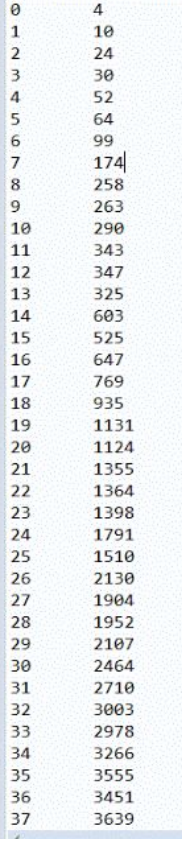
Quadratic Sorts

Mayaank Vadlamani & Kashif Peshimam

Random

Array Size | Steps



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2	24
3	30
4	52
5	64
6	99
7	174
8	258
9	263
10	290
11	343
12	347
13	325
14	603
15	525
16	647
17	769
18	935
19	1131
20	1124
21	1355
22	1364
23	1398
24	1791
25	1510
26	2130
27	1904
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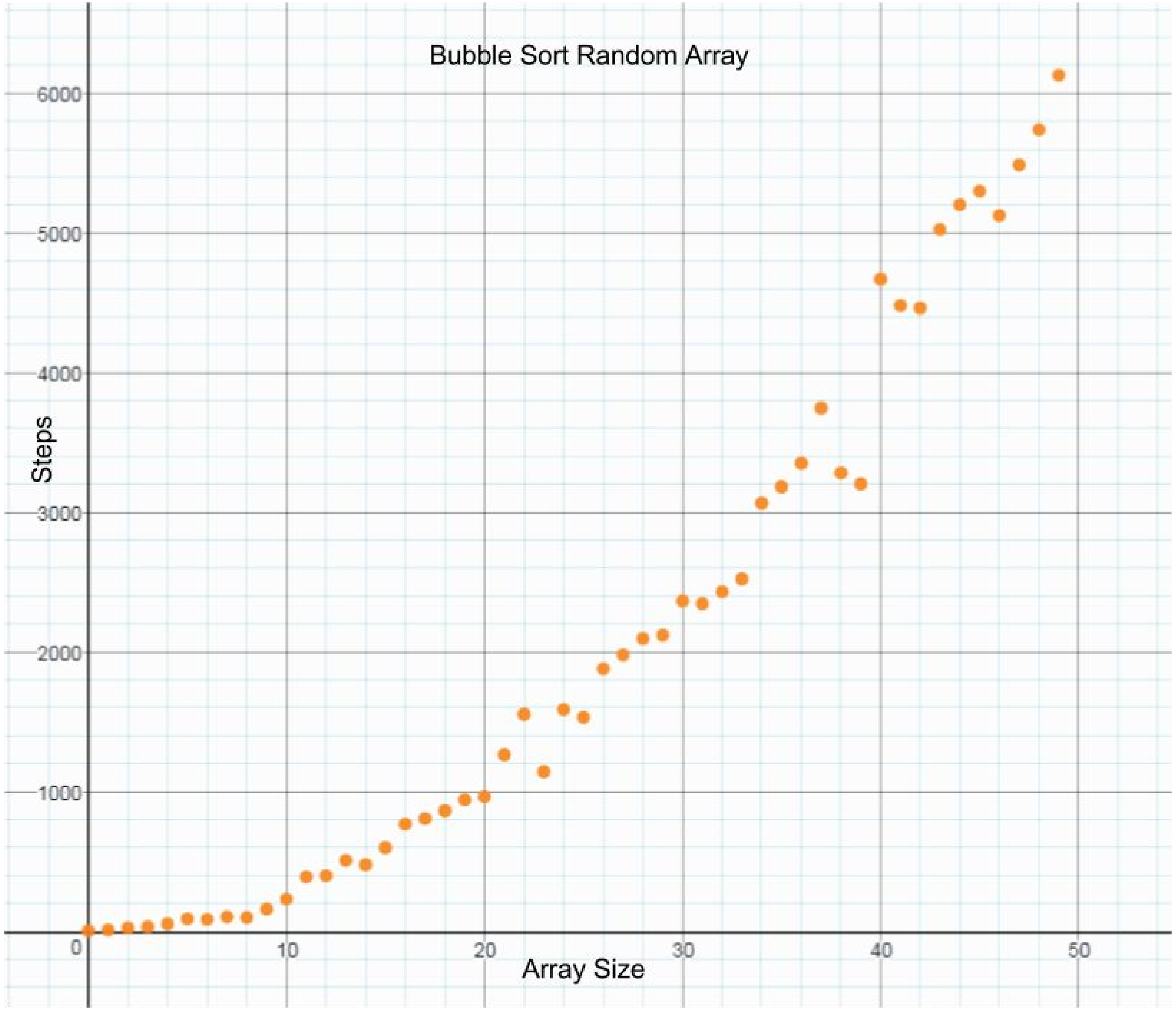
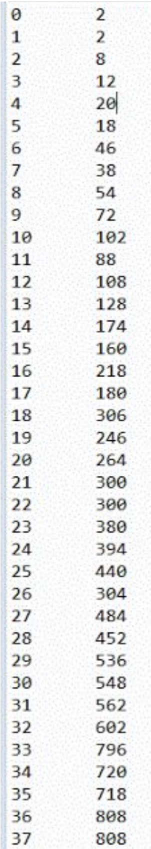
32	3003
33	2978
34	3266
35	3555
36	3451
37	3639



Array Size | Steps



0	2
1	2
2	8
3	12
4	20
5	18
6	46
7	38
8	54
9	72
10	102
11	88
12	108
13	128
14	174
15	160
16	218
17	180
18	306
19	246
20	264
21	300
22	300
23	380
24	394
25	440
26	304
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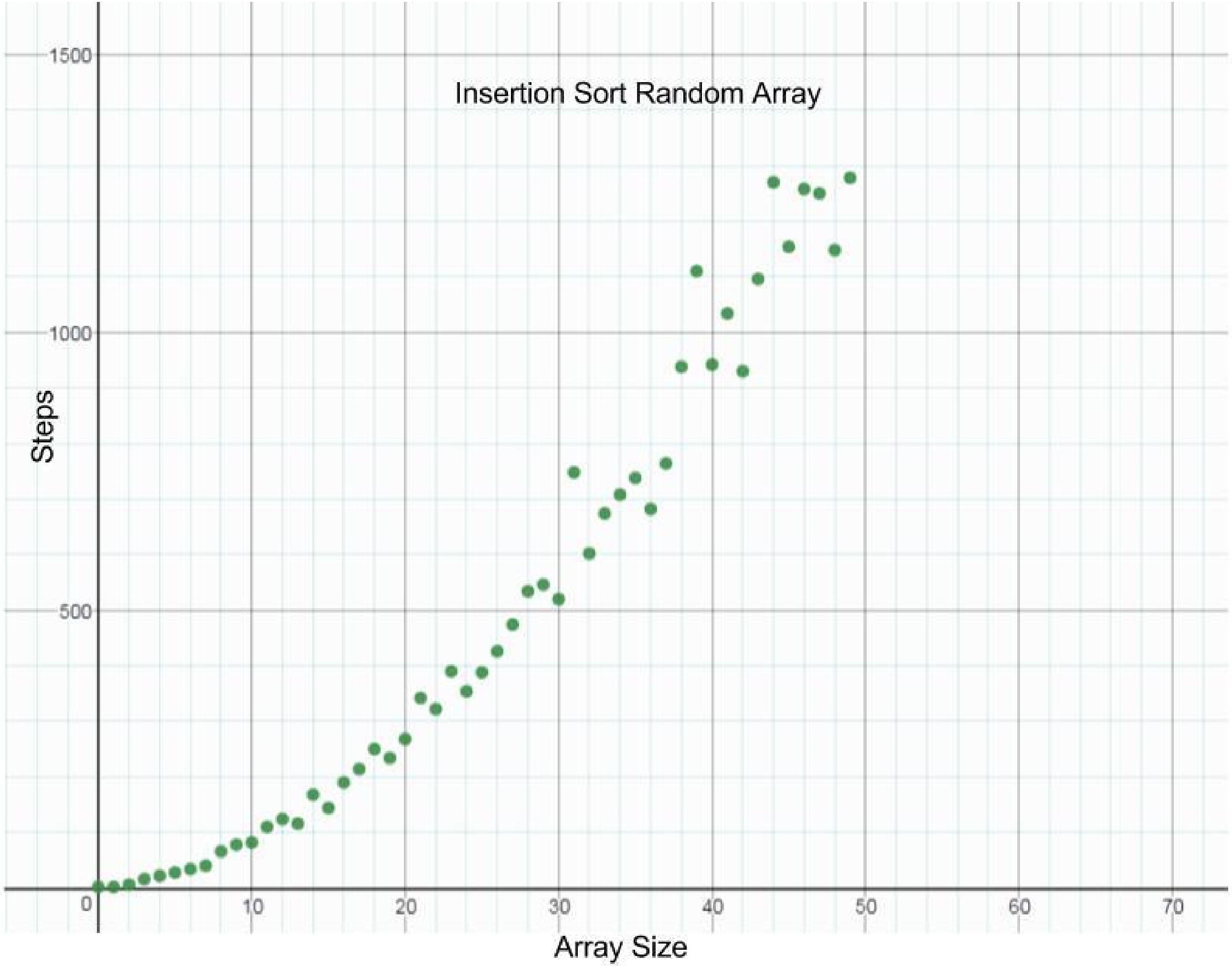
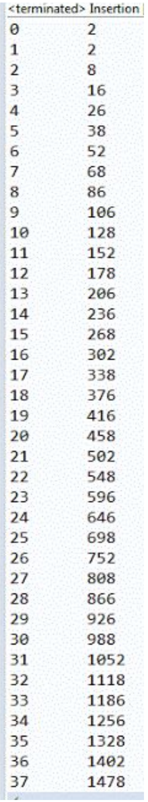


Array Size | Steps



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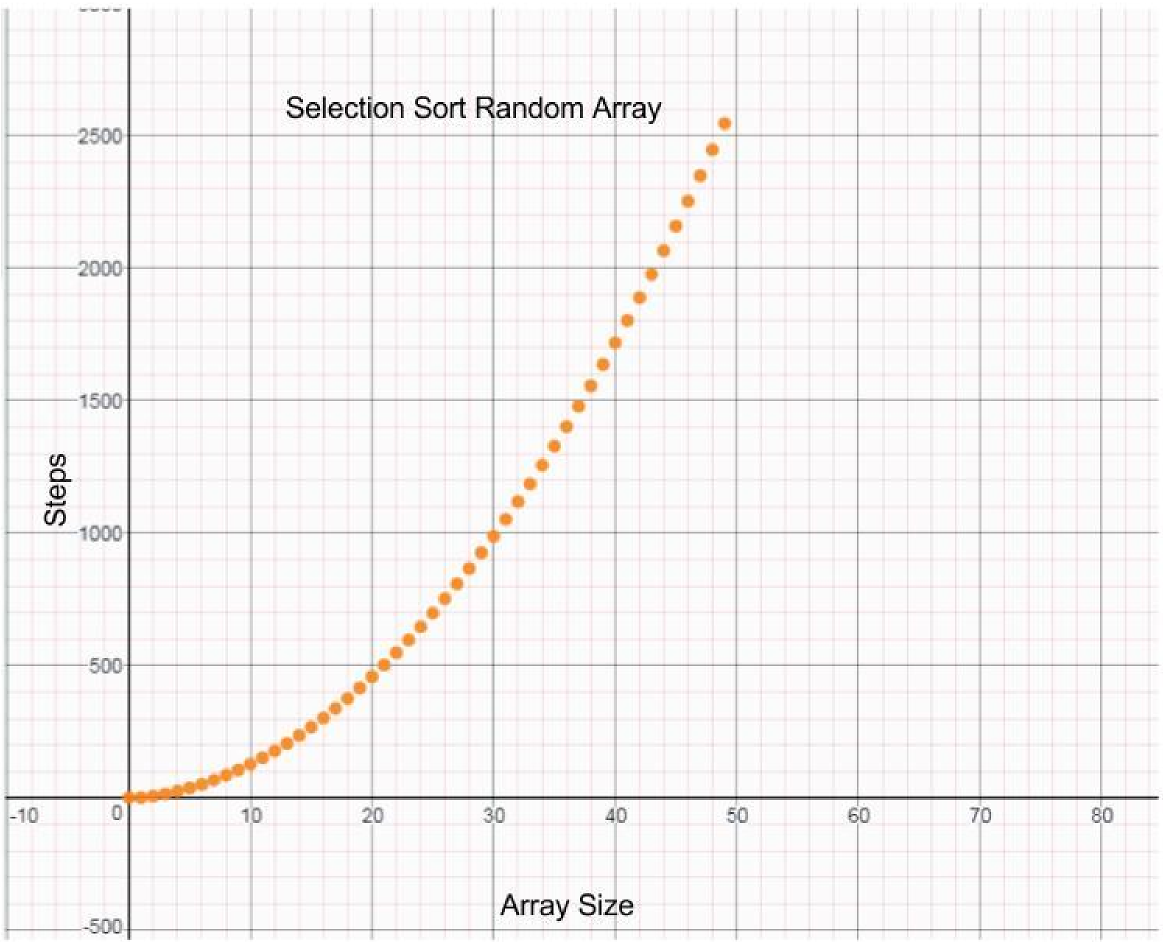
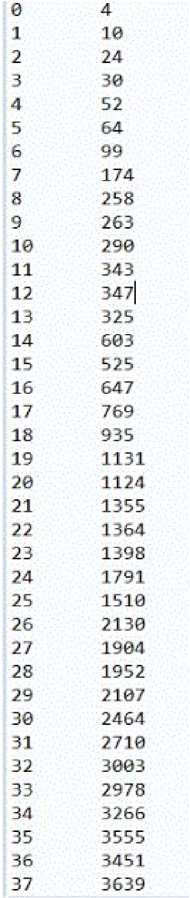
<terminated> Insertion
0          2
1          2
2          8
3          16
4          26
5          38
6          52
7          68
8          86
9          106
10         128
11         152
12         178
13         206
14         236
15         268
16         302
17         338
18         376
19         416
20         458
21         502
22         548
23         596
24         646
25         698
26         752
27         808
28         866
29         926
30         988
31         1052
32         1118
33         1186
34         1256
35         1328
36         1402
37         1478
```



Ascending

Array Size | Steps



0	4
1	10
2	24
3	30
4	52
5	64
6	99
7	174
8	258
9	263
10	290
11	343
12	347
13	325
14	603
15	525
16	647
17	769
18	935
19	1131
20	1124
21	1355
22	1364
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24	1791
25	1510
26	2130
27	1904
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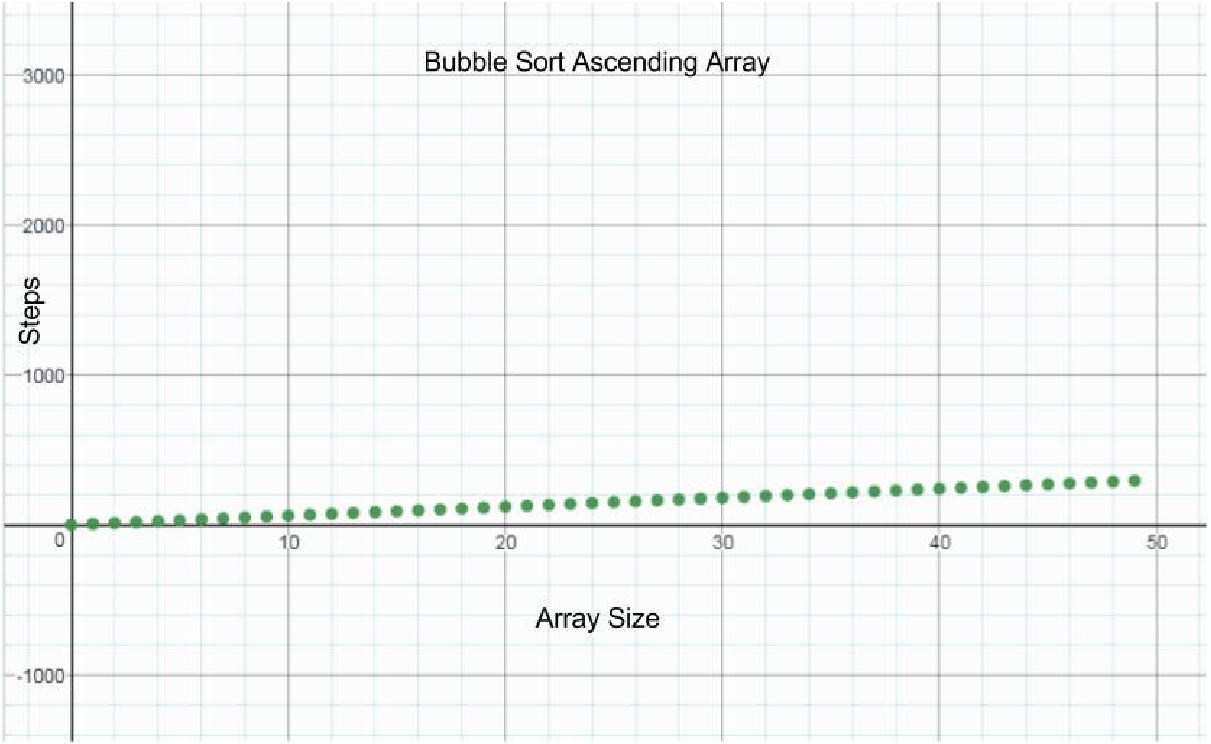
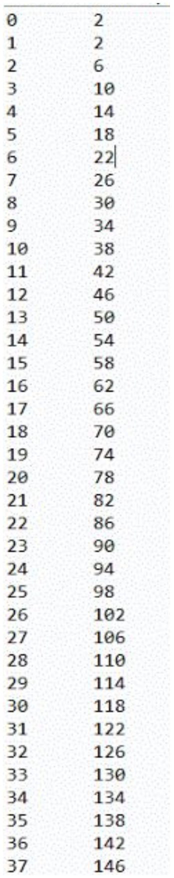


Array Size | Steps



```
0         2
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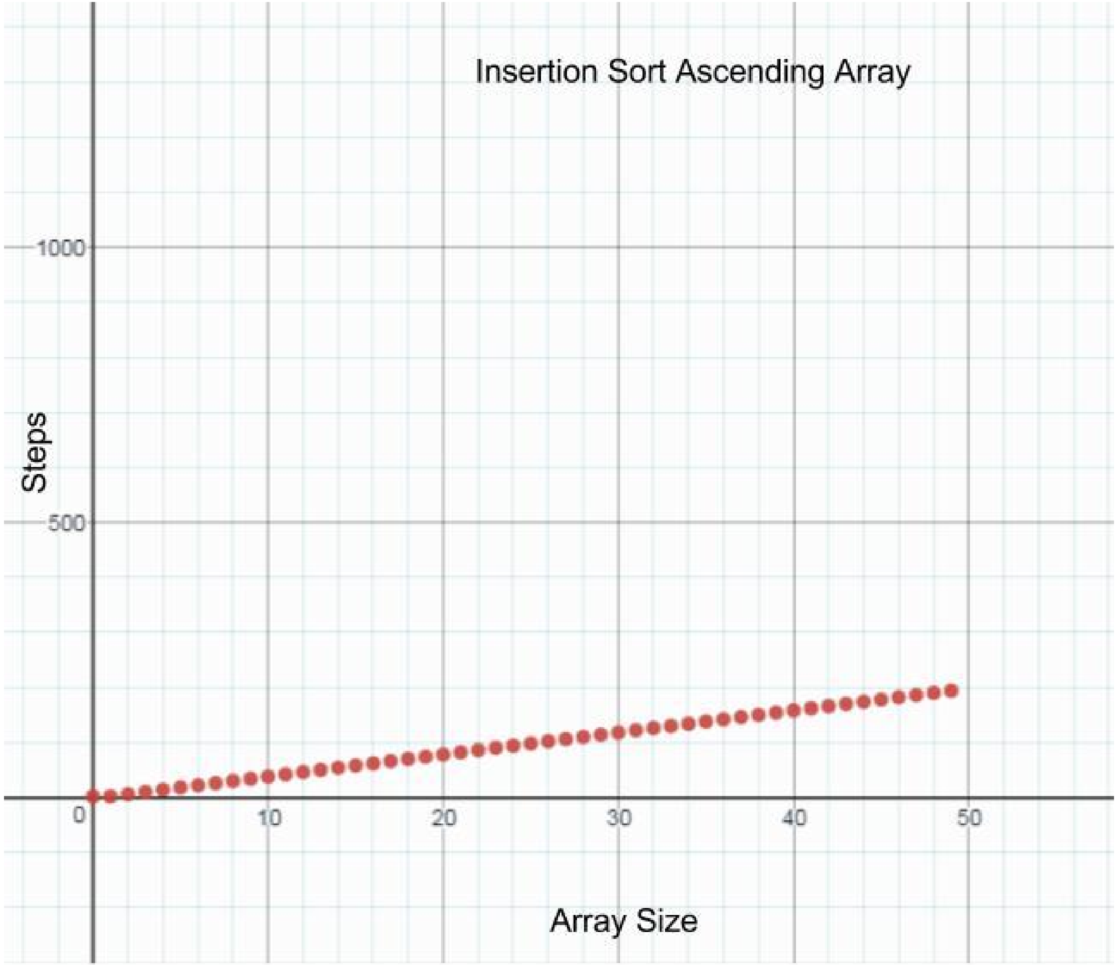
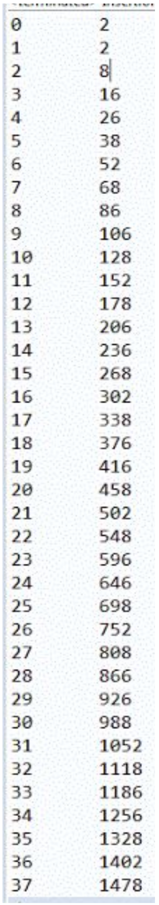
3         10
4         14
5         18
6         22
7         26
8         30
9         34
10        38
11        42
12        46
13        50
14        54
15        58
16        62
17        66
18        70
19        74
20        78
21        82
22        86
23        90
24        94
25        98
26        102
27        106
28        110
29        114
30        118
31        122
32        126
33        130
34        134
35        138
36        142
37        146
```



Array Size | Steps



```
0           2
1           2
2           8
3           16
4           26
5           38
6           52
7           68
8           86
9           106
10          128
11          152
12          178
13          206
14          236
15          268
16          302
17          338
18          376
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20          458
21          502
22          548
23          596
24          646
25          698
26          752
27          808
28          866
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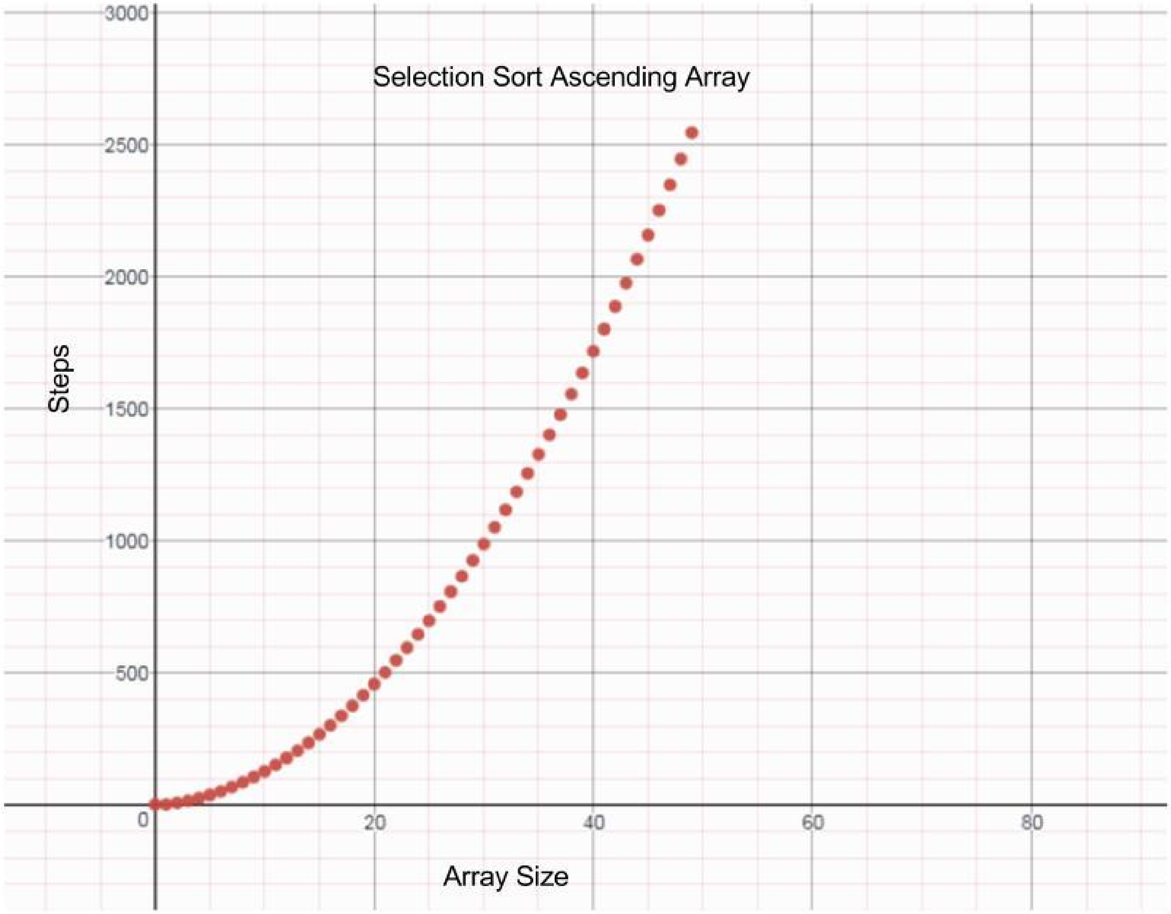
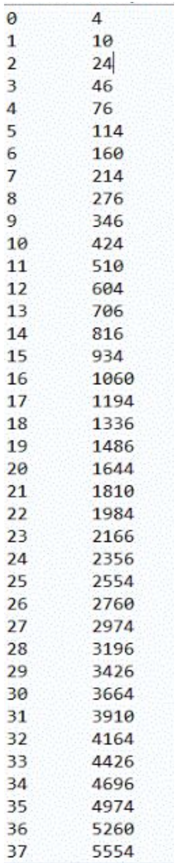
```



Descending

Array Size | Steps



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6	160
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9	346
10	424
11	510
12	604
13	706
14	816
15	934
16	1060
17	1194
18	1336
19	1486
20	1644
21	1810
22	1984
23	2166
24	2356
25	2554
26	2760
27	2974
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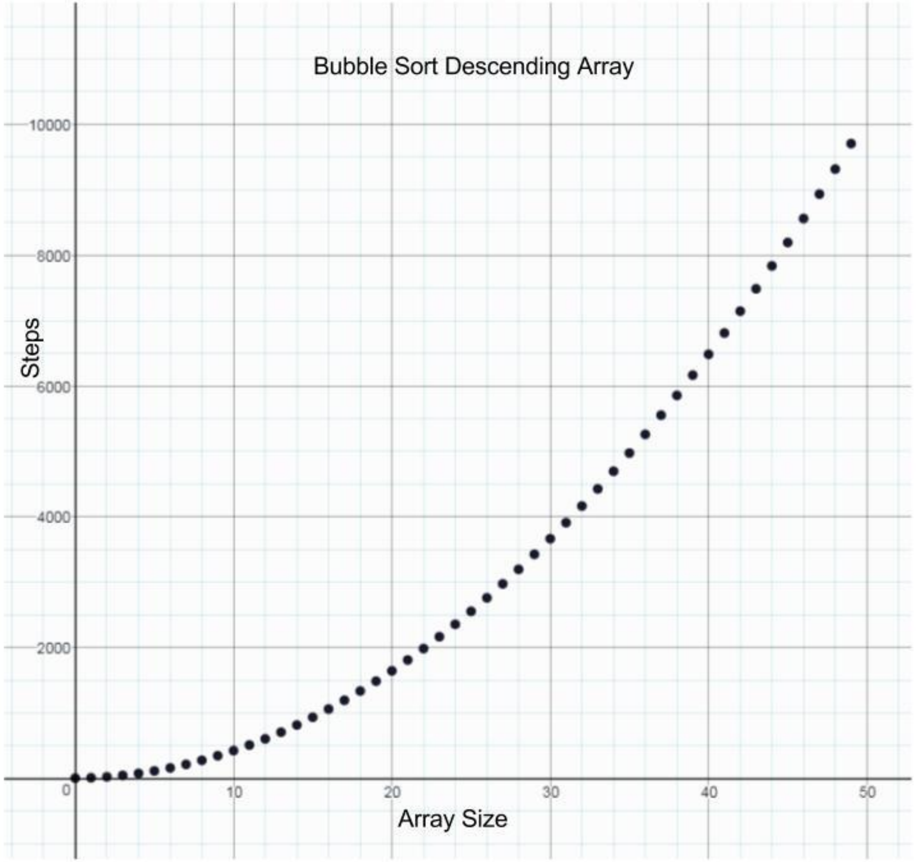
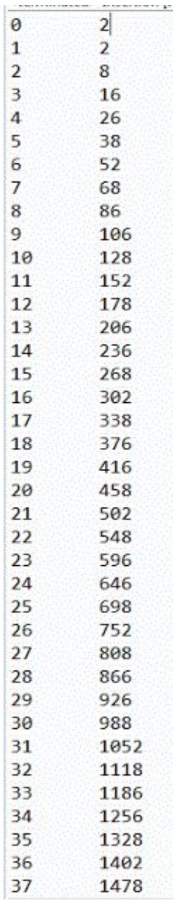


Array Size | Steps



0	2
1	2
2	8
3	16
4	26
5	38
6	52
7	68
8	86
9	106
10	128
11	152
12	178
13	206
14	236
15	268
16	302
17	338
18	376
19	416
20	458
21	502
22	548
23	596
24	646
25	698
26	752
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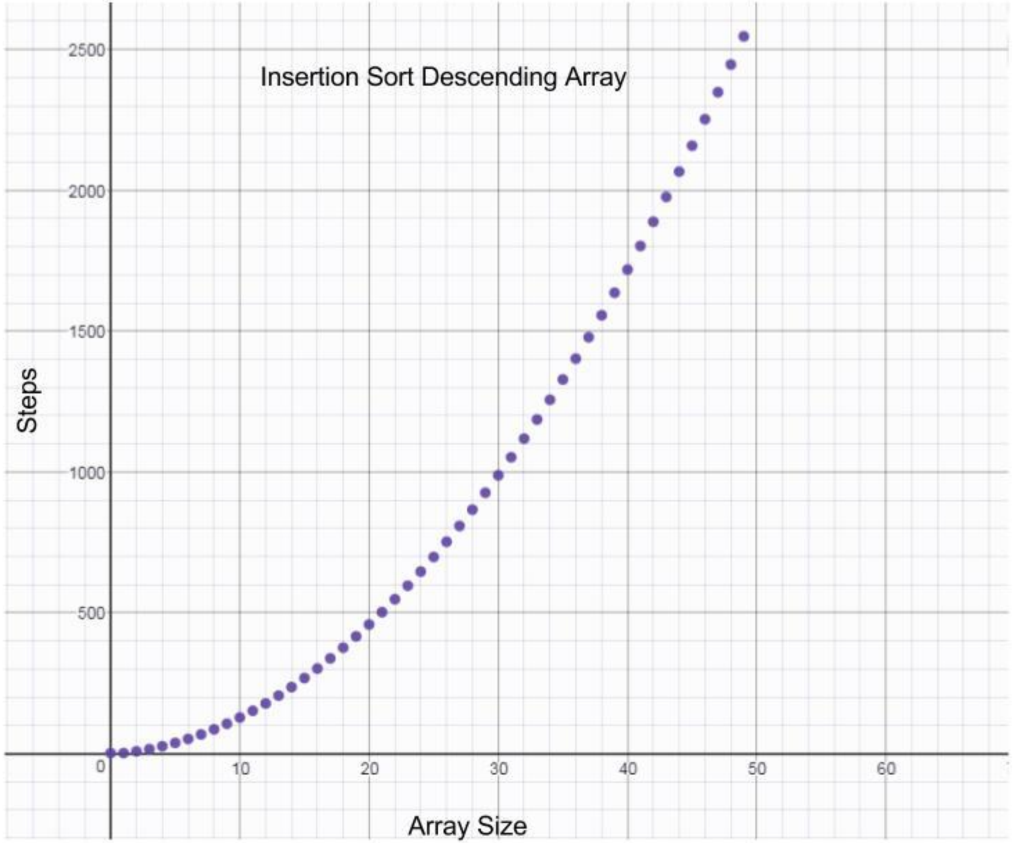
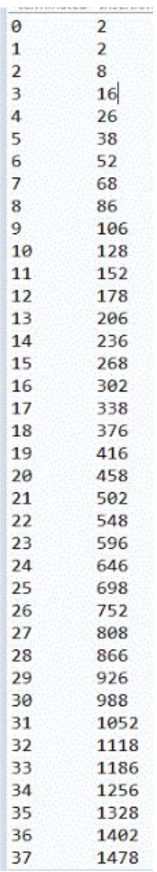
36	1402
37	1478



Array Size | Steps



0	2
1	2
2	8
3	16
4	26
5	38
6	52
7	68
8	86
9	106
10	128
11	152
12	178
13	206
14	236
15	268
16	302
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18	376
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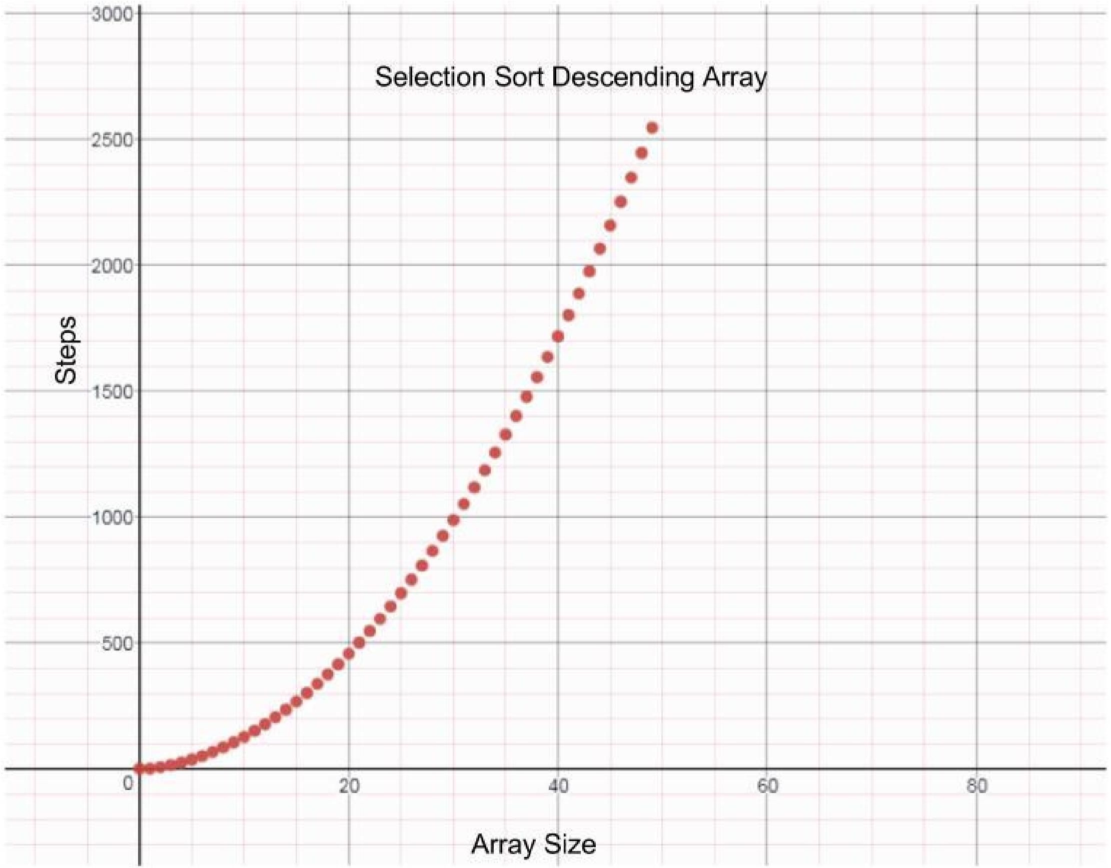
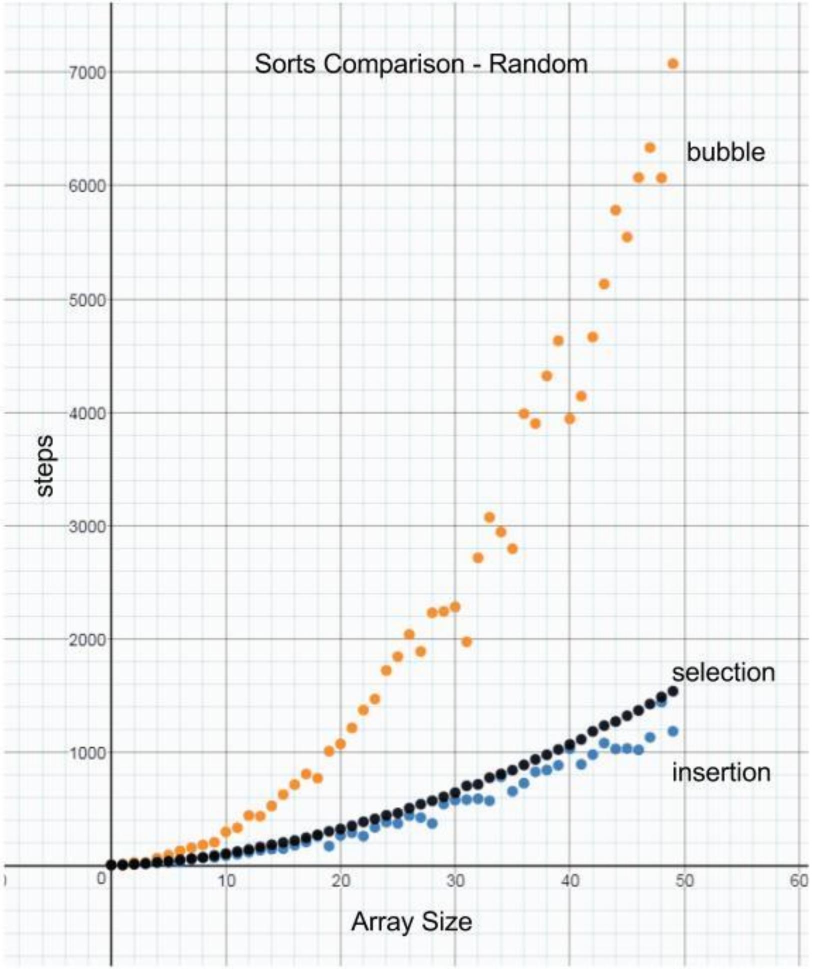
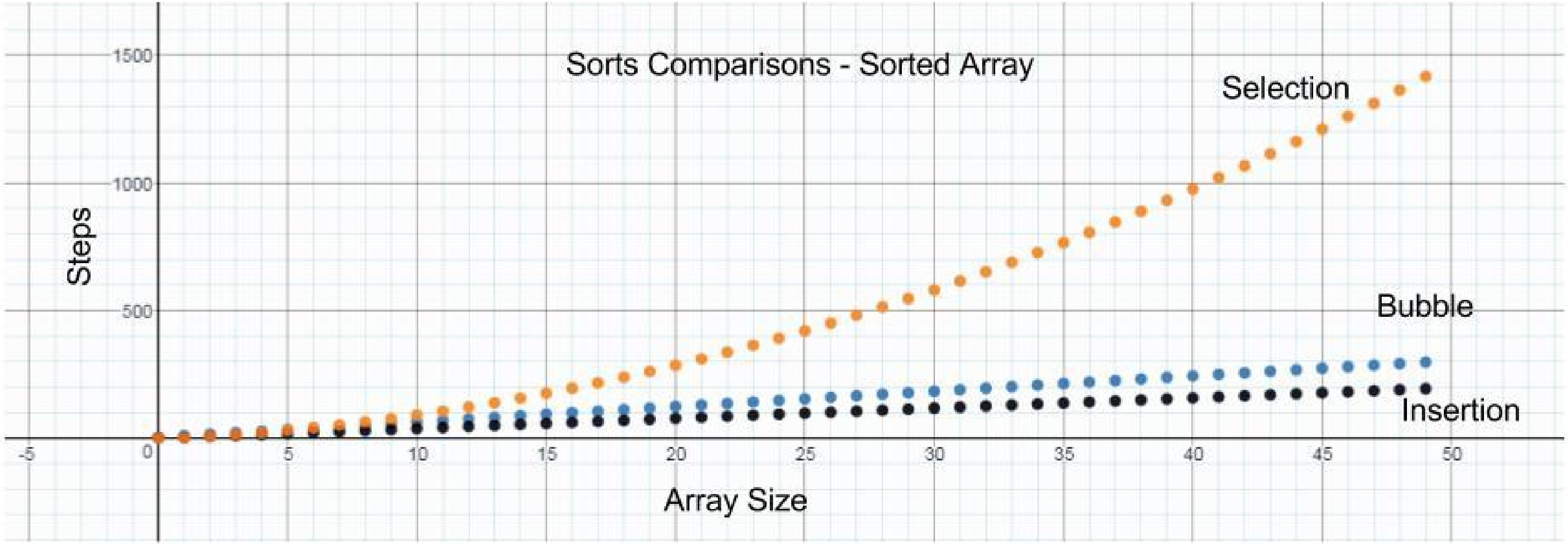
37	1478



All


Sorts Comparison - Random
bubble
selection
insertion
steps
Array Size
7000
6000
5000
4000
3000
2000
1000
0
10
20
30
40
50
60


Sorts Comparisons - Sorted Array
Selection
Bubble
Insertion
Steps
1500
1000
500
-5
0
5
10
15
20
25
30
35
40
45
50
Array Size

Explain why these are called quadratic sorts. O(n2)

- Number of comparisons increases as a quadratic relationship with array size
- Ex: Insertion sort
    - Outer loop runs N times
    - Inner loop runs N/2 times
    - N * N/2 = N^2

Which is the most efficient sort of a random array? Why?

- Insertion Sort
  - Insertion sort provides a O(n^2) worst case algorithm that adapts to O(n) tir data is nearly sorted.
  - requires less memory
    - Fewer comparisons

Which is the least efficient sort of a reverse ordered array? Why?

- Bubble Sort
  - Because of a large amount of possible swaps.
  - It compares every element to a lot of other elements. That slows it down
  - Worst case: O(n^2)
  - Average Case: O(n^2)
  - Best Case: O(n)

Which of these sort situations will produce a linear relationship O(n). Why?

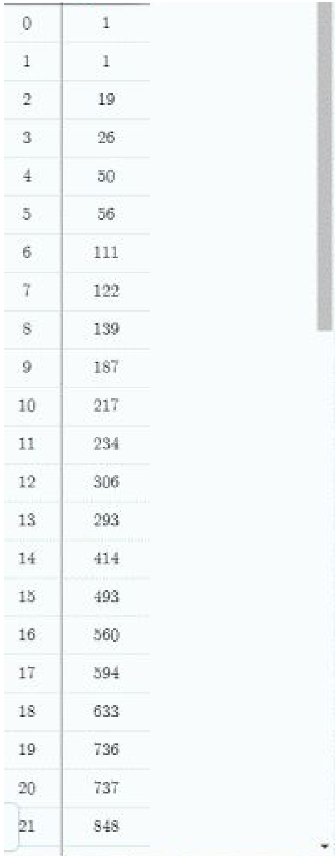
- Bubble and Insertion Sort with ascending ordered array
    - The array is already sorted
    - So the methods only pass through once (O(n))
    - do not swap anything, everything is already in order.

Part II

** Explained in CustomSort.java

Part II: Random

Array Size | Steps



0	1
1	1
2	19
3	26
4	50
5	56
6	111
7	122
8	139
9	187
10	217
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19	736
20	737
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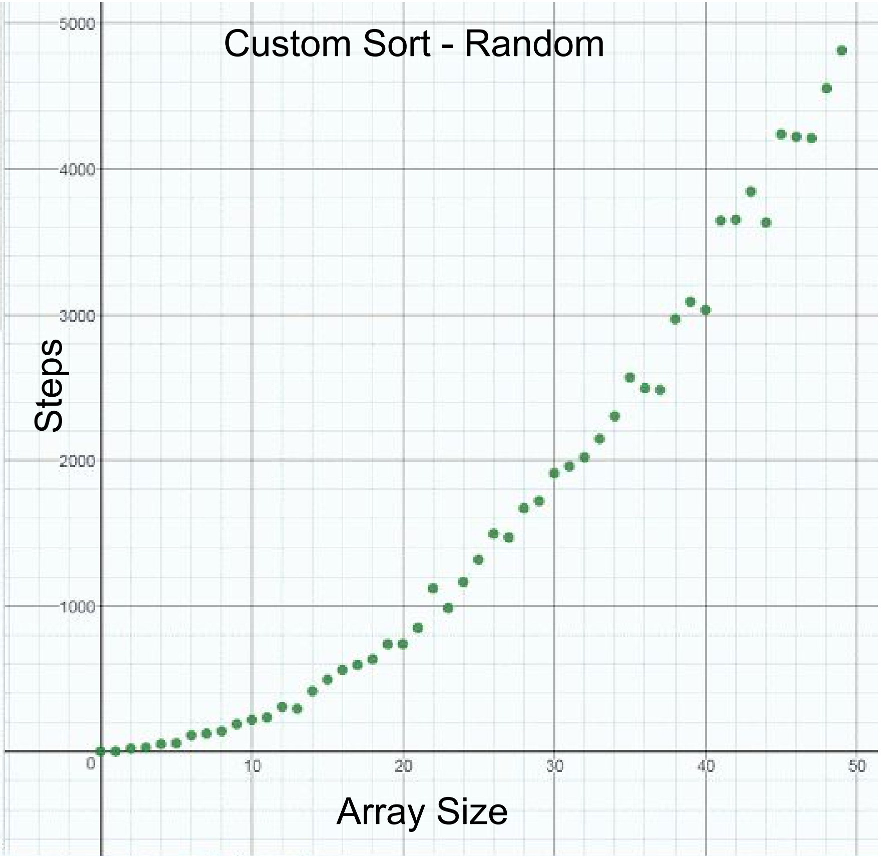
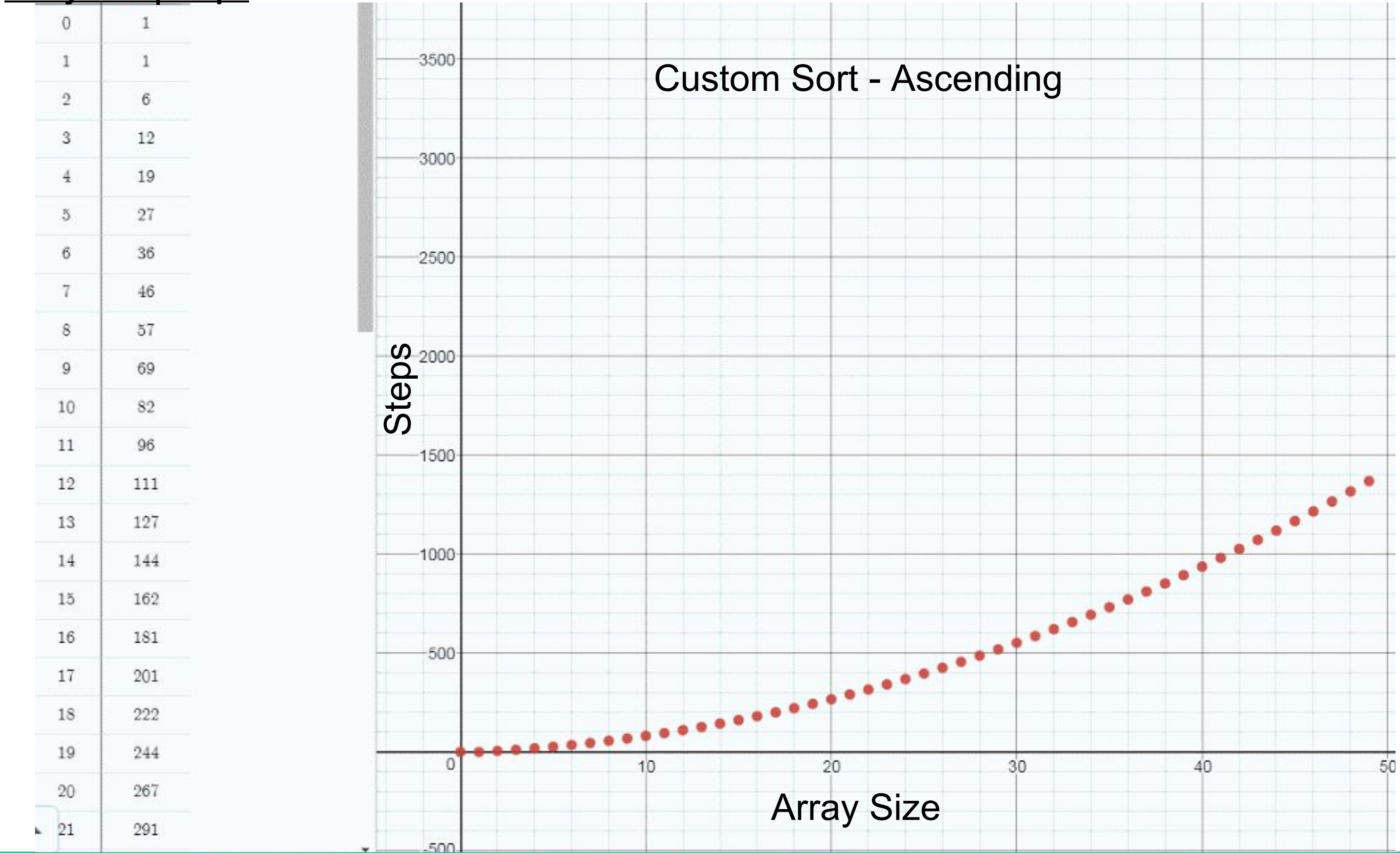


Part II: Ascending

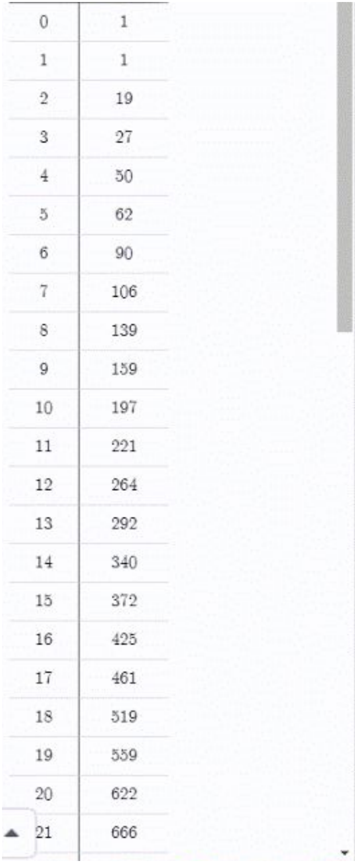
Array Size | Steps



0	1
1	1
2	6
3	12
4	19
5	27
6	36
7	46
8	57
9	69
10	82
11	96
12	111
13	127
14	144
15	162
16	181
17	201
18	222
19	244
20	267
21	291

Part II: Descending

Array Size | Steps



0	1
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3	27
4	50
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7	106
8	139
9	159
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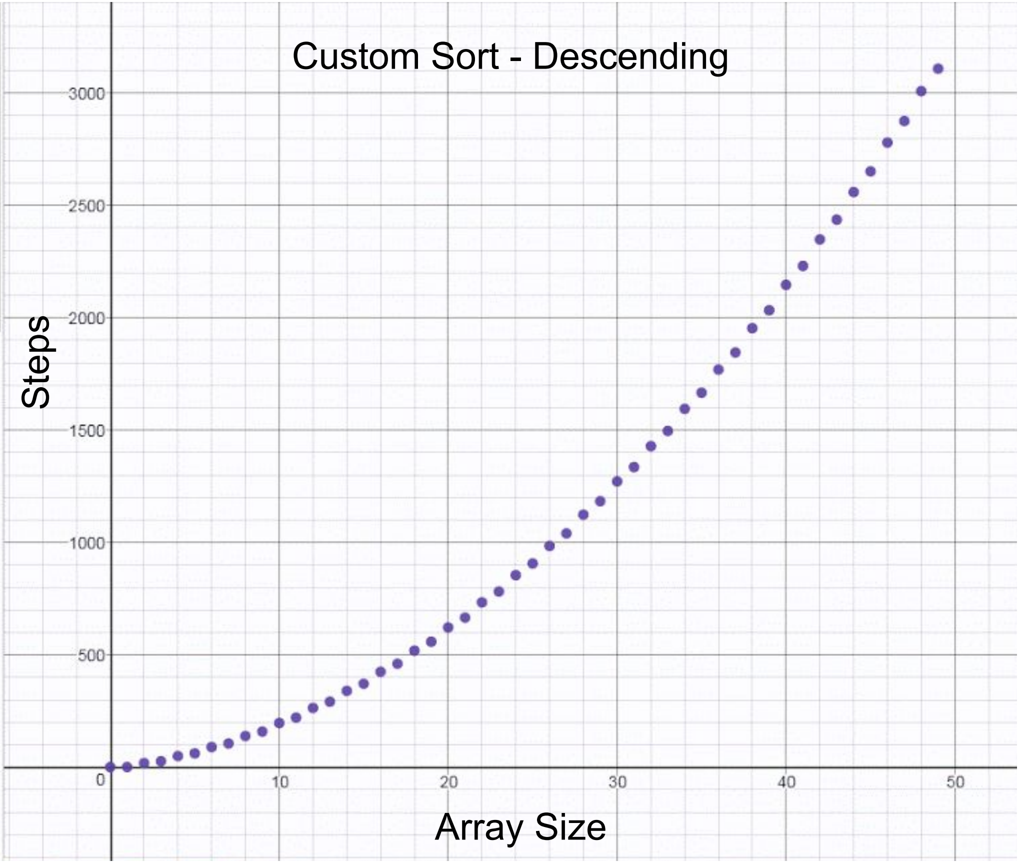
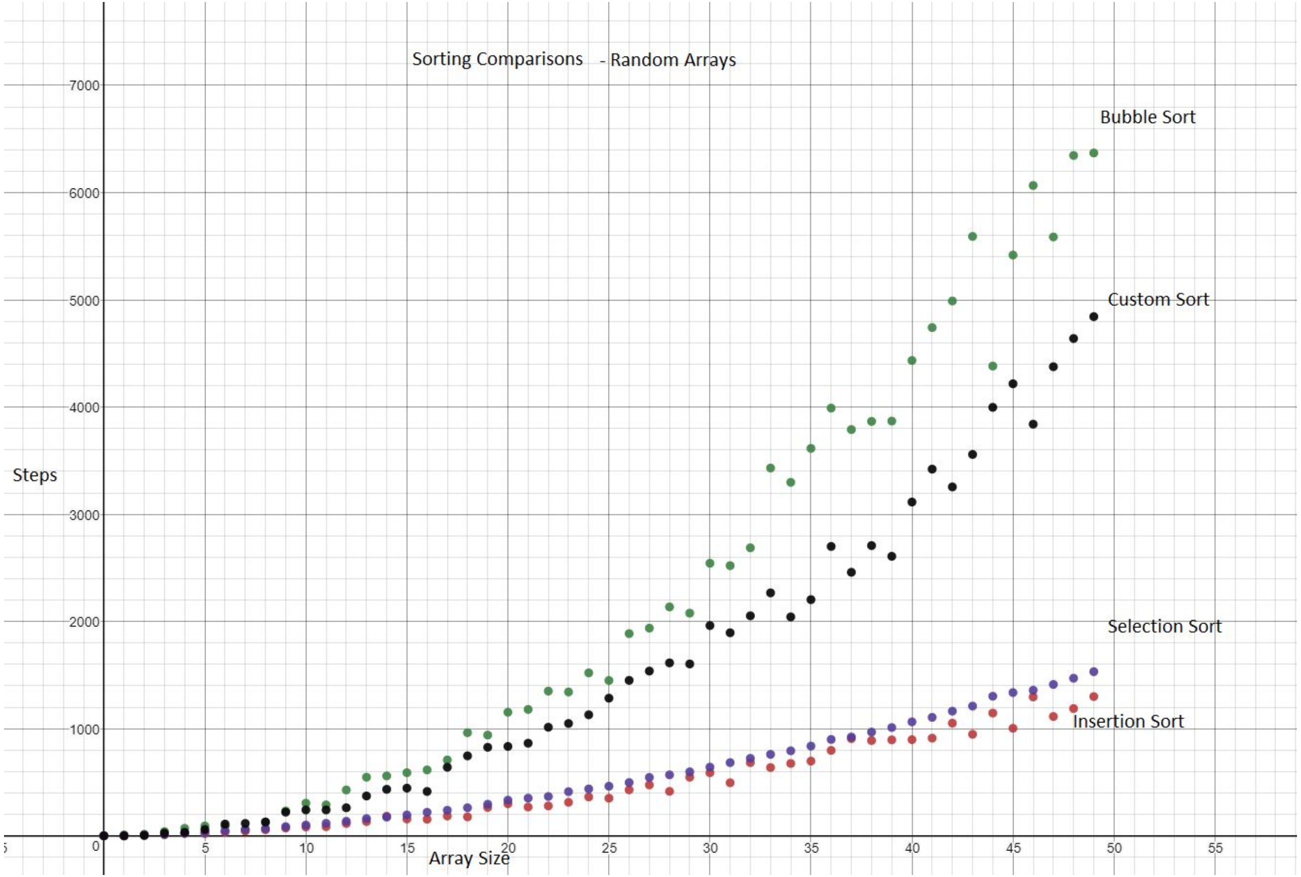
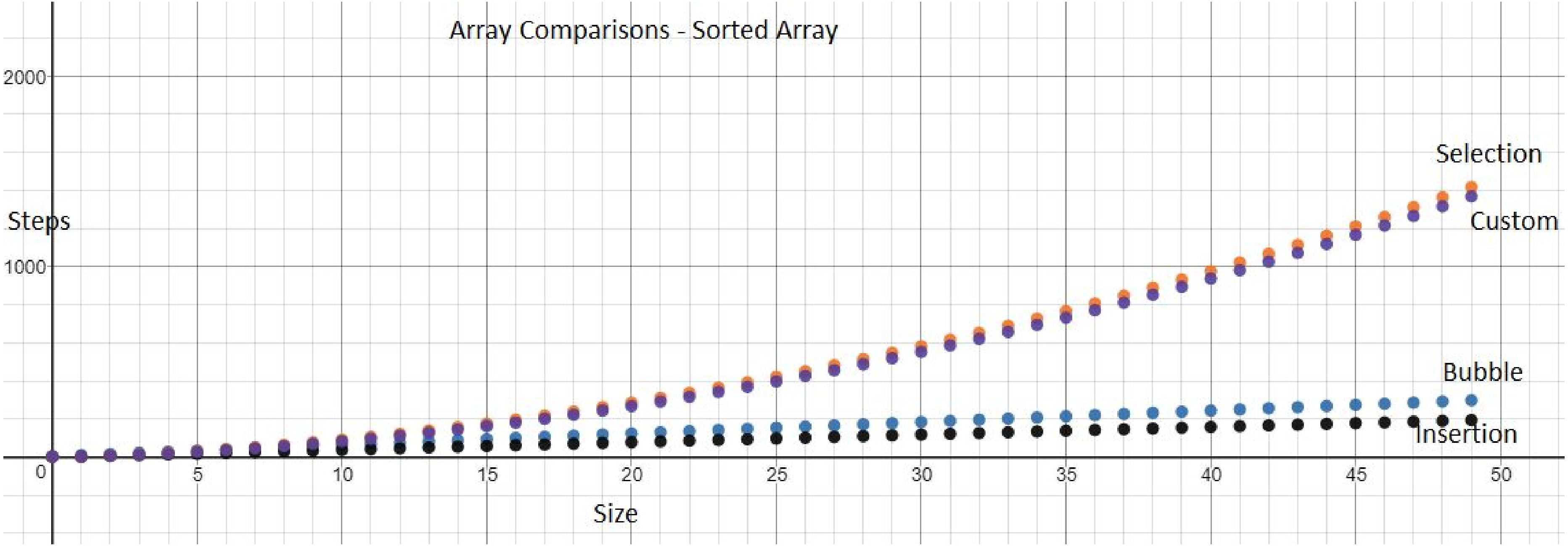


Comparison: Random



Comparison Sorted Array


Array Comparisons - Sorted Array
Steps
Size
Selection
Custom
Bubble
Insertion