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INFO 6205
Program Structures & Algorithms
Summer Full 2018
Assignment 3

In this Assignment, I will form different types of arrays and will sort it by Selection and Insertion sort.
Selection sort and Insertion sort have different complexities in different scenarios.
N is the number of elements in the array.

Sorts:	Best	Average	Worst
Selection	½ N^2	½ N^2	½ N^2
Insertion	N	¼ N^2	½ N^2

Here, I have created 4 different arrays as follows:

- Random Array
- Sorted Array
- Reverse Array
- Partially Sorted Array

1. CONCLUSION:

Some useful abbreviations:

- n – Number of elements in the Array.

I ran the experiment for various "n" like 1000,2000,4000,8000,16000 etc.
While doing the experiment, the mean pairs that were calculated each time for n which also ran in an incremental manner.

Experiments taken: 100 time.
So, 1st experiment ran for 100*1000 times.

Please find observations, screenshots, graphs, examples below:

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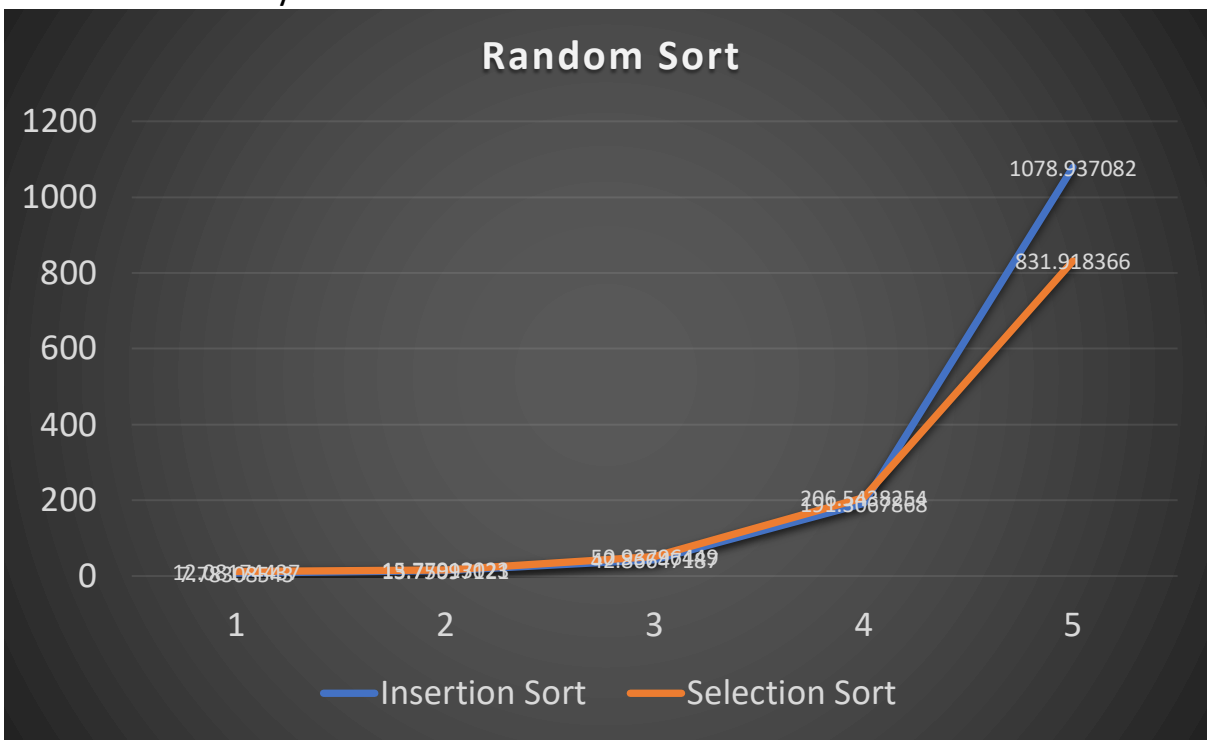
Observations:

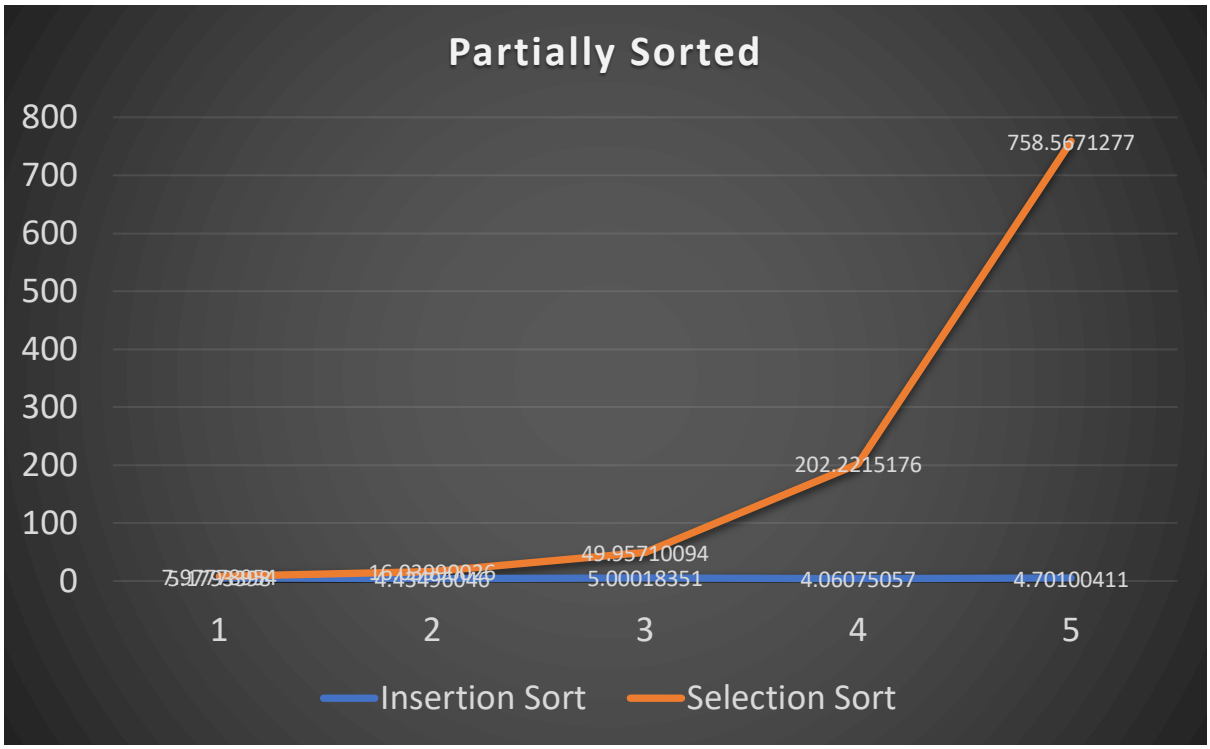
Array	N (No. of Elements)	Selection Sort time(milliseconds)	Insertion Sort time(milliseconds)	Result
Sorted	1000	10.30749803	7.43517455	Insertion
Reverse	1000	10.25576403	10.1069063	Selection
Random	1000	12.08174437	7.78308543	Insertion
Partial Sort	1000	7.97778954	5.1793398	Insertion
Sorted	2000	15.93404995	4.519438650001	Insertion
Reverse	2000	15.79157095	21.87396804	Selection
Random	2000	15.77913023	13.75097121	Insertion
Partial Sort	2000	16.03990026	4.43496046	Insertion
Sorted	4000	51.52672263	4.33987573	Insertion
Reverse	4000	50.36611286996	68.9221657	Selection
Random	4000	50.937964490006	42.86647187	Insertion
Partial Sort	4000	49.957100940004	5.00018351	Insertion
Sorted	8000	190.90480757	4.06110498	Insertion
Reverse	8000	188.1818505	299.9949137603	Selection
Random	8000	206.5438253802	191.30678682	Insertion
Partial Sort	8000	202.22151758	4.06075057	Insertion
Sorted	16000	782.06934952	4.95224215	Insertion
Reverse	16000	788.76900499	1203.3181278701	Selection
Random	16000	831.91836596	1078.93708227	Insertion
Partial Sort	16000	758.56712769	4.70100411	Insertion

2. Graph of different arrays:

- Random Sort Array:



- Partially Sort Array



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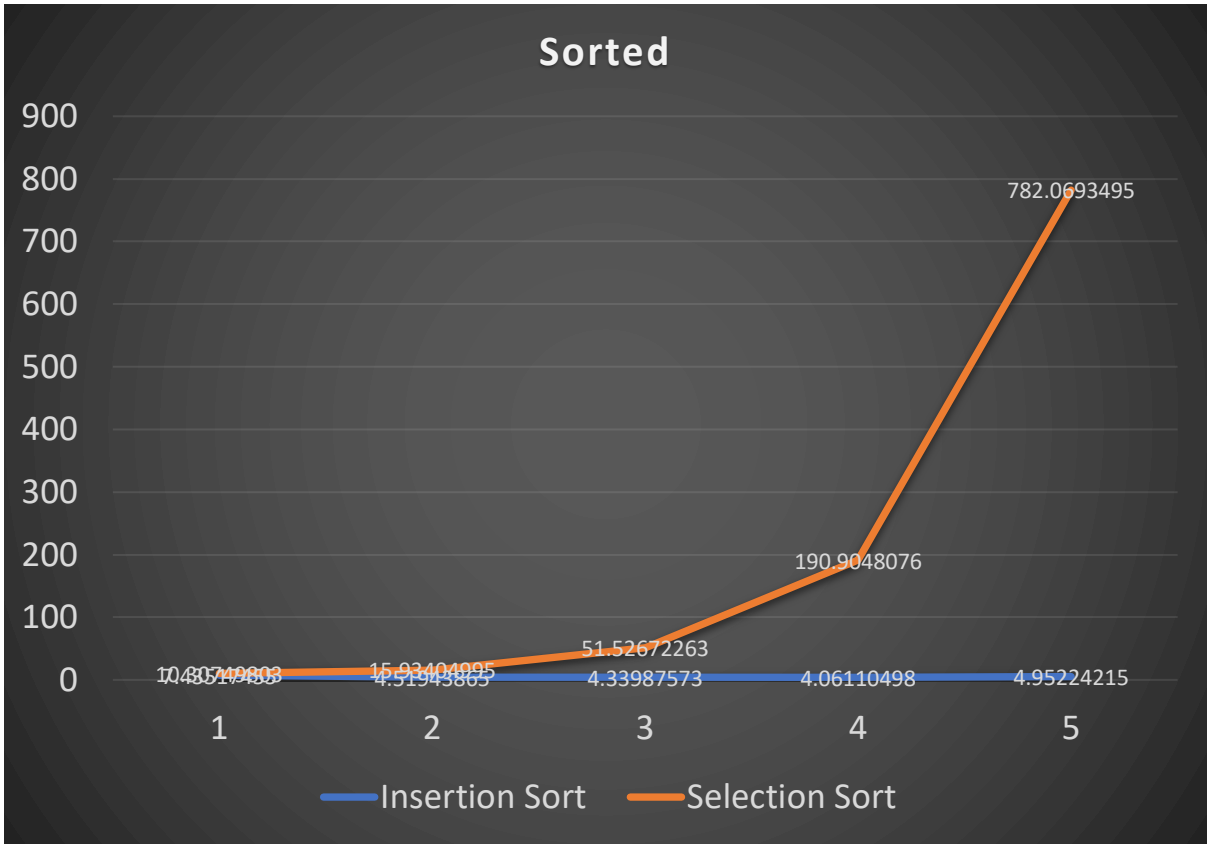
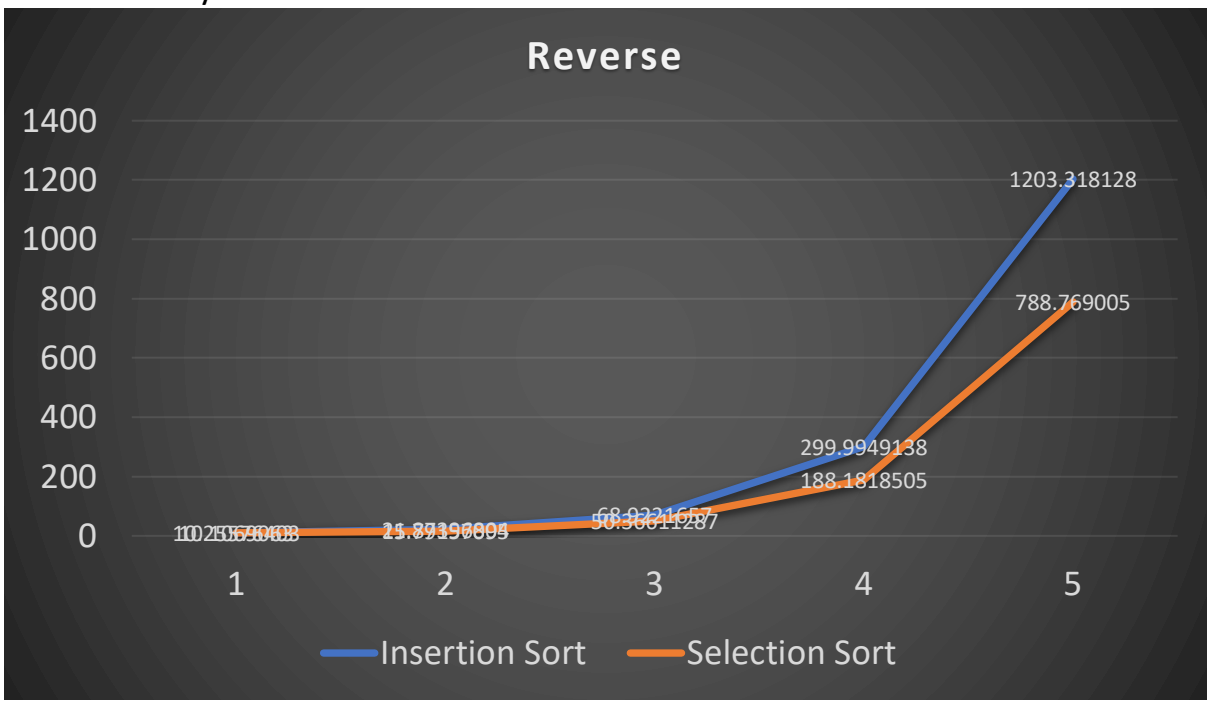
- Sorted Array:



- Reverse Array:



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Please find examples below:

Let's take an example to prove the compexity:

Examples:

(a). For Sorted Array:

Take n = 2000
In the screenshot, when I have taken:
Experiments: 100

Time Complexity of Selection Sort: N^2
Time Complexity of Insertion Sort: *N*

According to observation:
For Selection sort, time through code: 15.93404995 milliseconds.
For Insertion sort, time through code: 4.51943865001 milliseconds.

Insertion Sort is taking very less time as compared to Selection sort as its complexity is very lower than Selection sort.

Hence Proved

(b). For Reverse Array:

Take n = 2000
In the screenshot, when I have taken:
Experiments: 100

Time Complexity of Selection Sort: N^2
Time Complexity of Insertion Sort: N^2

According to observation:
For Insertion sort, time through code: 21.87396804 milliseconds.
For Selection sort, time through code: 15.79157095milliseconds.

Selection sort is taking less time as compared to Insertion sort.

Hence Proved

(c). For Random Array:
Take n = 2000
In the screenshot, when I have taken:
Experiments: 100

Time Complexity of Selection Sort: ½ N^2
Time Complexity of Insertion Sort: ¼ N^2

According to observation:
For Selection sort, time through code: 15.77913023 milliseconds.
For Insertion sort, time through code: 13.75097121 milliseconds.

Insertion Sort is better as it is taking less time and have time complexity as ¼ N^2 and ½ N^2 respectively.

Hence Proved

(a). For Partial Sort Array:
Take n = 2000
In the screenshot, when I have taken:
Experiments: 100

Time Complexity of Selection Sort: N^2
Time Complexity of Insertion Sort: N

According to observation:
For Selection sort, time through code: 16.03990026 milliseconds.
For Insertion sort, time through code: 4.43496046 milliseconds.

Insertion Sort is taking very less time as compared to Selection sort as its complexity is very lower than Selection sort.

Hence Proved

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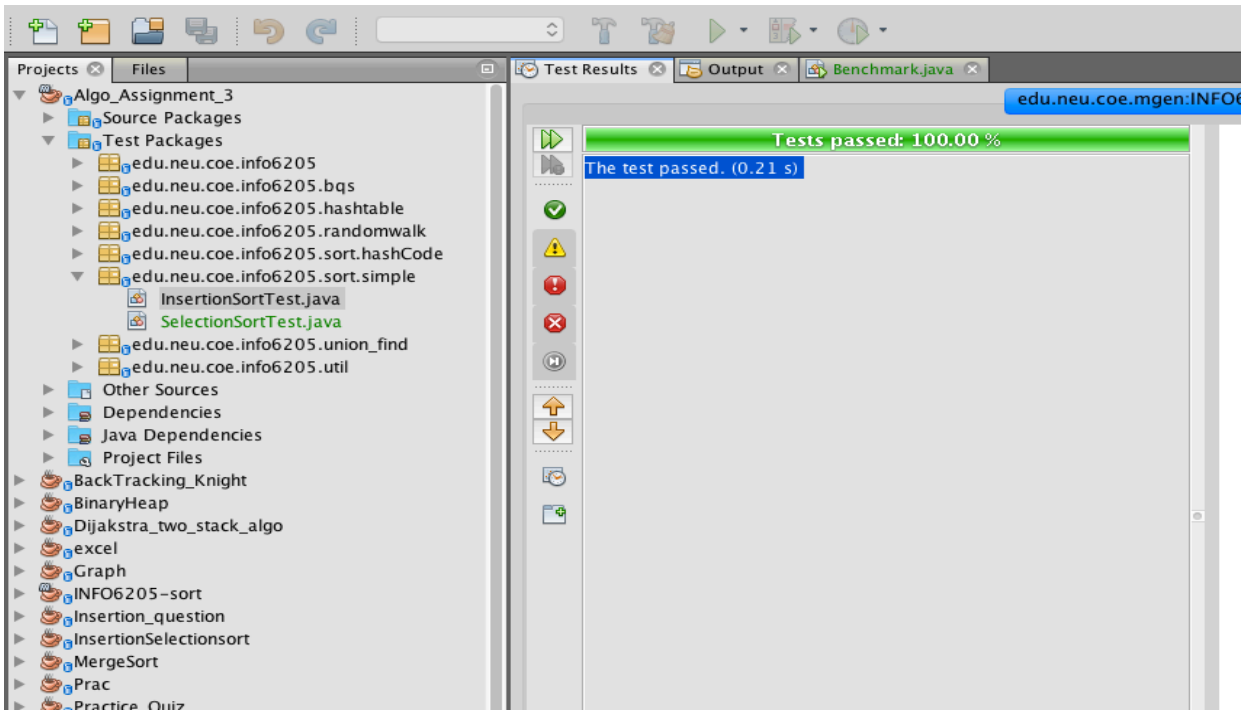
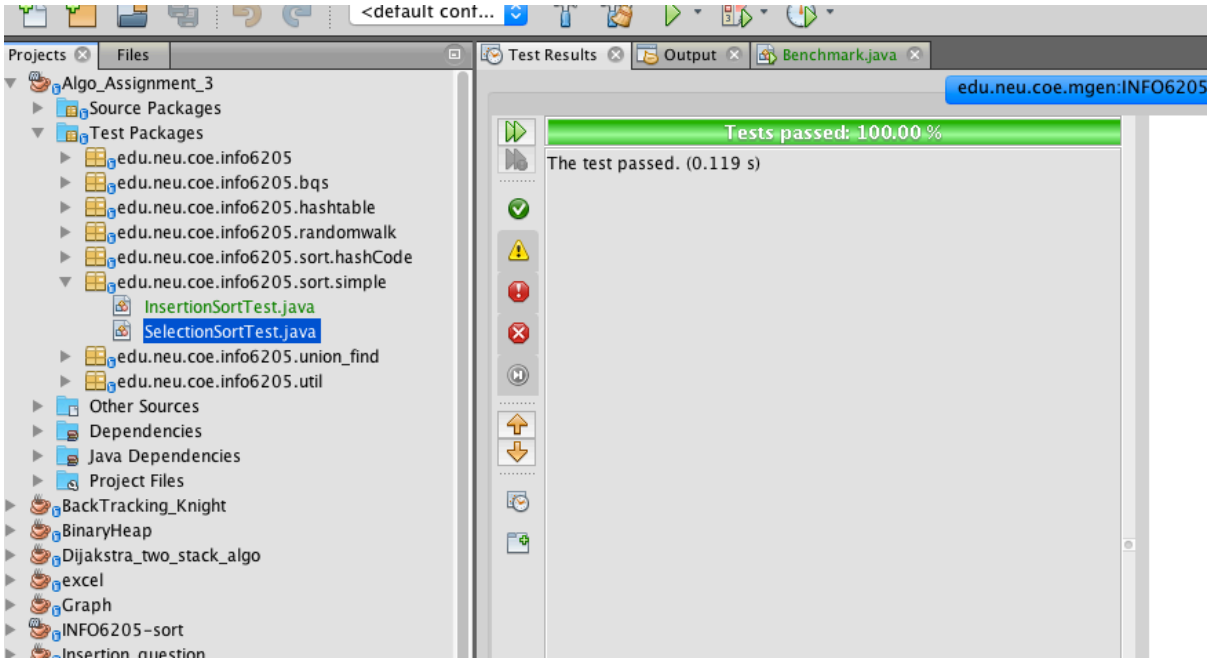
Test Cases: NETBEANS

- **Insertion Sort**



- **Selection Sort**



OUTPUT: NETBEANS

Result:

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