Istvan von Fedak
Data Structures

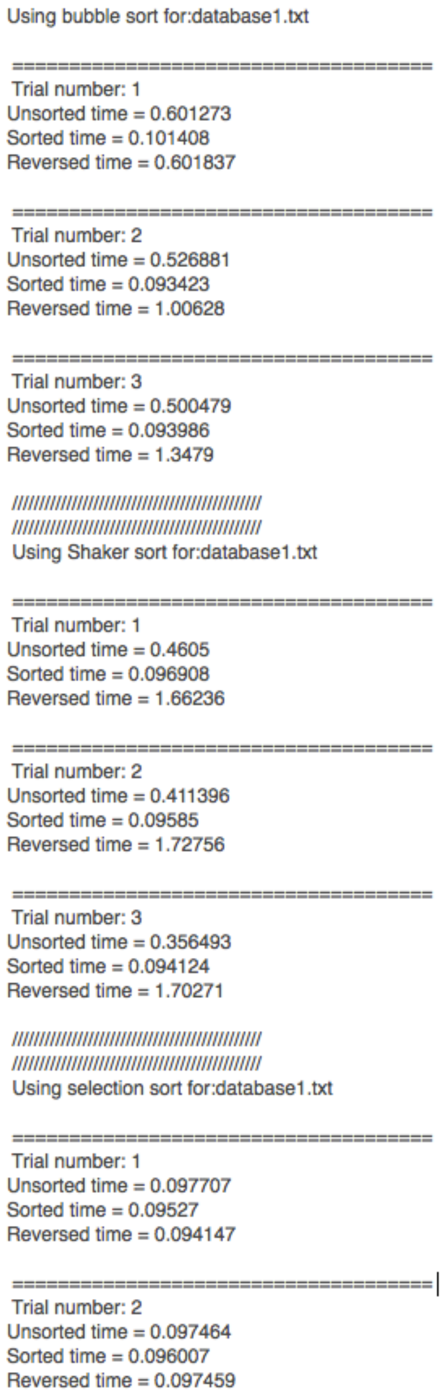
Lab2

Note: I converted this file from pages to word, sorry if something is off. The page breaks might not work :/

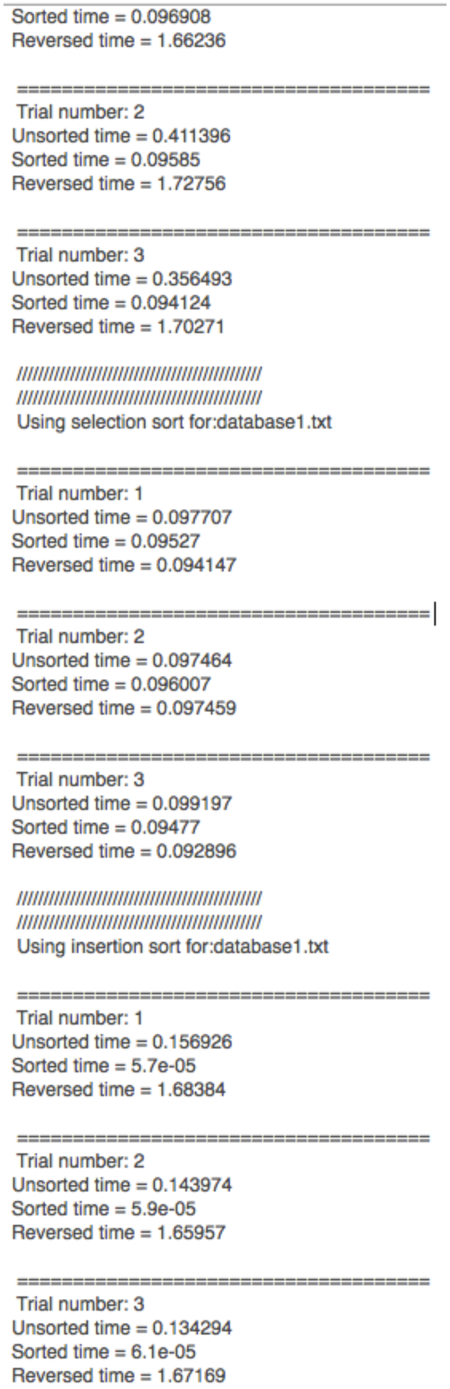
Basic compiling Instructions;

- there are going to be 7 different files in this document(main.cpp, Date.h, Date.cpp, Person.h, Person.cpp, support.h, support.cpp.
- I included an extra variable in Person.h named “howOld”. This is because the sorting functions were taking too long to complete and I had to make it faster. I do understand the main objective of this lab. Comparing two different objects composed of subclasses is resource intensive and the comparisons alone add a lot of time to the calculations.
- Within the support library, I included two personal functions that I use in other libraries.
- Date and Person classes have a lot of internal functions that are not related to the lab, I commented them out and indicated the functions that are used in the lab.
- In my main.cpp I have the sorting functions, print functions, and fin functions.
- I have included instructions on how my main() works within it

Screen shots, results and extra credit:



```
Using bubble sort for:database1.txt

 ======================================
 Trial number: 1
Unsorted time = 0.601273
Sorted time = 0.101408
Reversed time = 0.601837

 ======================================
 Trial number: 2
Unsorted time = 0.526881
Sorted time = 0.093423
Reversed time = 1.00628

 ======================================
 Trial number: 3
Unsorted time = 0.500479
Sorted time = 0.093986
Reversed time = 1.3479

 //////////////////////////////////////////////
 //////////////////////////////////////////////
 Using Shaker sort for:database1.txt

 ======================================
 Trial number: 1
Unsorted time = 0.4605
Sorted time = 0.096908
Reversed time = 1.66236

 ======================================
 Trial number: 2
Unsorted time = 0.411396
Sorted time = 0.09585
Reversed time = 1.72756

 ======================================
 Trial number: 3
Unsorted time = 0.356493
Sorted time = 0.094124
Reversed time = 1.70271

 //////////////////////////////////////////////
 //////////////////////////////////////////////
 Using selection sort for:database1.txt

 ======================================
 Trial number: 1
Unsorted time = 0.097707
Sorted time = 0.09527
Reversed time = 0.094147

 ======================================|
 Trial number: 2
Unsorted time = 0.097464
Sorted time = 0.096007
Reversed time = 0.097459
```



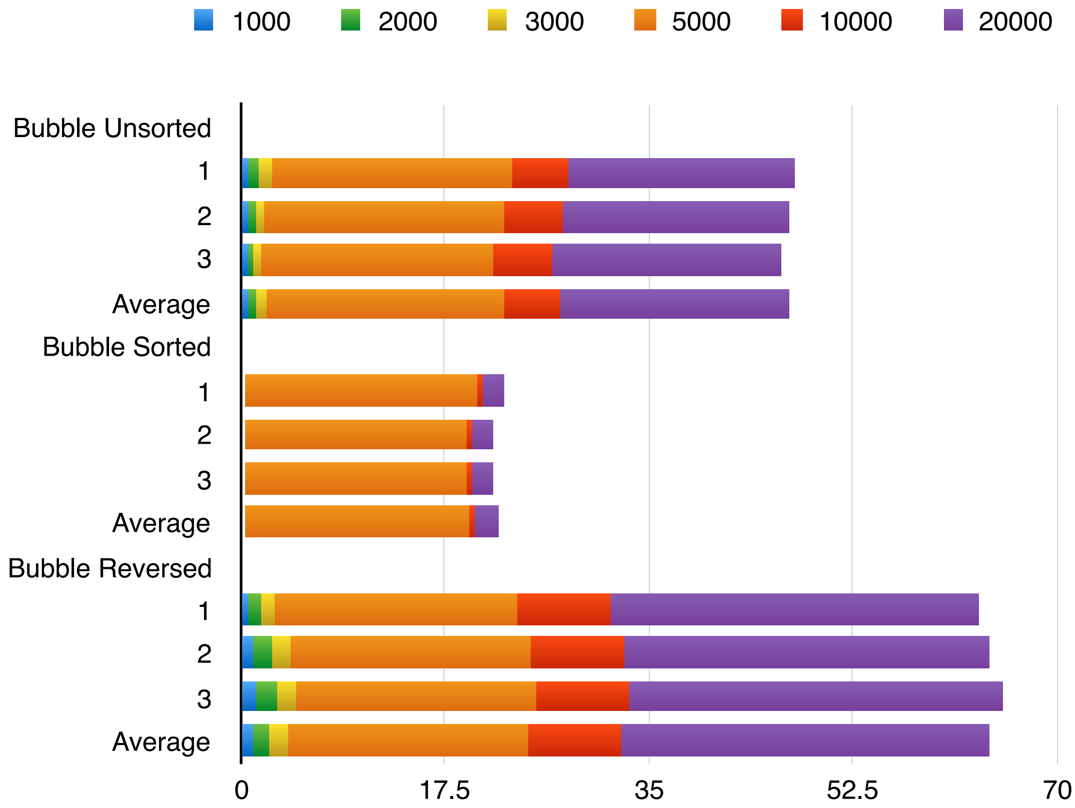
```
Sorted time = 0.096908
Reversed time = 1.66236

 ======================================
 Trial number: 2
Unsorted time = 0.411396
Sorted time = 0.09585
Reversed time = 1.72756

 ======================================
 Trial number: 3
Unsorted time = 0.356493
Sorted time = 0.094124
Reversed time = 1.70271

 //////////////////////////////////////////////
 //////////////////////////////////////////////
 Using selection sort for:database1.txt

 ======================================
 Trial number: 1
Unsorted time = 0.097707
Sorted time = 0.09527
Reversed time = 0.094147

 ======================================|
 Trial number: 2
Unsorted time = 0.097464
Sorted time = 0.096007
Reversed time = 0.097459

 ======================================
 Trial number: 3
Unsorted time = 0.099197
Sorted time = 0.09477
Reversed time = 0.092896

 //////////////////////////////////////////////
 //////////////////////////////////////////////
 Using insertion sort for:database1.txt

 ======================================
 Trial number: 1
Unsorted time = 0.156926
Sorted time = 5.7e-05
Reversed time = 1.68384

 ======================================
 Trial number: 2
Unsorted time = 0.143974
Sorted time = 5.9e-05
Reversed time = 1.65957

 ======================================
 Trial number: 3
Unsorted time = 0.134294
Sorted time = 6.1e-05
Reversed time = 1.67169
```

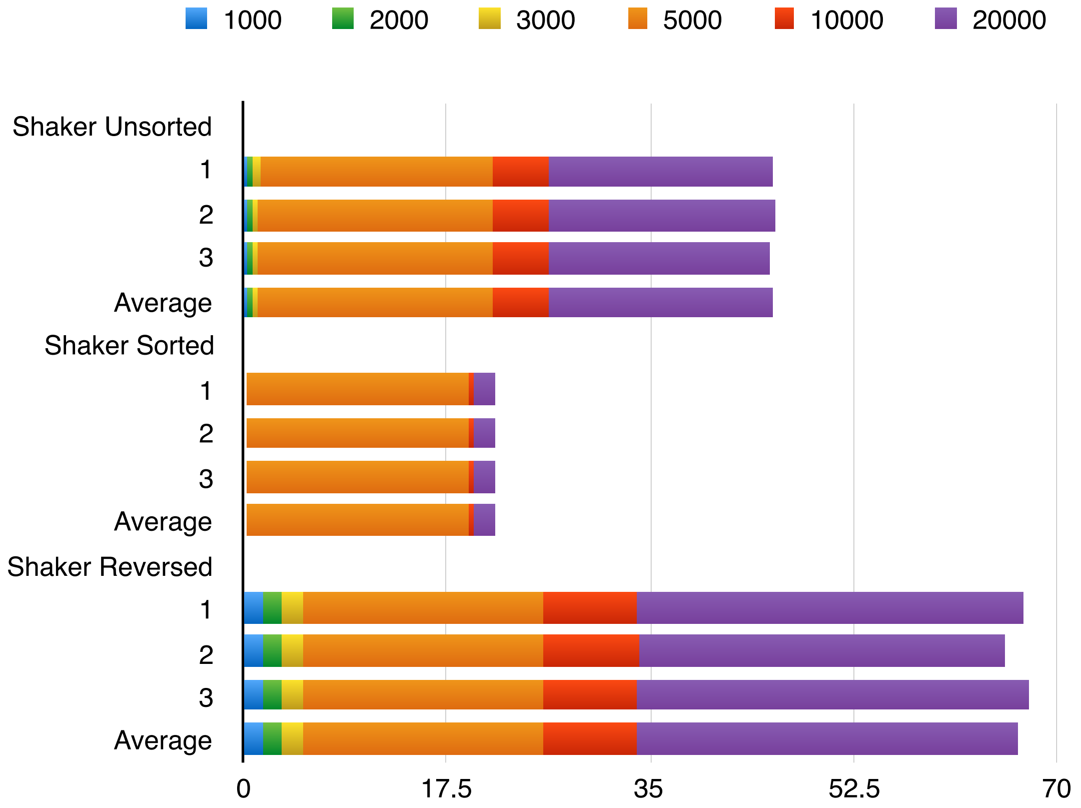
```
Using bubble sort for:database20.txt

 =======================================
 Trial number: 1
Unsorted time = 19.4878
Sorted time = 1.85864
Reversed time = 31.6019

 =======================================
 Trial number: 2
Unsorted time = 19.4925
Sorted time = 1.85581
Reversed time = 31.4885

 =======================================
 Trial number: 3
Unsorted time = 19.7136
Sorted time = 1.86934
Reversed time = 32.1027

 ////////////////////////////////////////////////////
 ////////////////////////////////////////////////////
 Using Shaker sort for:database20.txt

 =======================================
 Trial number: 1
Unsorted time = 19.1994
Sorted time = 1.8604
Reversed time = 33.3714

 =======================================
 Trial number: 2
Unsorted time = 19.4792
Sorted time = 1.85614
Reversed time = 31.542

 =======================================
 Trial number: 3
Unsorted time = 19.1786
Sorted time = 1.86124
Reversed time = 33.798

 ////////////////////////////////////////////////////
 ////////////////////////////////////////////////////
 Using selection sort for:database20.txt

 =======================================
 Trial number: 1
Unsorted time = 1.96863
Sorted time = 1.96661
Reversed time = 2.01039

 =======================================
 Trial number: 2
Unsorted time = 1.99354
Sorted time = 1.96976
Reversed time = 2.01202
```

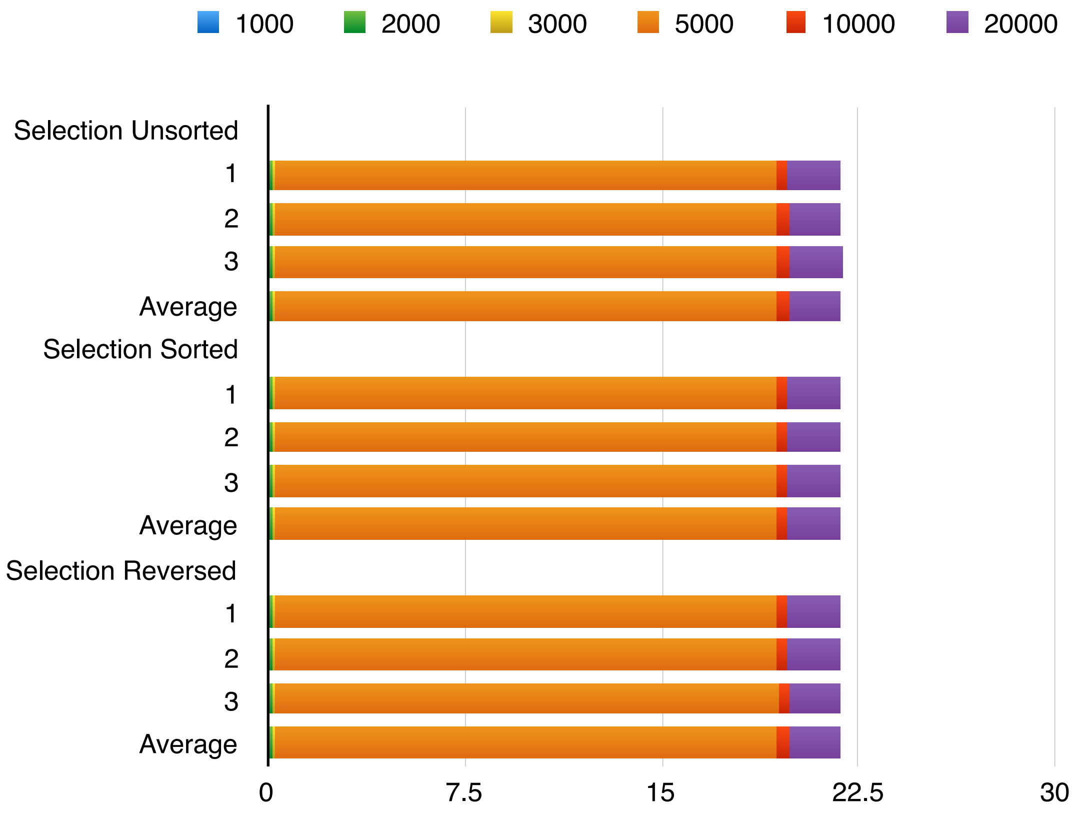
```
Sorted time = 1.8604
Reversed time = 33.3714

 =======================================
 Trial number: 2
Unsorted time = 19.4792
Sorted time = 1.85614
Reversed time = 31.542

 =======================================
 Trial number: 3
Unsorted time = 19.1786
Sorted time = 1.86124
Reversed time = 33.798

 ////////////////////////////////////////////////////
 ////////////////////////////////////////////////////
 Using selection sort for:database20.txt

 =======================================
 Trial number: 1
Unsorted time = 1.96863
Sorted time = 1.96661
Reversed time = 2.01039

 =======================================
 Trial number: 2
Unsorted time = 1.99354
Sorted time = 1.96976
Reversed time = 2.01202

 =======================================
 Trial number: 3
Unsorted time = 2.05951
Sorted time = 2.05229
Reversed time = 1.9032

 ////////////////////////////////////////////////////
 ////////////////////////////////////////////////////
 Using insertion sort for:database20.txt

 =======================================
 Trial number: 1
Unsorted time = 17.1598
Sorted time = 0.000223
Reversed time = 31.677

 =======================================
 Trial number: 2
Unsorted time = 15.7456
Sorted time = 0.000213
Reversed time = 31.5037

 =======================================
 Trial number: 3
Unsorted time = 15.353
Sorted time = 0.000222
Reversed time = 31.0563
```

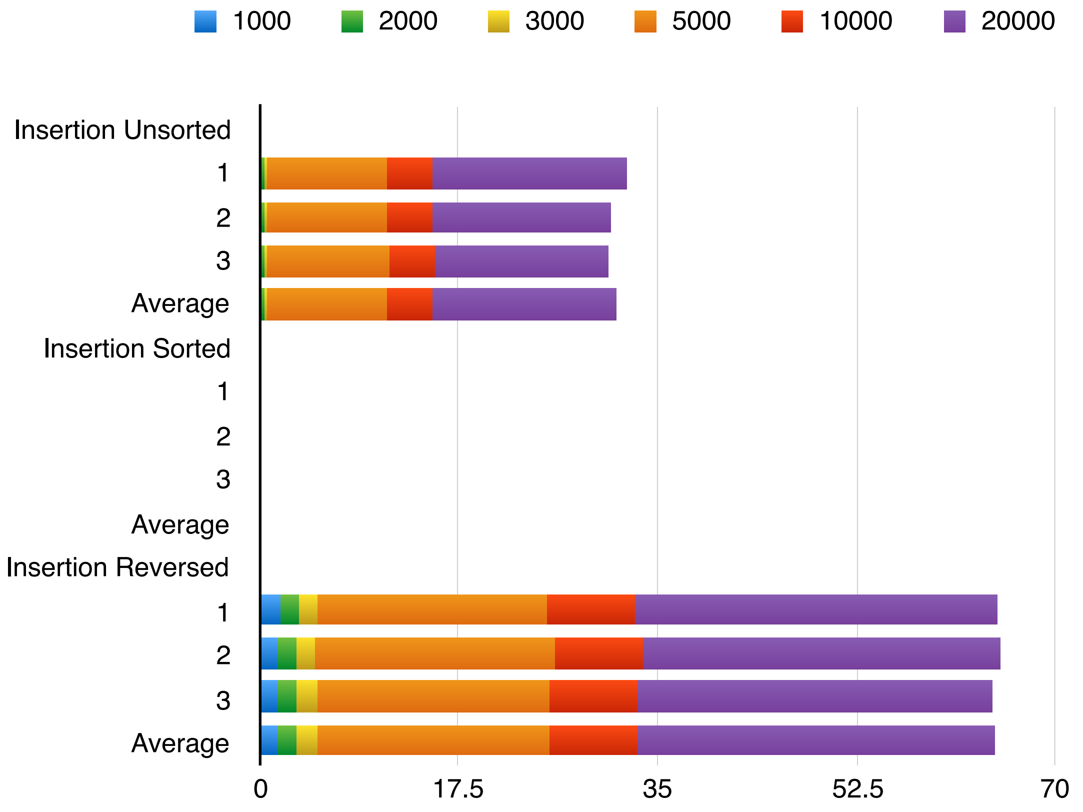
Algorithm	1000	2000	3000	5000	10000	20000
Bubble Unsorted						
1	0.601273	0.951176	1.14518	20.5949	4.7581	19.4878
2	0.526881	0.73867	0.723992	20.6483	4.89636	19.4925
3	0.500479	0.562755	0.597227	20.071	4.97821	19.7136
Average	0.54287766	0.750867	0.822133	20.4380666	4.87755666	19.5646333
Bubble Sorted						
1	0.101408	0.096877	0.092693	20.0191	0.438291	1.85864
2	0.093423	0.09288	0.09245	19.0723	0.463459	1.85581
3	0.093986	0.093656	0.092574	19.0572	0.469776	1.86934
Average	0.09627233	0.094471	0.09257233	19.3828666	0.45717533	1.86126333
Bubble Reversed						
1	0.601837	1.01693	1.3382	20.8393	7.89978	31.6019
2	1.00628	1.57858	1.74145	20.5694	7.8829	31.4885
3	1.3479	1.7267	1.72939	20.5918	7.88549	32.1027
Average	0.985339	1.44073666	1.60301333	20.6668333	7.88939	31.7310333
Shaker Unsorted						
1	0.4605	0.464645	0.552727	20.0884	4.80486	19.1994
2	0.411396	0.405603	0.518626	20.1168	4.88751	19.4792
3	0.356493	0.381931	0.503693	20.1058	4.86499	19.1786
Average	0.409463	0.417393	0.52501533	20.1036666	4.85245333	19.2857333
Shaker Sorted						
1	0.096908	0.096905	0.093282	19.1722	0.45706	1.8604
2	0.09585	0.094357	0.095783	19.171	0.454336	1.85614
3	0.094124	0.094208	0.097386	19.1652	0.455739	1.86124
Average	0.09562733	0.09515666	0.09548366	19.1694666	0.45571166	1.85926
Shaker Reversed						
1	1.66236	1.72407	1.73412	20.6944	7.93762	33.3714
2	1.72756	1.71387	1.72834	20.6843	8.21308	31.542
3	1.70271	1.69211	1.7105	20.6978	7.93758	33.798
Average	1.69754333	1.71001666	1.72432	20.6921666	8.02942666	32.9038

Selection Unsorted						
1	0.097707	0.096564	0.098286	19.066	0.44668	1.96863
2	0.097464	0.099078	0.096087	19.0789	0.46117	1.99354
3	0.099197	0.095995	0.094608	19.0775	0.456943	2.05951
Average	0.098122666	0.097212333	0.096327	19.0741333	0.454931	2.007226666
Selection Sorted						
1	0.09527	0.104954	0.094858	19.0718	0.448471	1.96661
2	0.096007	0.094679	0.098252	19.047	0.444076	1.96976
3	0.09477	0.093897	0.094948	19.0548	0.445289	2.05229
Average	0.095349	0.097843333	0.096019333	19.0578666	0.445945333	1.99622
Selection Reversed						
1	0.094147	0.098288	0.094788	19.0402	0.444206	2.01039
2	0.097459	0.093779	0.094761	19.0604	0.454707	2.01202
3	0.092896	0.093191	0.092978	19.1942	0.445069	1.9032
Average	0.094834	0.095086	0.094175666	19.0982666	0.447994	1.975203333
Insertion Unsorted						
1	0.156926	0.200715	0.338791	10.4917	3.91358	17.1598
2	0.143974	0.198576	0.342919	10.3962	3.9797	15.7456
3	0.134294	0.190027	0.345941	10.7078	3.9029	15.353
Average	0.145064666	0.196439333	0.342550333	10.5319	3.93206	16.0861333
Insertion Sorted						
1	5.7E-05	5.6E-05	4.7E-05	0.007559	0.000105	0.000223
2	5.9E-05	5.6E-05	4.7E-05	0.007547	0.000105	0.000213
3	6.1E-05	5.8E-05	6E-05	0.007545	0.0001	0.000222
Average	5.9E-05	5.7E-05	5.133333333	0.007550333	0.000103333	0.000219333
Insertion Reversed						
1	1.68384	1.64564	1.65918	20.3399	7.76411	31.677
2	1.65957	1.64558	1.64615	20.9205	7.74707	31.5037
3	1.67169	1.63501	1.65197	20.5604	7.73498	31.0563
Average	1.6717	1.642076666	1.652433333	20.6069333	7.74872	31.4123333


1000
2000
3000
5000
10000
20000
Bubble Unsorted
1
2
3
Average
Bubble Sorted
1
2
3
Average
Bubble Reversed
1
2
3
Average
0
17.5
35
52.5
70


1000
2000
3000
5000
10000
20000
Shaker Unsorted
1
2
3
Average
Shaker Sorted
1
2
3
Average
Shaker Reversed
1
2
3
Average
0
17.5
35
52.5
70


1000
2000
3000
5000
10000
20000
Selection Unsorted
1
2
3
Average
Selection Sorted
1
2
3
Average
Selection Reversed
1
2
3
Average
0
7.5
15
22.5
30


1000
2000
3000
5000
10000
20000
Insertion Unsorted
1
2
3
Average
Insertion Sorted
1
2
3
Average
Insertion Reversed
1
2
3
Average
0
17.5
35
52.5
70

Comments on the timing of each routine and extra credit:

Bubble:

- Bubble sort got the job done. It took longer than usual in almost all scenarios (unsorted, sorted and reversed) compared to insertion and selection sort. Since bubble relies heavily in comparison, once you start comparing complex objects, it slows down exponentially.

Shaker:

- Shaker is almost the same algorithm as bubble but does double the amount of work in half the amount of “i” loops. In some scenarios it performed slower than bubble by a marginal number.

Selection:

- Selection, while I was using the “howOld”, performed the faster than all other sorting algorithms in sorting unsorted and reversed data. This would be a good algorithm to use when you need a consistent time for sorting arrays no matter what way the arrays are arranged.

Insertion:

- Insertions strength is the speed at which it detects if the array was already sorted. It outperformed all of the other algorithms by a lot less time. The only problem with insertion is when the array is reversed, which in such cases it behave almost the same as bubble sort. When the array was unsorted, It performed faster than bubble and shaker giving it a slight advantage. I would use this algorithm if I knew I would have a lot of already sorted arrays.

Source code:

note: I had the database files(ex: database1.txt) in text files with in my project directory. Furthermore, please excuse me if I have a lot of functions within my classes I tried to make it easy to read and comprehend by commenting out all the unnecessary functions for this lab. I also made my main black so its easier to find.