

Question 2 – Analyzation of Efficiency of Search Algorithms – Alexander Sun

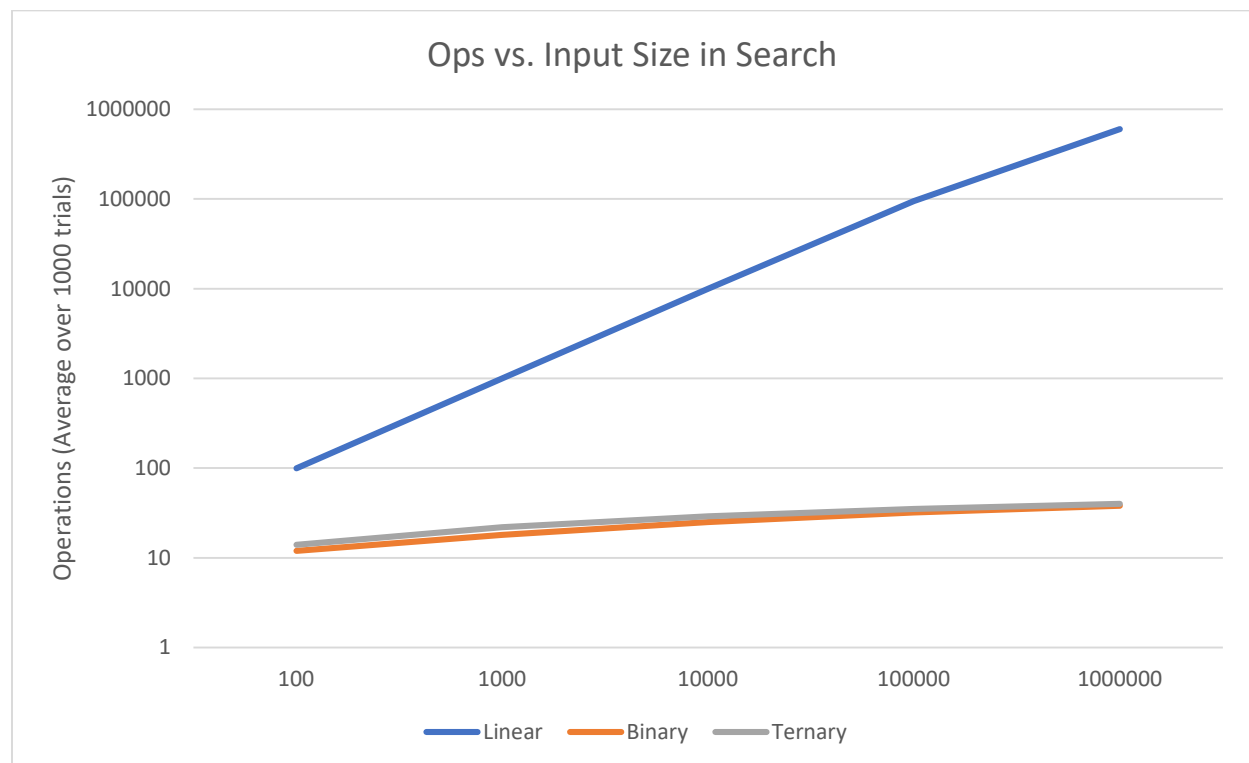
Introduction of Algorithms:

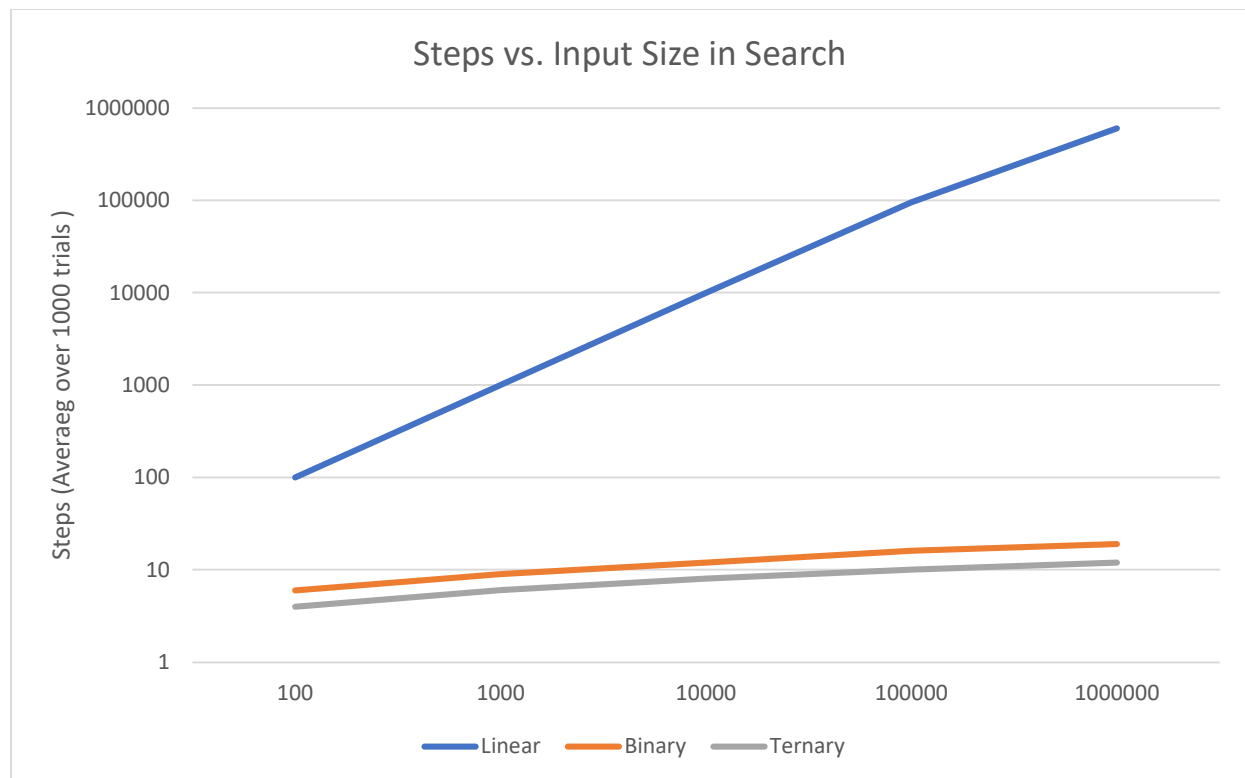
The three search algorithms are Linear Search, Binary Search, and Ternary Search. The first 2 we have seen before, and I chose to implement ternary search as it's a variant of binary search that brings up some interesting considerations. Ternary search acts the same as binary search except that it cuts the array into 3 sections, and then continues to search within the section that the target value would be present in. Its theoretical time complexity is $O(\log_3(n))$. This intrigued me as I wondered why it isn't more commonly used, if it's theoretically more efficient than binary search.

Ops vs. Steps

This is discussed more in a comment in my code, but ops represent the number of comparison operations that occur, and steps refer to the number of times the code loops or number of times searched before the target is found.

Graphs & Data:





Raw Data:

Input Size	Ops Measured			
	Linear	Binary	Ternary	
100		100	12	14
1000		999	18	22
10000		9939	25	29
100000		94909	32	35
1000000		604254	38	40

Input Size	Steps Measured			
	Linear	Binary	Ternary	
100		100	6	4
1000		999	9	6
10000		9939	12	8
100000		94909	16	10
1000000		604254	19	12

Observations/Reflection:

The reason I chose to show both steps & ops here is because from a steps perspective binary search requires more to find the target, as seen from the second graph. However, it averages less operations than ternary search despite this. This shows that binary search may still be more efficient despite

requiring more passes to find the target. This fact would have been neglected if only steps were counted, so I decided to count both and display them graphically.

Furthermore, the step counter is accurate as if you were to take \log_2 and \log_3 of the input size, then you would receive the steps measured in the table. Furthermore, as two operations are required from binary search in most cases, and four operations from ternary search per step, that the ops are pretty close to the theoretical value.