

Lab Report

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MW 2:00 – 3:15PM
Run on a Mac Pro with Intel Xeon E5 Processor

Screenshots of arrays with given data:

0. Default

```
[rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 0
Arrays.sort() a      1.0  20190329_115110  xliu102/gyap  1Kints.txt
Arrays.sort() b      0.0  20190329_115110  xliu102/gyap  1Kints.txt
Arrays.sort() c      0.0  20190329_115110  xliu102/gyap  1Kints.txt
Arrays.sort() d      0.0  20190329_115110  xliu102/gyap  1Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 0
Arrays.sort() a      0.0  20190329_115115  xliu102/gyap  2Kints.txt
Arrays.sort() b      0.0  20190329_115115  xliu102/gyap  2Kints.txt
Arrays.sort() c      0.0  20190329_115115  xliu102/gyap  2Kints.txt
Arrays.sort() d      0.0  20190329_115115  xliu102/gyap  2Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 0
Arrays.sort() a      1.0  20190329_115119  xliu102/gyap  4Kints.txt
Arrays.sort() b      0.0  20190329_115119  xliu102/gyap  4Kints.txt
Arrays.sort() c      0.0  20190329_115119  xliu102/gyap  4Kints.txt
Arrays.sort() d      0.0  20190329_115119  xliu102/gyap  4Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 0
Arrays.sort() a      0.0  20190329_115124  xliu102/gyap  8Kints.txt
Arrays.sort() b      0.0  20190329_115124  xliu102/gyap  8Kints.txt
Arrays.sort() c      0.0  20190329_115124  xliu102/gyap  8Kints.txt
Arrays.sort() d      1.0  20190329_115124  xliu102/gyap  8Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 0
Arrays.sort() a      1.0  20190329_115129  xliu102/gyap  16Kints.txt
Arrays.sort() b      1.0  20190329_115129  xliu102/gyap  16Kints.txt
Arrays.sort() c      0.0  20190329_115129  xliu102/gyap  16Kints.txt
Arrays.sort() d      0.0  20190329_115129  xliu102/gyap  16Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 0
Arrays.sort() a      1.0  20190329_115134  xliu102/gyap  32Kints.txt
Arrays.sort() b      0.0  20190329_115134  xliu102/gyap  32Kints.txt
Arrays.sort() c      1.0  20190329_115134  xliu102/gyap  32Kints.txt
Arrays.sort() d      1.0  20190329_115134  xliu102/gyap  32Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 0
Arrays.sort() a      32.0 20190329_115140  xliu102/gyap  1Mints.txt
Arrays.sort() b      17.0 20190329_115140  xliu102/gyap  1Mints.txt
Arrays.sort() c      38.0 20190329_115140  xliu102/gyap  1Mints.txt
Arrays.sort() d      1.0  20190329_115140  xliu102/gyap  1Mints.txt
```

1. Bubble Sort

```
rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 1
Bubble Sort a      5.0  20190329_115234  xliu102/gyap  1Kints.txt
Bubble Sort b      0.0  20190329_115234  xliu102/gyap  1Kints.txt
Bubble Sort c      2.0  20190329_115234  xliu102/gyap  1Kints.txt
Bubble Sort d      2.0  20190329_115234  xliu102/gyap  1Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 1
Bubble Sort a     10.0  20190329_115245  xliu102/gyap  2Kints.txt
Bubble Sort b      1.0  20190329_115245  xliu102/gyap  2Kints.txt
Bubble Sort c      3.0  20190329_115245  xliu102/gyap  2Kints.txt
Bubble Sort d      1.0  20190329_115245  xliu102/gyap  2Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 1
Bubble Sort a    19.0  20190329_115250  xliu102/gyap  4Kints.txt
Bubble Sort b      3.0  20190329_115250  xliu102/gyap  4Kints.txt
Bubble Sort c    10.0  20190329_115250  xliu102/gyap  4Kints.txt
Bubble Sort d      4.0  20190329_115250  xliu102/gyap  4Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 1
Bubble Sort a   44.0  20190329_115254  xliu102/gyap  8Kints.txt
Bubble Sort b   13.0  20190329_115254  xliu102/gyap  8Kints.txt
Bubble Sort c   42.0  20190329_115254  xliu102/gyap  8Kints.txt
Bubble Sort d   13.0  20190329_115254  xliu102/gyap  8Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 1
Bubble Sort a  142.0  20190329_115259  xliu102/gyap  16Kints.txt
Bubble Sort b  52.0  20190329_115259  xliu102/gyap  16Kints.txt
Bubble Sort c 168.0  20190329_115259  xliu102/gyap  16Kints.txt
Bubble Sort d  50.0  20190329_115259  xliu102/gyap  16Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 1
Bubble Sort a 571.0  20190329_115303  xliu102/gyap  32Kints.txt
Bubble Sort b 207.0  20190329_115303  xliu102/gyap  32Kints.txt
Bubble Sort c 668.0  20190329_115303  xliu102/gyap  32Kints.txt
Bubble Sort d 202.0  20190329_115303  xliu102/gyap  32Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 1
Bubble Sort a 667133.0  20190329_115311  xliu102/gyap  1Mints.txt
Bubble Sort b 207380.0  20190329_115311  xliu102/gyap  1Mints.txt
Bubble Sort c 675766.0  20190329_115311  xliu102/gyap  1Mints.txt
Bubble Sort d 194839.0  20190329_115311  xliu102/gyap  1Mints.txt
```

2. Selection Sort

```
rett-pro-27:~ gyap$ cd Desktop/Lab7/
rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 2
Selection Sort a      6.0  20190329_115416  xliu102/gyap  1Kints.txt
Selection Sort b      1.0  20190329_115416  xliu102/gyap  1Kints.txt
Selection Sort c      7.0  20190329_115416  xliu102/gyap  1Kints.txt
Selection Sort d      1.0  20190329_115416  xliu102/gyap  1Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 2
Selection Sort a      8.0  20190329_115423  xliu102/gyap  2Kints.txt
Selection Sort b      6.0  20190329_115423  xliu102/gyap  2Kints.txt
Selection Sort c      3.0  20190329_115423  xliu102/gyap  2Kints.txt
Selection Sort d      1.0  20190329_115423  xliu102/gyap  2Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 2
Selection Sort a      17.0 20190329_115429  xliu102/gyap  4Kints.txt
Selection Sort b      10.0 20190329_115429  xliu102/gyap  4Kints.txt
Selection Sort c      8.0  20190329_115429  xliu102/gyap  4Kints.txt
Selection Sort d      6.0  20190329_115429  xliu102/gyap  4Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 2
Selection Sort a      28.0 20190329_115434  xliu102/gyap  8Kints.txt
Selection Sort b      22.0 20190329_115434  xliu102/gyap  8Kints.txt
Selection Sort c      31.0 20190329_115434  xliu102/gyap  8Kints.txt
Selection Sort d      22.0 20190329_115434  xliu102/gyap  8Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 2
Selection Sort a      93.0 20190329_115437  xliu102/gyap  16Kints.txt
Selection Sort b      86.0 20190329_115437  xliu102/gyap  16Kints.txt
Selection Sort c      124.0 20190329_115437  xliu102/gyap  16Kints.txt
Selection Sort d      86.0 20190329_115437  xliu102/gyap  16Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 2
Selection Sort a      356.0 20190329_115443  xliu102/gyap  32Kints.txt
Selection Sort b      343.0 20190329_115443  xliu102/gyap  32Kints.txt
Selection Sort c      494.0 20190329_115443  xliu102/gyap  32Kints.txt
Selection Sort d      342.0 20190329_115443  xliu102/gyap  32Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 2
Selection Sort a 347795.0 20190329_115449  xliu102/gyap  1Mints.txt
Selection Sort b 346532.0 20190329_115449  xliu102/gyap  1Mints.txt
Selection Sort c 375616.0 20190329_115449  xliu102/gyap  1Mints.txt
Selection Sort d 334165.0 20190329_115449  xliu102/gyap  1Mints.txt
```

3. Insertion Sort

```
Last login: Fri Mar 29 11:53:14 on ttys001
[rett-pro-27:~ gyap$ cd Desktop/Lab7/
[rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 3
Insertion Sort a      2.0  20190329_115515  xliu102/gyap  1Kints.txt
Insertion Sort b      0.0  20190329_115515  xliu102/gyap  1Kints.txt
Insertion Sort c      2.0  20190329_115515  xliu102/gyap  1Kints.txt
Insertion Sort d      0.0  20190329_115515  xliu102/gyap  1Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 3
Insertion Sort a      3.0  20190329_115523  xliu102/gyap  2Kints.txt
Insertion Sort b      0.0  20190329_115523  xliu102/gyap  2Kints.txt
Insertion Sort c      3.0  20190329_115523  xliu102/gyap  2Kints.txt
Insertion Sort d      0.0  20190329_115523  xliu102/gyap  2Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 3
Insertion Sort a      6.0  20190329_115527  xliu102/gyap  4Kints.txt
Insertion Sort b      0.0  20190329_115527  xliu102/gyap  4Kints.txt
Insertion Sort c      12.0 20190329_115527  xliu102/gyap  4Kints.txt
Insertion Sort d      0.0  20190329_115527  xliu102/gyap  4Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 3
Insertion Sort a      17.0 20190329_115531  xliu102/gyap  8Kints.txt
Insertion Sort b      0.0  20190329_115531  xliu102/gyap  8Kints.txt
Insertion Sort c      48.0 20190329_115531  xliu102/gyap  8Kints.txt
Insertion Sort d      0.0  20190329_115531  xliu102/gyap  8Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 3
Insertion Sort a      39.0 20190329_115536  xliu102/gyap  16Kints.txt
Insertion Sort b      0.0  20190329_115536  xliu102/gyap  16Kints.txt
Insertion Sort c      180.0 20190329_115536  xliu102/gyap  16Kints.txt
Insertion Sort d      0.0  20190329_115536  xliu102/gyap  16Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 3
Insertion Sort a      138.0 20190329_115541  xliu102/gyap  32Kints.txt
Insertion Sort b      0.0  20190329_115541  xliu102/gyap  32Kints.txt
Insertion Sort c      710.0 20190329_115541  xliu102/gyap  32Kints.txt
Insertion Sort d      0.0  20190329_115541  xliu102/gyap  32Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 3
Insertion Sort a 114516.0 20190329_115546  xliu102/gyap  1Mints.txt
Insertion Sort b      2.0  20190329_115546  xliu102/gyap  1Mints.txt
Insertion Sort c 694058.0 20190329_115546  xliu102/gyap  1Mints.txt
Insertion Sort d      2.0  20190329_115546  xliu102/gyap  1Mints.txt
```

4. Merge Sort

```
rett-pro-27:~ gyap$ cd Desktop/Lab7/
rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 4
Merge Sort a      1.0  20190329_115655  xliu102/gyap  1Kints.txt
Merge Sort b      0.0  20190329_115655  xliu102/gyap  1Kints.txt
Merge Sort c      1.0  20190329_115655  xliu102/gyap  1Kints.txt
Merge Sort d      0.0  20190329_115655  xliu102/gyap  1Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 4
Merge Sort a      1.0  20190329_115702  xliu102/gyap  2Kints.txt
Merge Sort b      0.0  20190329_115702  xliu102/gyap  2Kints.txt
Merge Sort c      0.0  20190329_115702  xliu102/gyap  2Kints.txt
Merge Sort d      1.0  20190329_115702  xliu102/gyap  2Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 4
Merge Sort a      3.0  20190329_115708  xliu102/gyap  4Kints.txt
Merge Sort b      1.0  20190329_115708  xliu102/gyap  4Kints.txt
Merge Sort c      1.0  20190329_115708  xliu102/gyap  4Kints.txt
Merge Sort d      0.0  20190329_115708  xliu102/gyap  4Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 4
Merge Sort a      2.0  20190329_115712  xliu102/gyap  8Kints.txt
Merge Sort b      1.0  20190329_115712  xliu102/gyap  8Kints.txt
Merge Sort c      1.0  20190329_115712  xliu102/gyap  8Kints.txt
Merge Sort d      1.0  20190329_115712  xliu102/gyap  8Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 4
Merge Sort a      4.0  20190329_115716  xliu102/gyap  16Kints.txt
Merge Sort b      3.0  20190329_115716  xliu102/gyap  16Kints.txt
Merge Sort c      3.0  20190329_115716  xliu102/gyap  16Kints.txt
Merge Sort d      1.0  20190329_115716  xliu102/gyap  16Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 4
Merge Sort a      8.0  20190329_115721  xliu102/gyap  32Kints.txt
Merge Sort b      6.0  20190329_115721  xliu102/gyap  32Kints.txt
Merge Sort c      4.0  20190329_115721  xliu102/gyap  32Kints.txt
Merge Sort d      4.0  20190329_115721  xliu102/gyap  32Kints.txt
rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 4
Merge Sort a     127.0  20190329_115729  xliu102/gyap  1Mints.txt
Merge Sort b     123.0  20190329_115729  xliu102/gyap  1Mints.txt
Merge Sort c     130.0  20190329_115729  xliu102/gyap  1Mints.txt
Merge Sort d     123.0  20190329_115729  xliu102/gyap  1Mints.txt
```

5. Quick Sort

```
[rett-pro-27:Lab7 gyap$ java Sorting 1Kints.txt 5
Quick Sort a      1.0  20190329_115831  xliu102/gyap  1Kints.txt
Quick Sort b      0.0  20190329_115831  xliu102/gyap  1Kints.txt
Quick Sort c      0.0  20190329_115831  xliu102/gyap  1Kints.txt
Quick Sort d      0.0  20190329_115831  xliu102/gyap  1Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 2Kints.txt 5
Quick Sort a      1.0  20190329_115837  xliu102/gyap  2Kints.txt
Quick Sort b      0.0  20190329_115837  xliu102/gyap  2Kints.txt
Quick Sort c      0.0  20190329_115837  xliu102/gyap  2Kints.txt
Quick Sort d      1.0  20190329_115837  xliu102/gyap  2Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 4Kints.txt 5
Quick Sort a      1.0  20190329_115841  xliu102/gyap  4Kints.txt
Quick Sort b      0.0  20190329_115841  xliu102/gyap  4Kints.txt
Quick Sort c      0.0  20190329_115841  xliu102/gyap  4Kints.txt
Quick Sort d      1.0  20190329_115841  xliu102/gyap  4Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 8Kints.txt 5
Quick Sort a      2.0  20190329_115848  xliu102/gyap  8Kints.txt
Quick Sort b      0.0  20190329_115848  xliu102/gyap  8Kints.txt
Quick Sort c      0.0  20190329_115848  xliu102/gyap  8Kints.txt
Quick Sort d      1.0  20190329_115848  xliu102/gyap  8Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 16Kints.txt 5
Quick Sort a      2.0  20190329_115852  xliu102/gyap  16Kints.txt
Quick Sort b      3.0  20190329_115852  xliu102/gyap  16Kints.txt
Quick Sort c      3.0  20190329_115852  xliu102/gyap  16Kints.txt
Quick Sort d      0.0  20190329_115852  xliu102/gyap  16Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 32Kints.txt 5
Quick Sort a      4.0  20190329_115857  xliu102/gyap  32Kints.txt
Quick Sort b      1.0  20190329_115857  xliu102/gyap  32Kints.txt
Quick Sort c      2.0  20190329_115857  xliu102/gyap  32Kints.txt
Quick Sort d      2.0  20190329_115857  xliu102/gyap  32Kints.txt
[rett-pro-27:Lab7 gyap$ java Sorting 1Mints.txt 5
Quick Sort a      50.0 20190329_115903  xliu102/gyap  1Mints.txt
Quick Sort b      18.0 20190329_115903  xliu102/gyap  1Mints.txt
Quick Sort c      16.0 20190329_115903  xliu102/gyap  1Mints.txt
Quick Sort d      12.0 20190329_115903  xliu102/gyap  1Mints.txt
```

Tables of four arrays (a, b, c, d):

**Note: ms = milliseconds.

Array a:

Array a	1K.txt	2K.txt	4K.txt	8K.txt	16K.txt	32K.txt	1M.txt
Default	1 ms	0 ms	1 ms	0 ms	1 ms	1 ms	32 ms
Bubble Sort	5 ms	10 ms	19 ms	44 ms	142 ms	571 ms	667133 ms (Over 10 min)
Selection	6 ms	8 ms	17 ms	28 ms	93 ms	356 ms	347795 ms
Insertion	2 ms	3 ms	6 ms	17 ms	39 ms	138 ms	114516 ms
Merge	1 ms	1 ms	3 ms	2 ms	4 ms	8 ms	127 ms
Quick	1 ms	1 ms	1 ms	2 ms	2 ms	4 ms	50 ms

Array b:

Array b	1K.txt	2K.txt	4K.txt	8K.txt	16K.txt	32K.txt	1M.txt
Default	0 ms	0 ms	0 ms	0 ms	1 ms	0 ms	17 ms
Bubble Sort	0 ms	1 ms	3 ms	13 ms	52 ms	207 ms	207380 ms
Selection	1 ms	6 ms	10 ms	22 ms	86 ms	343 ms	346532 ms
Insertion	0 ms	0 ms	2 ms				
Merge	0 ms	0 ms	1 ms	1 ms	3 ms	6 ms	123 ms
Quick	0 ms	0 ms	0 ms	0 ms	3 ms	1 ms	18 ms

Array c:

Array c	1K.txt	2K.txt	4K.txt	8K.txt	16K.txt	32K.txt	1M.txt
Default	0 ms	1 ms	38 ms				
Bubble Sort	2 ms	3 ms	10 ms	42 ms	168 ms	668 ms	675766 ms (Over 10 min)
Selection	7 ms	3 ms	8 ms	31 ms	124 ms	494 ms	375616 ms
Insertion	2 ms	3 ms	12 ms	48 ms	180 ms	710 ms	694058 ms (Over 10 min)
Merge	1 ms	0 ms	1 ms	1 ms	3 ms	4 ms	130 ms
Quick	0 ms	0 ms	0 ms	0 ms	3 ms	2 ms	16 ms

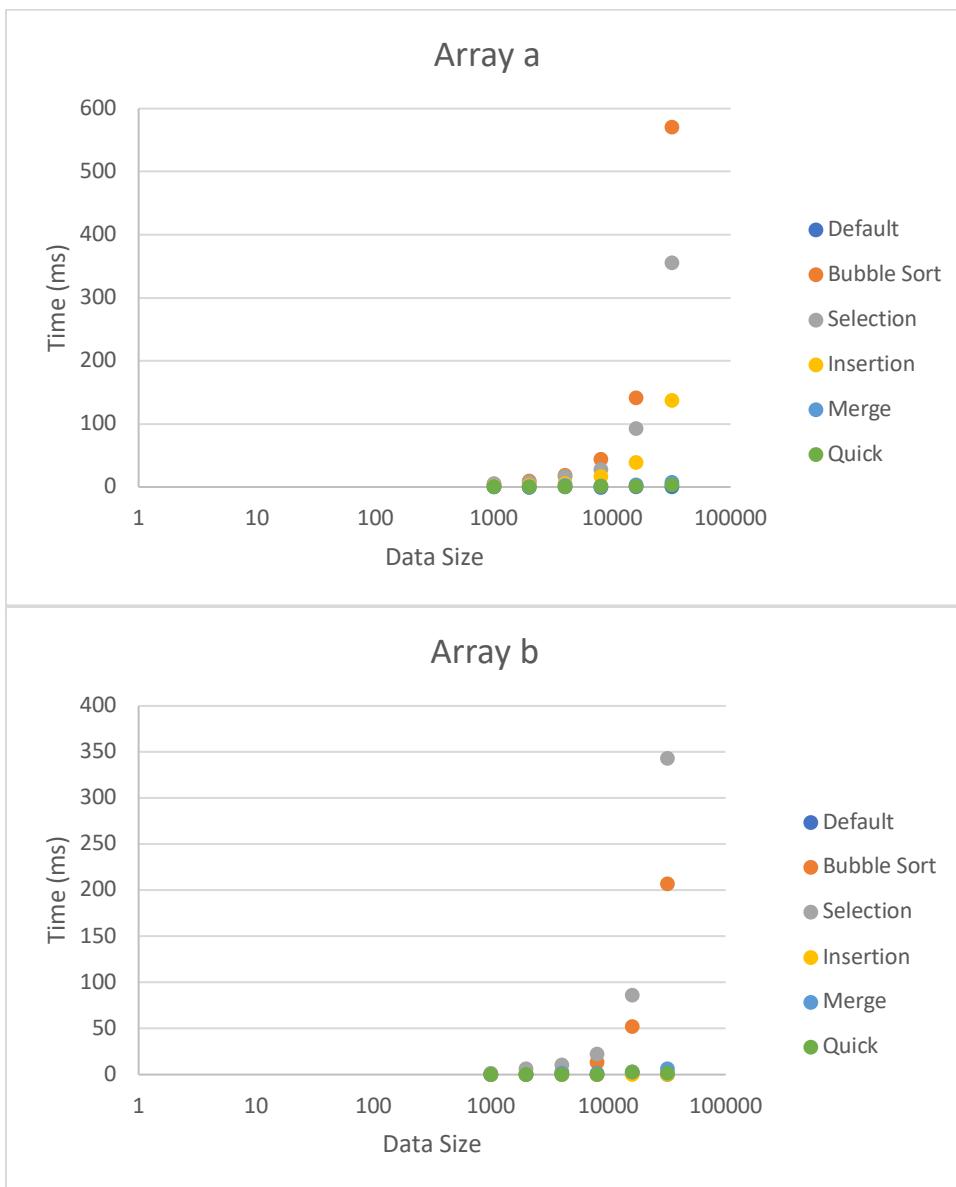
Array d:

Array d	1K.txt	2K.txt	4K.txt	8K.txt	16K.txt	32K.txt	1M.txt
Default	0 ms	0 ms	0 ms	1 ms	0 ms	1 ms	1 ms
Bubble Sort	2 ms	1 ms	4 ms	13 ms	50 ms	202 ms	194839 ms
Selection	1 ms	1 ms	6 ms	22 ms	186 ms	342 ms	334165 ms
Insertion	0 ms	0 ms	2 ms				
Merge	0 ms	1 ms	0 ms	1 ms	1 ms	4 ms	123 ms
Quick	0 ms	1 ms	1 ms	1 ms	0 ms	2 ms	12 ms

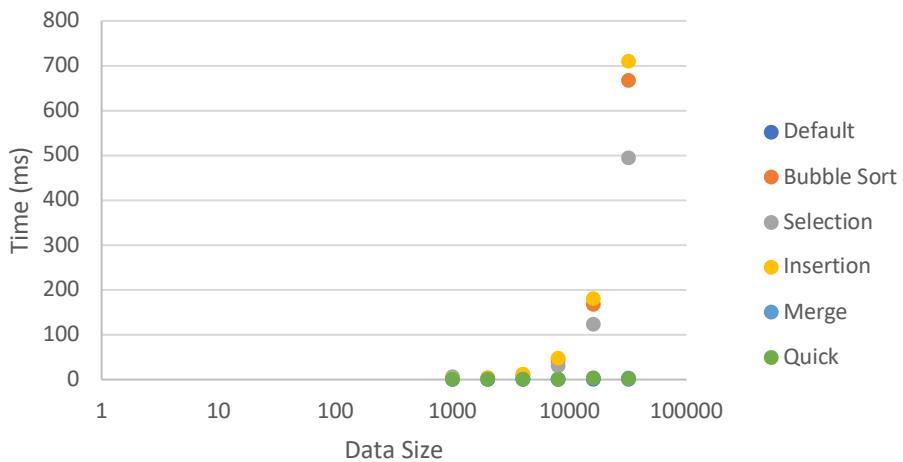
EXTRA CREDIT:

Plots of data using earlier tables with a logarithmic scale:

**Note: did not include plot points for the 1Mint.txt files because the other plot points would not appear since the time taken to sort was drastically different for bubble, selection, and insertion sort.



Array c



Array d

