CS201
Fall 2019
Section 2
Homework Assignment 2
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I.   Result Tables

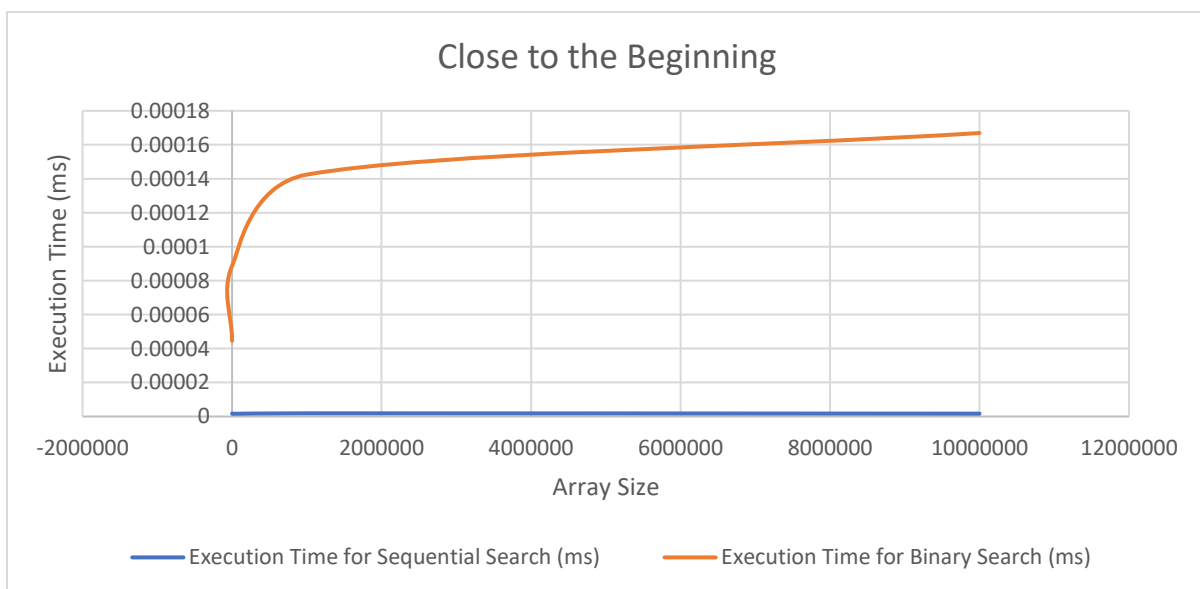# Close to the Beginning

Sequential Search

Array Size	Time (ms)
101	0.0000017558
10001	0.0000016064
1000001	0.0000018875
10000001	0.0000016859

Binary Search

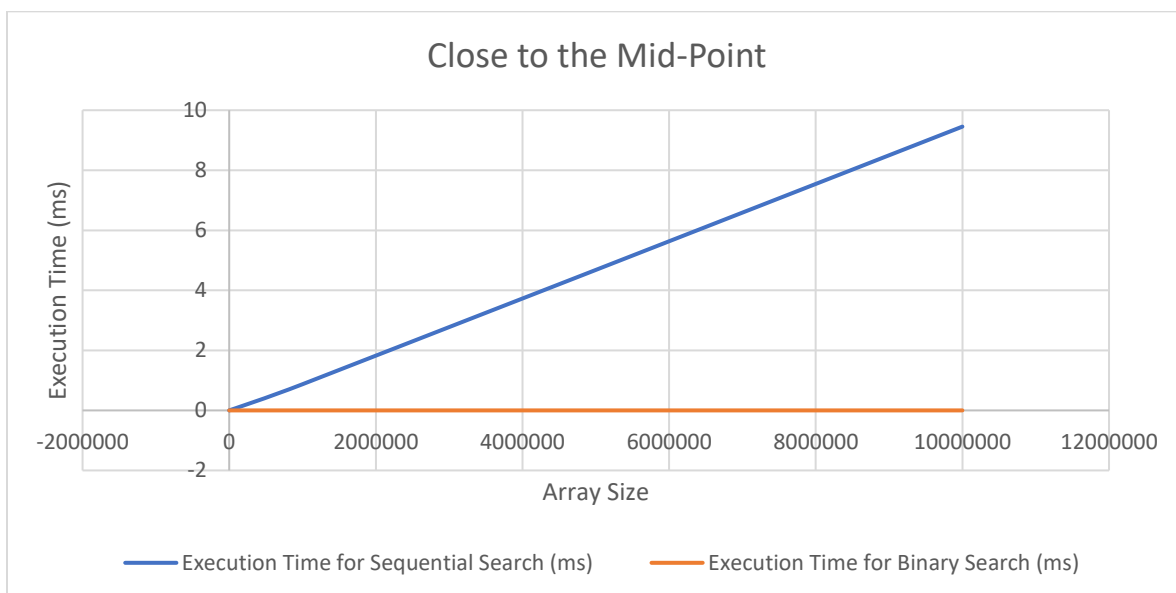| Array Size	Time (ms)
101	0.0000445662
10001	0.0000897338
1000001	0.0001424410
10000001	0.0001669130

Close to the Mid-Point

Sequential Search

Array Size	Time (ms)
101	0.000092
10001	0.008739
1000001	0.872176
10000001	9.453870

Binary Search

Array Size	Time (ms)
101	0.0000080027
10001	0.0000080841
1000001	0.0000079643
10000001	0.0000080284

Close to the End
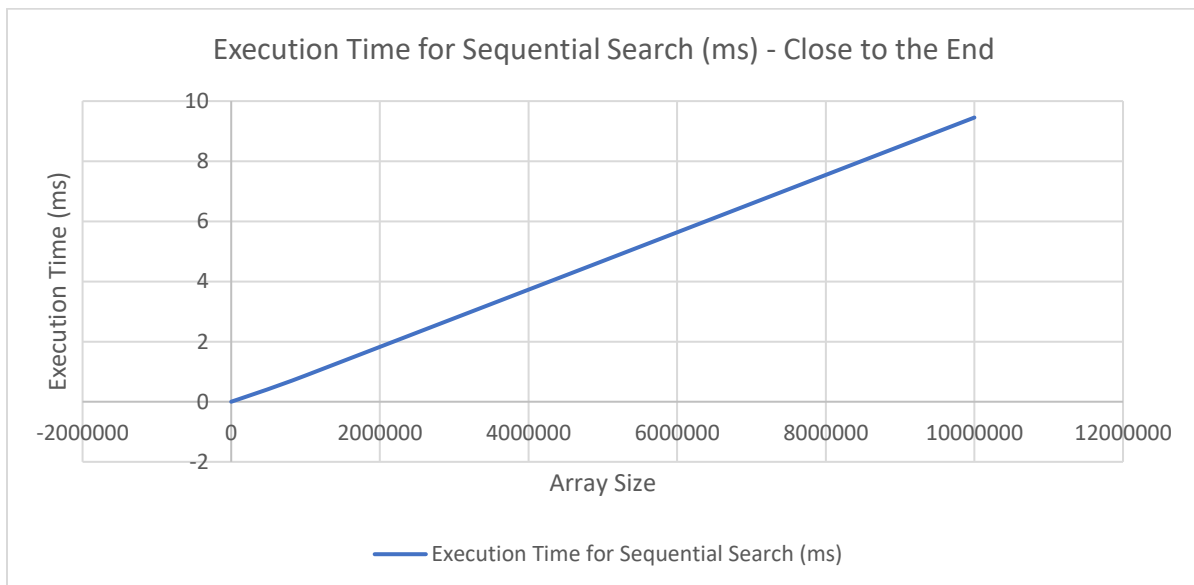
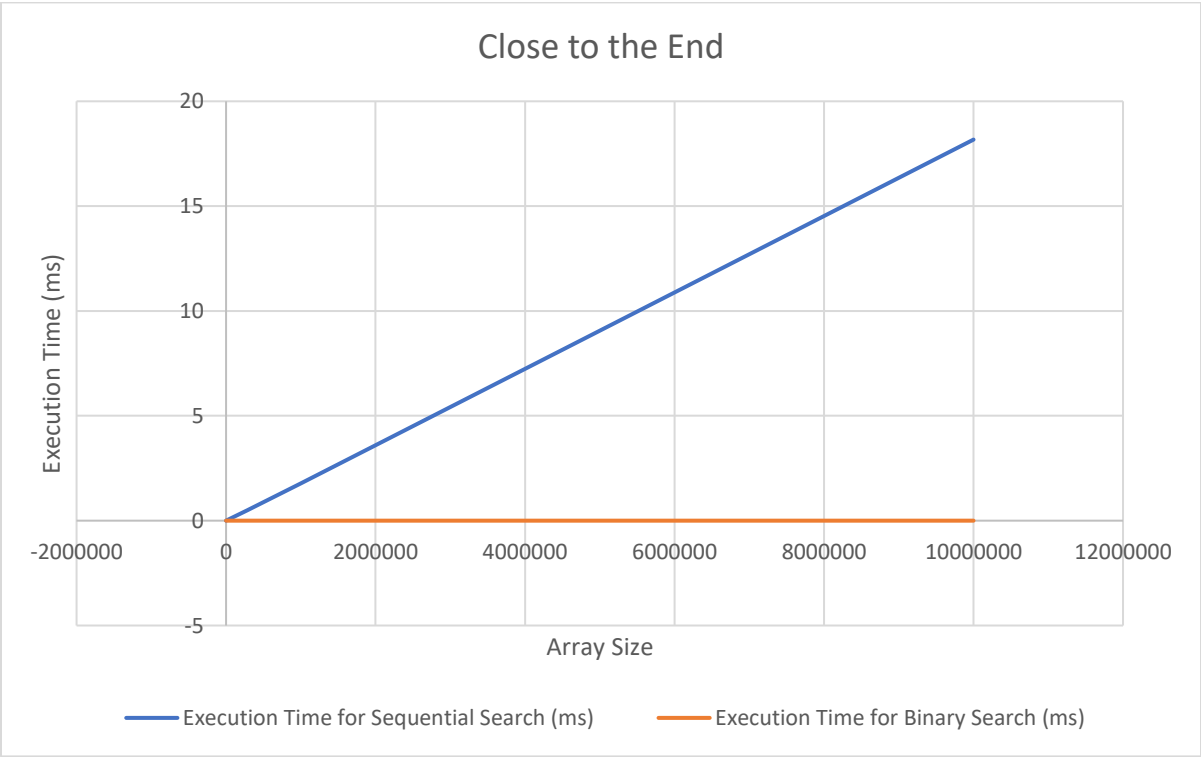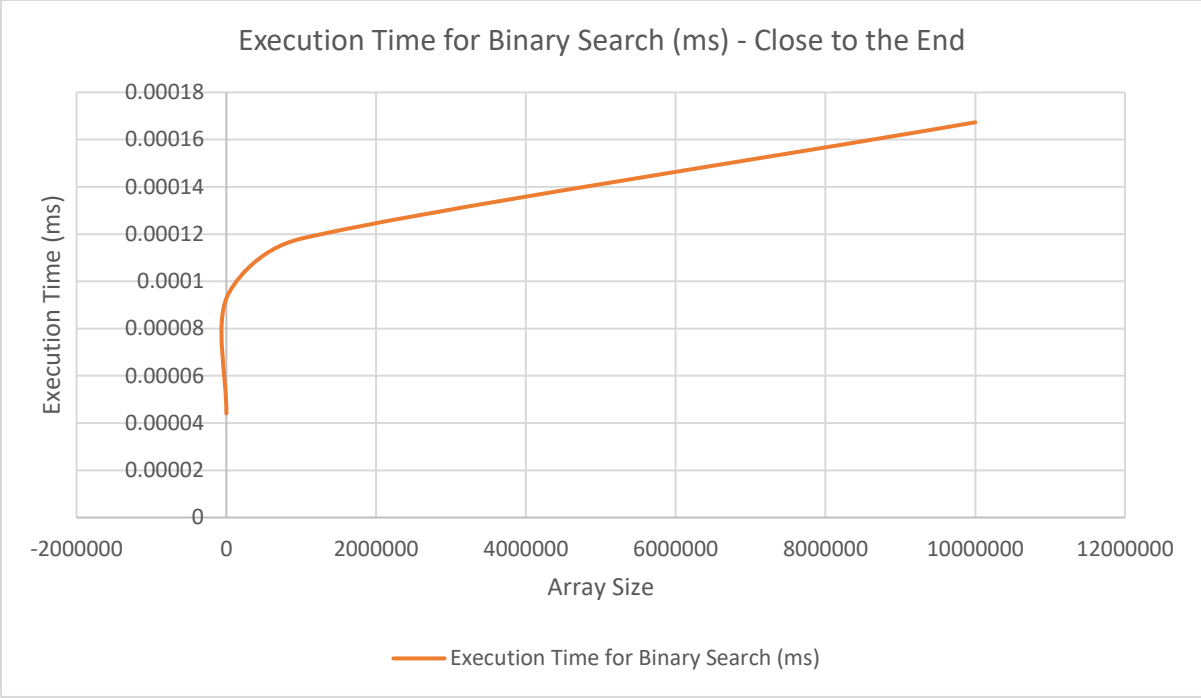**Sequential Search**

Array Size	Time (ms)
101	0.000185
10001	0.017436
1000001	1.7762
10000001	18.1729

Binary Search

Array Size	Time (ms)
101	0.0000440448
10001	0.0000935630
1000001	0.0001180780
10000001	0.0001673350

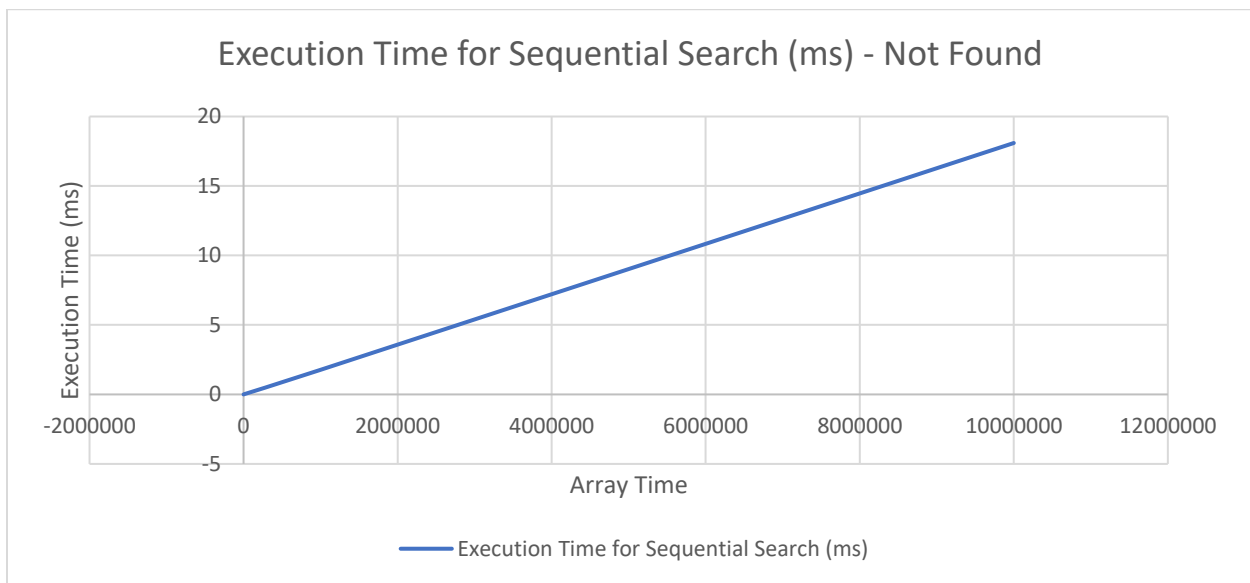Execution Time for Binary Search (ms) - Close to the End

Close to the End

Not Found

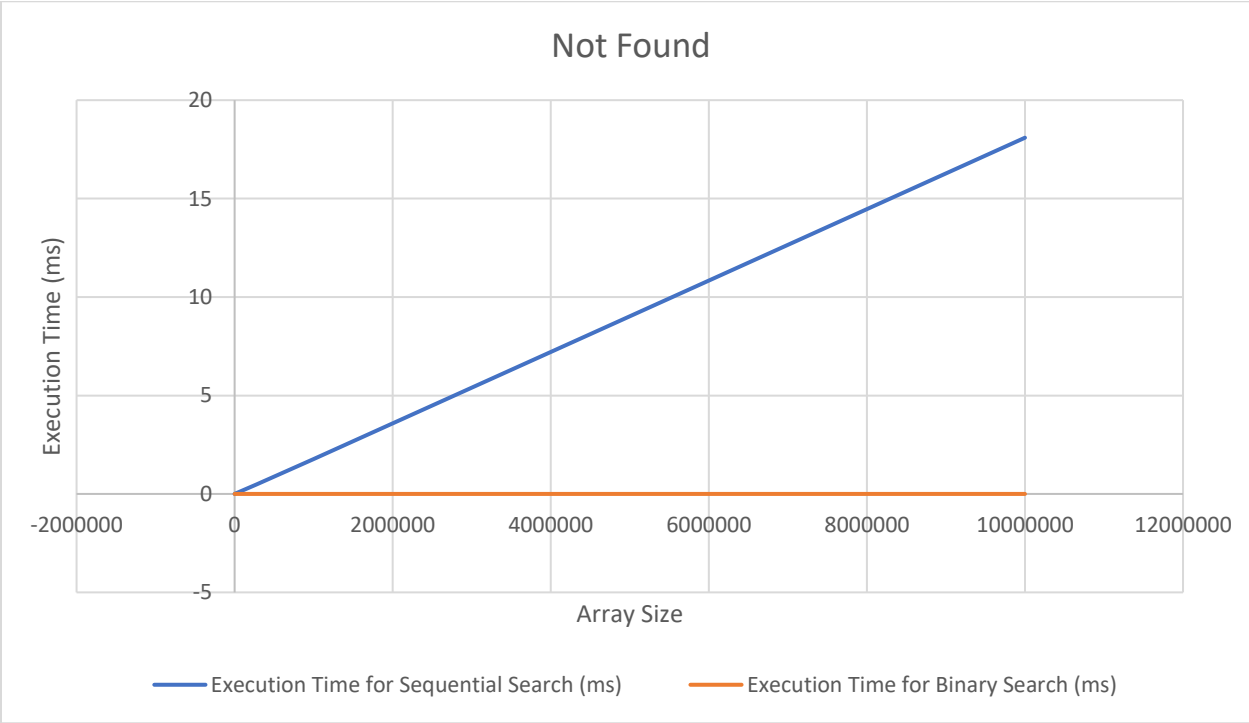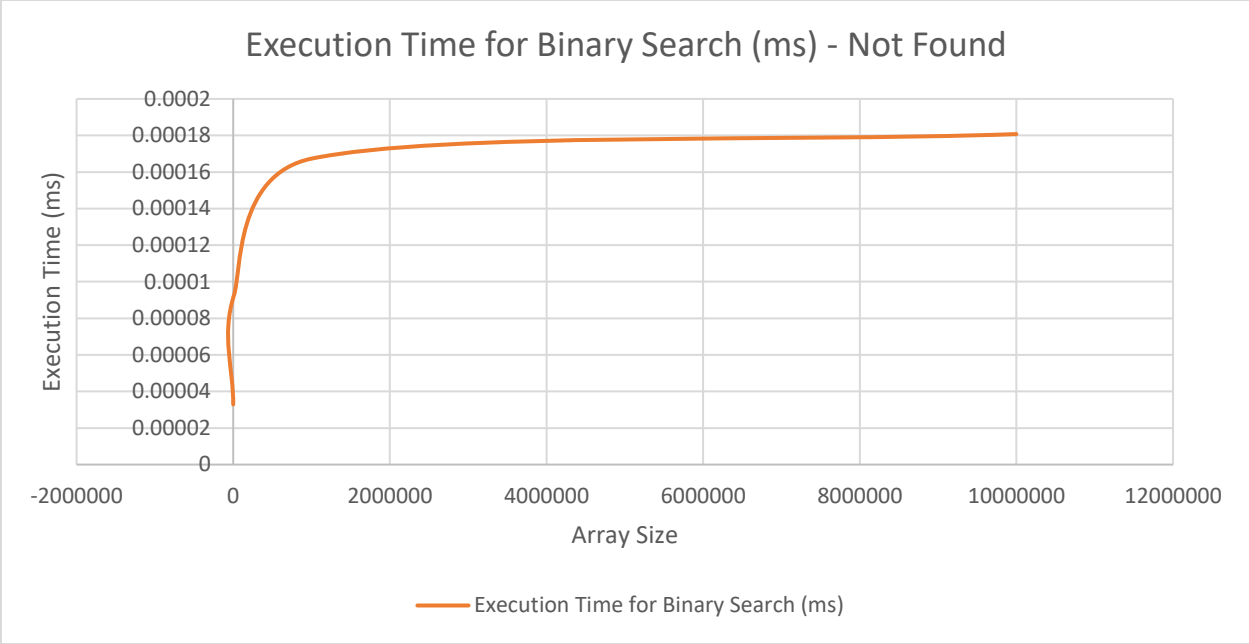**Sequential Search**

Array Size	Time (ms)
101	0.0001873
10001	0.018577
1000001	1.77191
10000001	18.0926

Binary Search

Array Size	Time (ms)
101	0.0000329194
10001	0.0000926171
1000001	0.0001673350
10000001	0.0001807490

Execution Time for Binary Search (ms) - Not Found

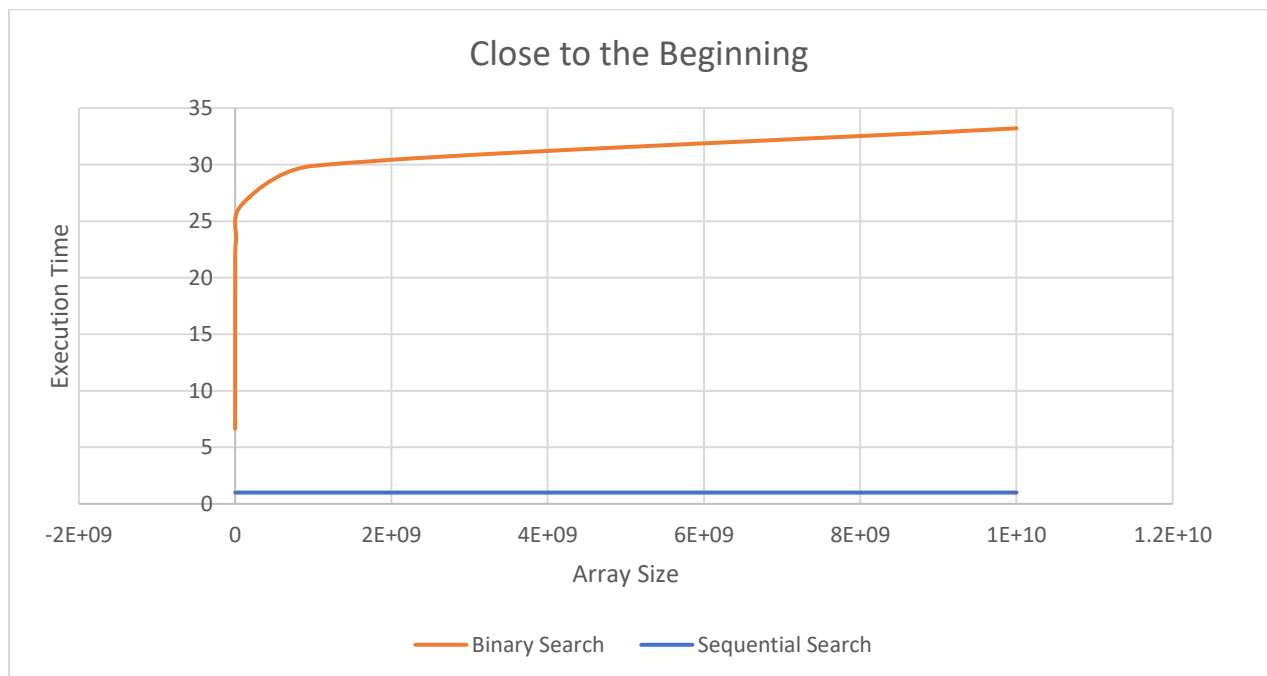Not Found

II. Big O Notations – Best and Worst Cases

Sequential Search

- The best case arises where the key is close to the first index (close to the beginning) ➔ **O(1)**
- The worst case arises where the key is close to the last index or not found in array (close to the end, not found) ➔ **O(N)**
- Average Case ➔ $O(N) = \frac{O(N) + O(1)}{2}$

Binary Search

- The best case arises where the key is at the mid-point of the array (close to the mid-point) ➔ **O(1)**
- The worst case arises where the key is close to the beginning or end or not found (close to the beginning, close to the end, not found) ➔ **O(log(N))**
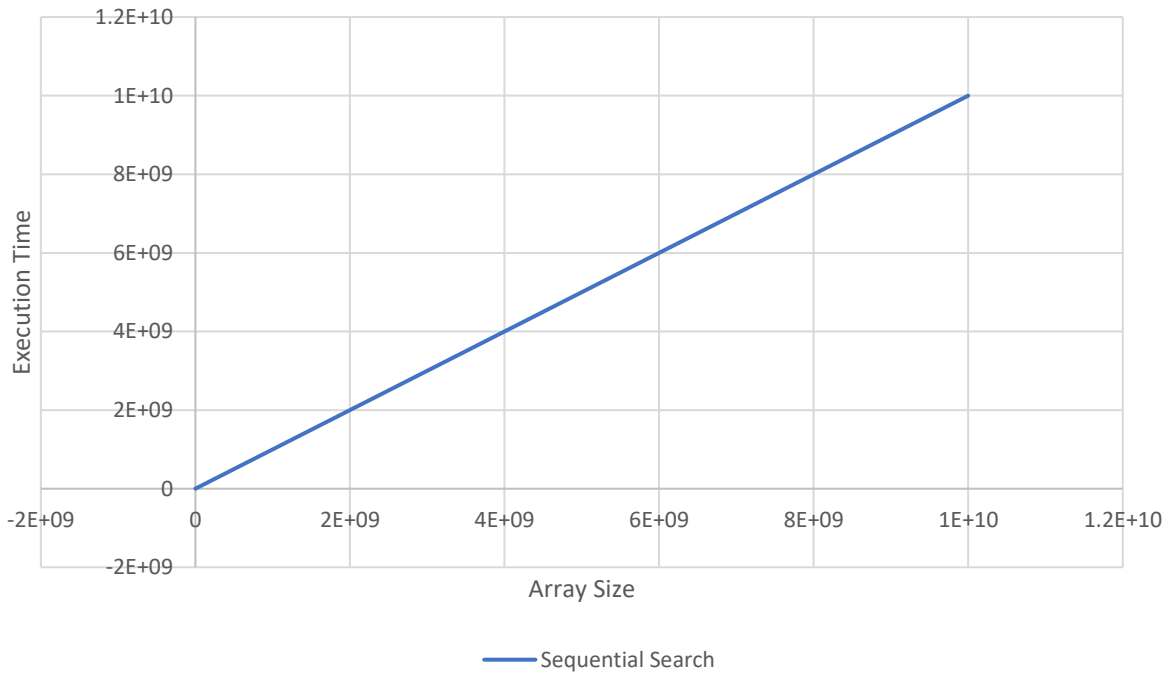- Average Case ➔ $O(\log(N)) = \frac{O(\log(N)) + O(1)}{2}$
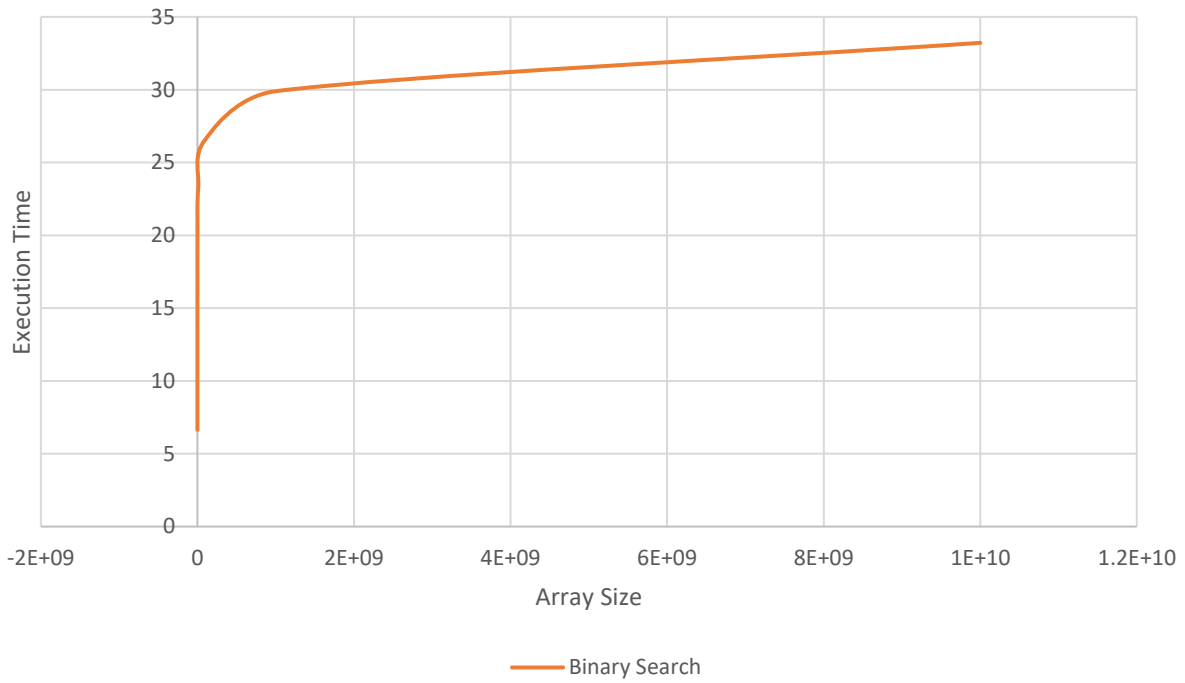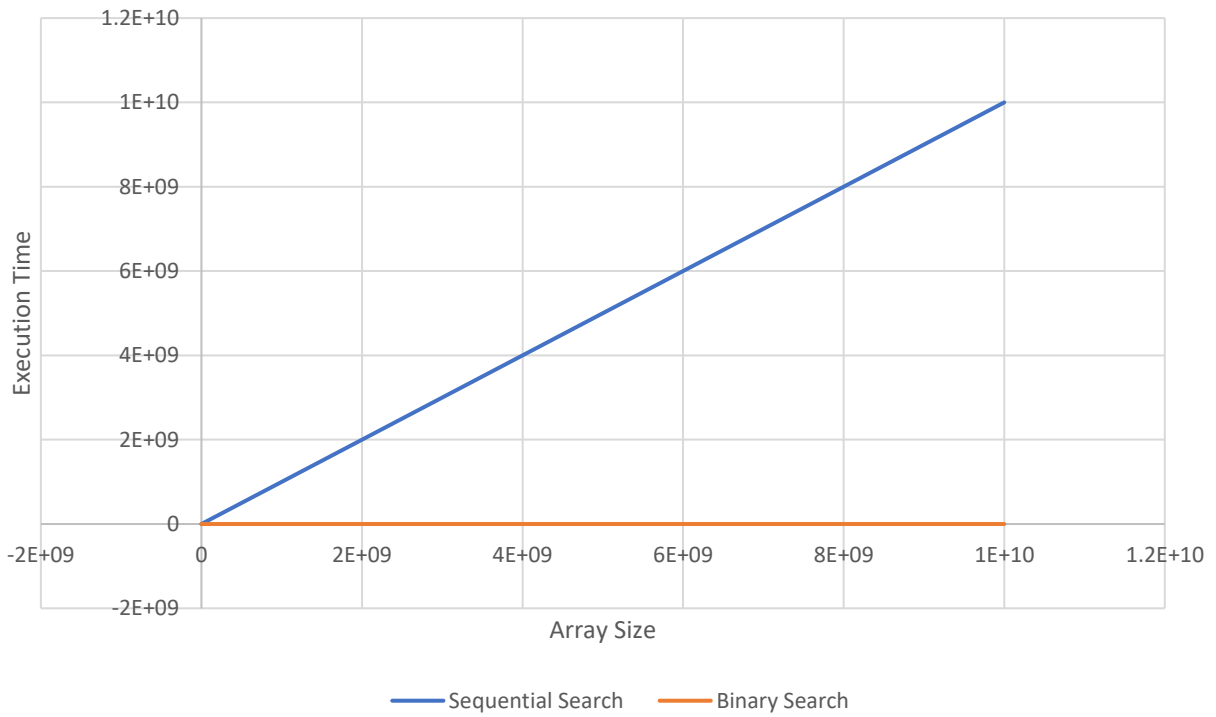
III. Theoretical Graphics

Close to the Mid-Point

Execution Time vs Array Size

Sequential Search — Binary Search
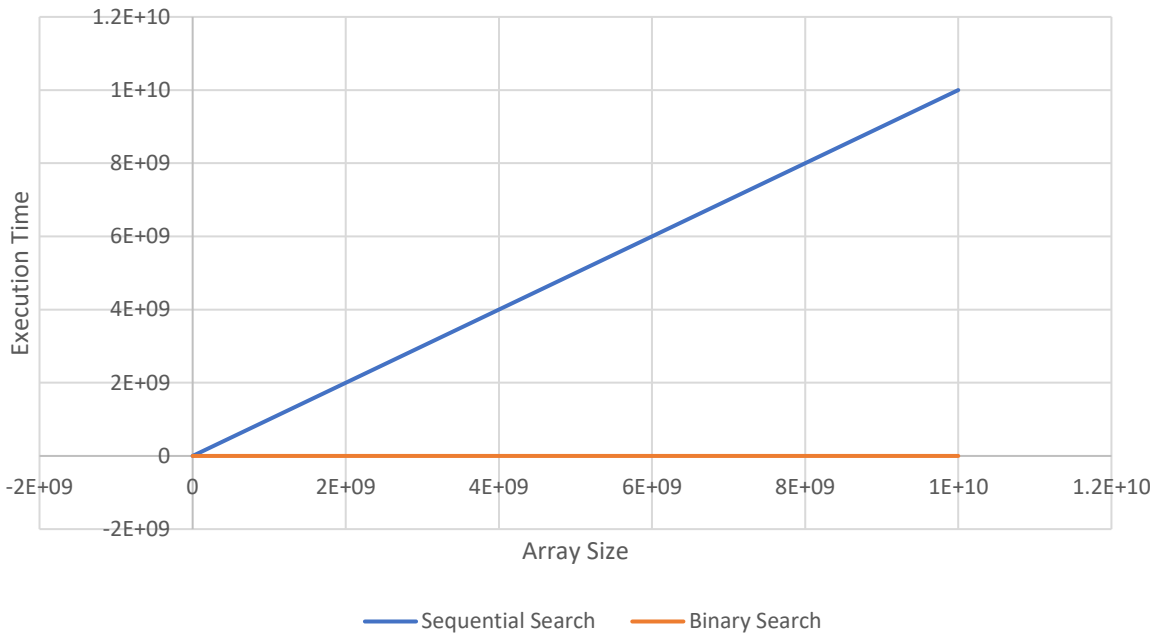
Execution Time for Sequential Search (ms) - Close to the End
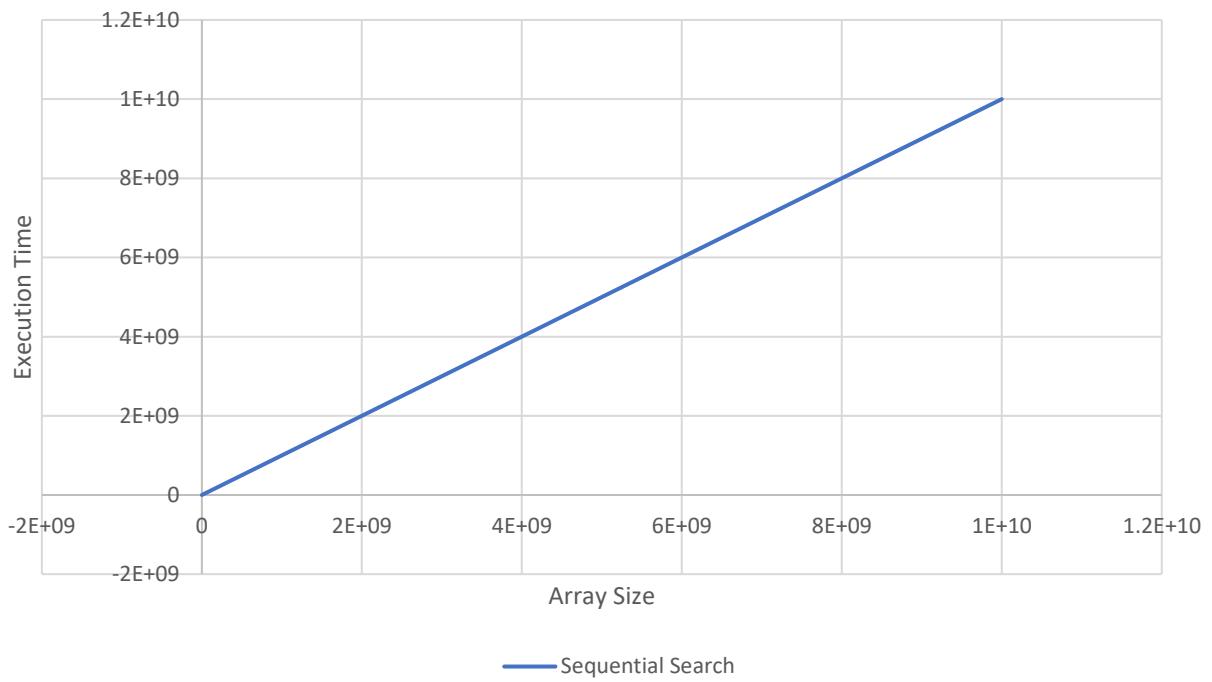
Sequential Search

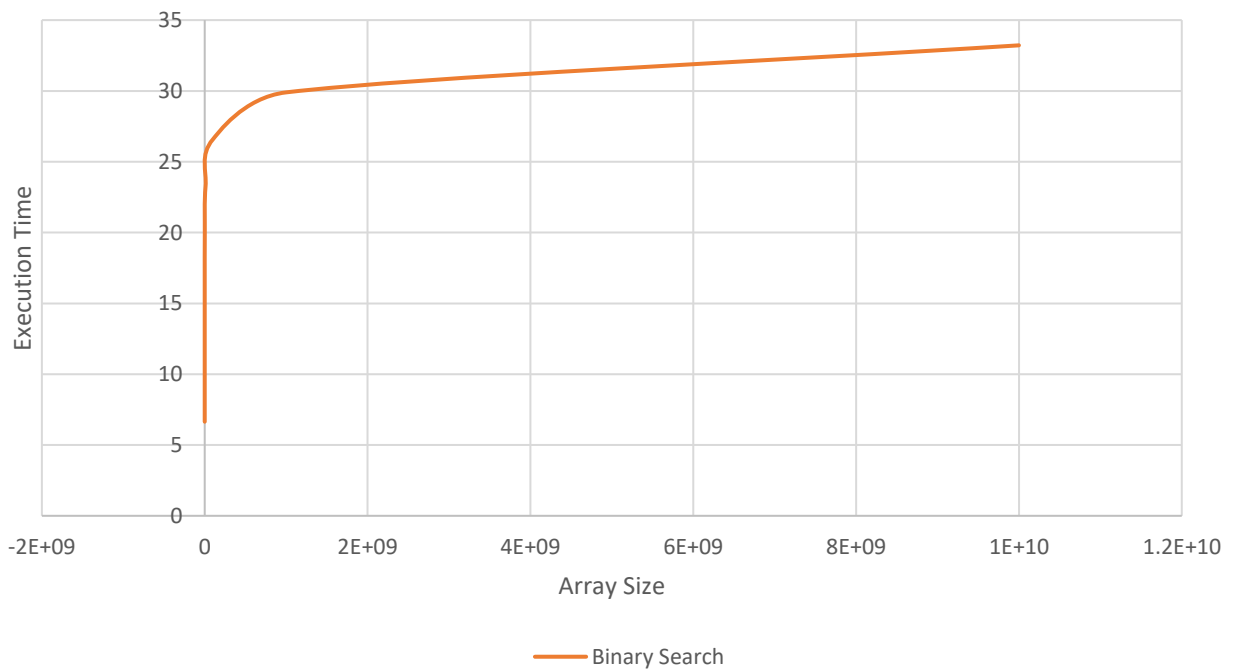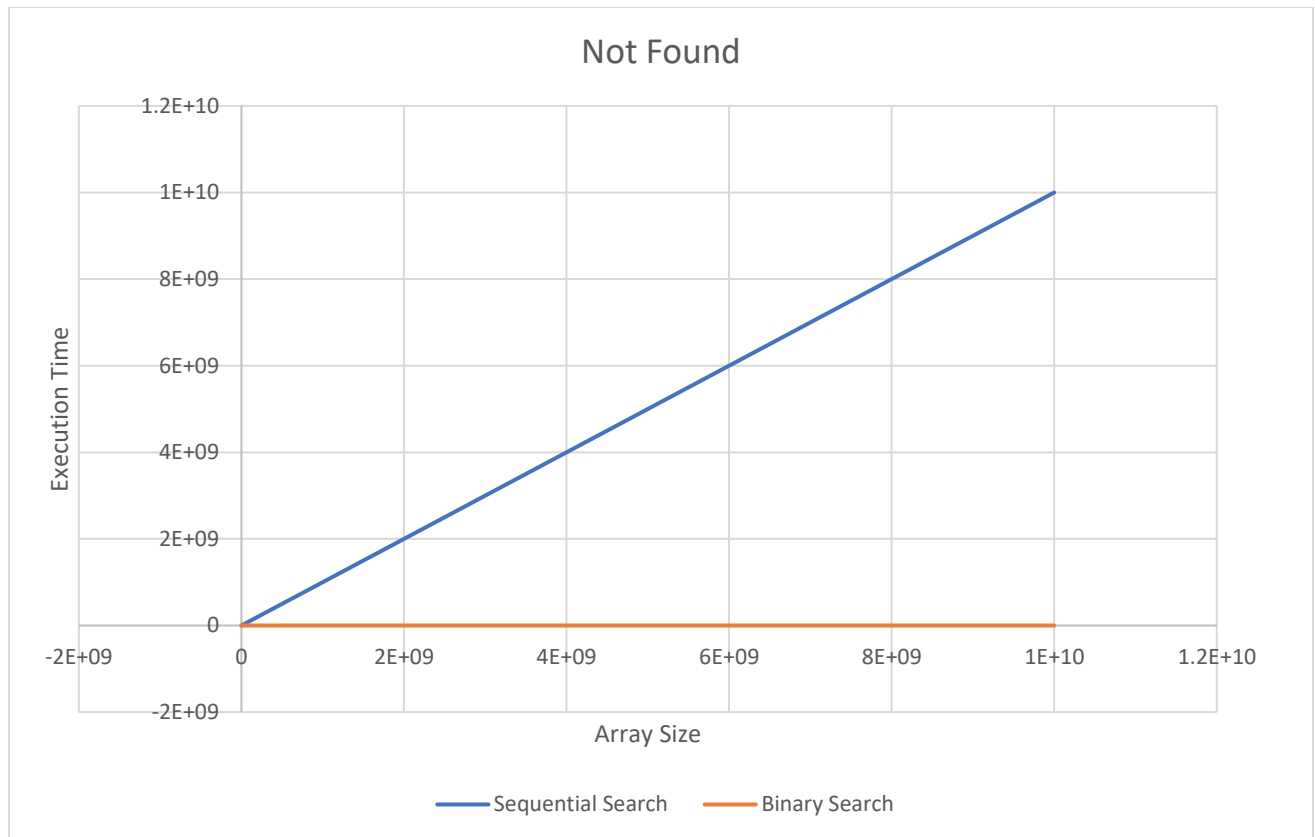# Execution Time for Binary Search - Close to the End

Close to the End

Execution Time for Sequential Search (ms) - Not Found

Execution Time for Binary Search (ms) - Not Found

IV. System Specifications

Vostro 5481

Device name   DESKTOP-C4M6KNV

Processor   Intel(R) Core(TM) i7-8565U CPU @ 1.80GHz   1.99 GHz

Installed RAM 8.00 GB (7.78 GB usable)

V. Conclusion

As we can see in the graphs that are drawn based on our data, although there are some errors based on my computer systems, the graphs are similar to expected graphs that are drawn based on mathematical functions. For sequential search this mathematical function is **O(N)**, so that our graphs should be linear. For binary search this mathematical function is **O(log(N))**, so that our graphs should be logarithmic. As a result, we can see the similarities between graphs of our data and expected graphs.