000	0.03125
30000	0.015625
31000	0.03125
32000	0.046875
33000	0.03125
34000	0.03125
35000	0.015625
36000	0.03125
37000	0.03125
38000	0.015625
39000	0.03125
40000	0.03125

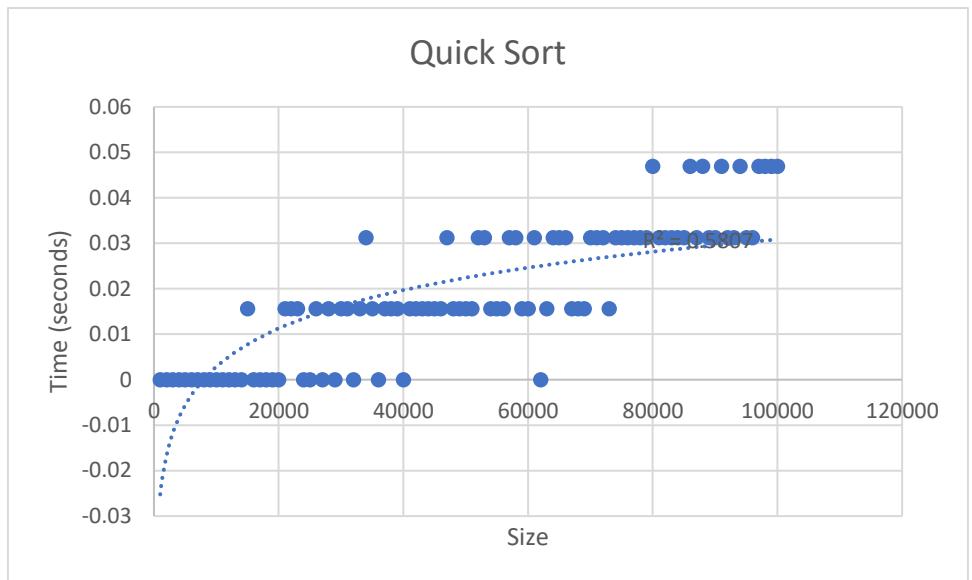


41000	0.03125
42000	0.03125
43000	0.03125
44000	0.046875
45000	0.046875
46000	0.046875
47000	0.03125
48000	0.03125
49000	0.03125
50000	0.03125
51000	0.046875
52000	0.0625
53000	0.0625
54000	0.03125
55000	0.0625
56000	0.0625
57000	0.046875
58000	0.046875
59000	0.046875
60000	0.0625
61000	0.046875
62000	0.0625
63000	0.046875
64000	0.03125
65000	0.03125
66000	0.046875
67000	0.046875
68000	0.046875
69000	0.0625
70000	0.0625
71000	0.0625
72000	0.046875
73000	0.078125
74000	0.0625
75000	0.0625
76000	0.0625
77000	0.0625
78000	0.078125
79000	0.0625
80000	0.0625
81000	0.09375
82000	0.046875
83000	0.078125

84000	0.0625
85000	0.0625
86000	0.0625
87000	0.078125
88000	0.0625
89000	0.078125
90000	0.078125
91000	0.078125
92000	0.078125
93000	0.078125
94000	0.0625
95000	0.0625
96000	0.09375
97000	0.09375
98000	0.0625
99000	0.0625
100000	0.0625

## QUICK SORT

1000	0
2000	0
3000	0
4000	0
5000	0
6000	0
7000	0
8000	0
9000	0
10000	0
11000	0
12000	0
13000	0
14000	0
15000	0.015625
16000	0
17000	0
18000	0
19000	0
20000	0
21000	0.015625
22000	0.015625
23000	0.015625
24000	0
25000	0
26000	0.015625
27000	0
28000	0.015625
29000	0
30000	0.015625
31000	0.015625
32000	0
33000	0.015625
34000	0.03125
35000	0.015625
36000	0
37000	0.015625
38000	0.015625
39000	0.015625
40000	0
41000	0.015625

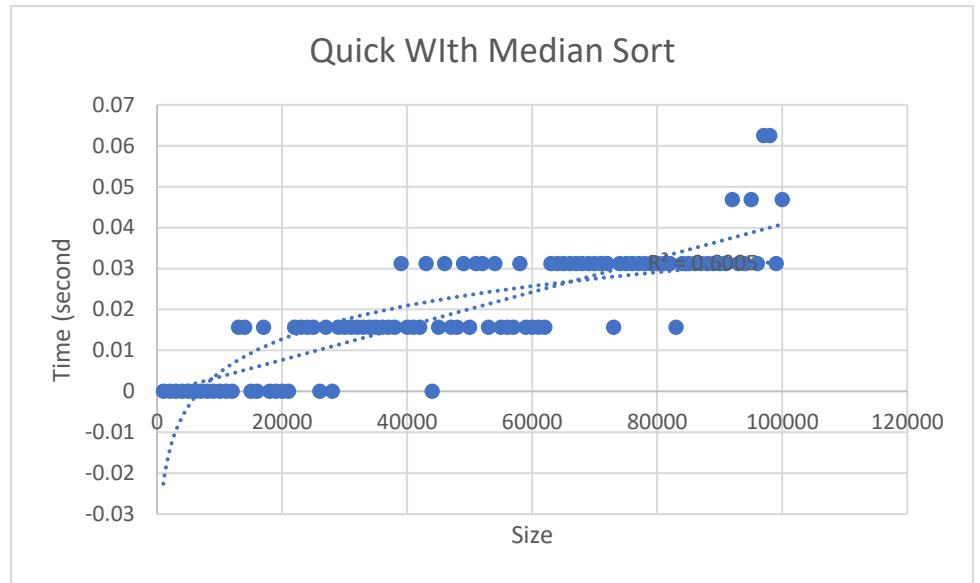


42000	0.015625
43000	0.015625
44000	0.015625
45000	0.015625
46000	0.015625
47000	0.03125
48000	0.015625
49000	0.015625
50000	0.015625
51000	0.015625
52000	0.03125
53000	0.03125
54000	0.015625
55000	0.015625
56000	0.015625
57000	0.03125
58000	0.03125
59000	0.015625
60000	0.015625
61000	0.03125
62000	0
63000	0.015625
64000	0.03125
65000	0.03125
66000	0.03125
67000	0.015625
68000	0.015625
69000	0.015625
70000	0.03125
71000	0.03125
72000	0.03125
73000	0.015625
74000	0.03125
75000	0.03125
76000	0.03125
77000	0.03125
78000	0.03125
79000	0.03125
80000	0.046875
81000	0.03125
82000	0.03125
83000	0.03125
84000	0.03125

85000	0.03125
86000	0.046875
87000	0.03125
88000	0.046875
89000	0.03125
90000	0.03125
91000	0.046875
92000	0.03125
93000	0.03125
94000	0.046875
95000	0.03125
96000	0.03125
97000	0.046875
98000	0.046875
99000	0.046875
100000	0.046875

### QUICK SORT WITH MEDIAN

1000	0
2000	0
3000	0
4000	0
5000	0
6000	0
7000	0
8000	0
9000	0
10000	0
11000	0
12000	0
13000	0.015625
14000	0.015625
15000	0
16000	0
17000	0.015625
18000	0
19000	0
20000	0
21000	0
22000	0.015625
23000	0.015625
24000	0.015625
25000	0.015625
26000	0
27000	0.015625
28000	0
29000	0.015625
30000	0.015625
31000	0.015625
32000	0.015625
33000	0.015625
34000	0.015625
35000	0.015625
36000	0.015625
37000	0.015625
38000	0.015625
39000	0.03125
40000	0.015625
41000	0.015625



42000	0.015625
43000	0.03125
44000	0
45000	0.015625
46000	0.03125
47000	0.015625
48000	0.015625
49000	0.03125
50000	0.015625
51000	0.03125
52000	0.03125
53000	0.015625
54000	0.03125
55000	0.015625
56000	0.015625
57000	0.015625
58000	0.03125
59000	0.015625
60000	0.015625
61000	0.015625
62000	0.015625
63000	0.03125
64000	0.03125
65000	0.03125
66000	0.03125
67000	0.03125
68000	0.03125
69000	0.03125
70000	0.03125
71000	0.03125
72000	0.03125
73000	0.015625
74000	0.03125
75000	0.03125
76000	0.03125
77000	0.03125
78000	0.03125
79000	0.03125
80000	0.03125
81000	0.03125
82000	0.03125
83000	0.015625
84000	0.03125

85000	0.03125
86000	0.03125
87000	0.03125
88000	0.03125
89000	0.03125
90000	0.03125
91000	0.03125
92000	0.046875
93000	0.03125
94000	0.03125
95000	0.046875
96000	0.03125
97000	0.0625
98000	0.0625
99000	0.03125
100000	0.046875

1. Do the sorts we know to be of  $O(n^2)$  complexity demonstrate this behavior? (The iterative sorts)

Yes, the iterative sorts all display a quadratic relationship

2. Do the sorts we know to be of  $O(n \cdot \lg(n))$  complexity demonstrate this behavior? (The recursive sorts)

The recursive functions demonstrate a logarithmic relationship, although there are a lot of outliers.

3. For any plot points that are outliers (far away from the rest of the curve), how do you explain them?

Since the inputs were generated randomly, some arrays will be sorted more quickly although the time complexity might be higher.