**Bangladesh University of Engineering and Technology**

**Department of Computer Science and Engineering**

**CSE 204**

**Data Structures and Algorithms I Sessional**

Offline 1

Title: Running Time Comparison between Linear Search and Binary Search

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**Objective:** This report shows running time comparison between two searching algorithms: Linear Search and Binary Search. At first, an integer will be taken as input which will be used to allocate an array of that size. Then the array will be filled with random numbers using the rand() function. After that, a random key will be searched using both Binary and Linear search algorithm. Running time will be taken using functions provided by chrono library.

**Machine Configuration:**

Processor: Intel Core i5 8300H CPU @ 2.30GHz, 2304 MHz, 4 Cores, 8 Logical Processors

OS Name: Microsoft Windows 10 Home 64bit

Total Physical Memory: 15.9 GB

Total Virtual Memory: 20.5 GB

GPU: NVIDIA GeForce GTX 1050Ti (4GB)

**Input:**

|  |  |  |
| --- | --- | --- |
| Array Size | Running Time for Linear Search (ns) | Running Time for Binary Search (ns) |
| 100 | 218.44 | 89.85 |
| 200 | 568.87 | 109.74 |
| 500 | 1595.31 | 130.05 |
| 1000 | 2702.77 | 149.43 |
| 2000 | 4901.17 | 179.98 |
| 5000 | 9661.54 | 195.08 |
| 10000 | 21101.6 | 212.21 |

Figure 1: Running time graph for Linear Search.

Figure 2: Running time graph for Binary Search.

Figure 3: Running time comparison between Binary Search and Linear Search.

**Discussion:** Binary search is an extremely efficient algorithm. This search technique consumes less time in searching the given item in minimum possible comparisons. To do the binary search, first, we have to sort the array elements. The sorting was done using merge sort algorithm. Binary search uses divide and conquer approach which makes it hugely faster than Linear Search. It is evident from the table that Binary search has an complexity of O(log 2 n).

On the other hand, in a linear search, each element of an array is retrieved one by one in a logical order and checked whether it is desired element or not. A search will be unsuccessful if all the elements are accessed, and the desired element is not found. In the worst case, the number of an average case we may have to scan half of the size of the array (n/2). The worst-case efficiency of this technique is O(n) stands for the order of execution.

For small array size (such as 10-200) the difference of running time is negligible. However, when a larger array is used, the difference is huge and noticeable. Both linear and binary search algorithms can be useful depending on the application. When an array is the data structure and elements are arranged in sorted order, then binary search is preferred for quicksearching.