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ANALYSIS AND COMPARATIVE STUDY OF SEARCHING TECHNIQUES

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ABSTRACT

We live in the age of technolgy and it is quiet obvious that it is increasing day-by-day endlessly. In this technical era researchers are focusing on the development of the existing technologies. Software engineering is the dominant branch of Computer Science that deals with the development and analysis of the software. The objective of this study is to analyze and compare the existing searching algorithms (linear search and binary search). In this paper, we will discuss both these searching algorithms and compare them on the basis of their time complexities for given set of data.

KEYWORDS: searching, linear search, binary search.

INTRODUCTION

A searching algorithm is an algorithm that allows the efficient retrieval of a particular item from a set of many items. It is used for searching or finding a perticular item from a given list or record .The list may be sorted or unsorted various searching techniques are used depending on the type of list .Searching is the algorithm process of finding a specific item or a set of items in a given collection of item. A searching algorithm typically answers the user whether the item searched by him is present or not. Computer systems are often used to store large amounts of data from which individual records can be retrieved according to some search criterion so, it is our need to search and fetch the data in that manner so that it will take lesser time and will be efficient. For this purpose some approaches are needed that not only saves our time but also fetches the required data efficiently. In this study we will discuss linear and binary search algorithms on the basis of their efficiency and time complexity.

Searching falls into two categories:

1.External searching: External searching is a searching technique that is used to search an item or a record from the external storage device. Thus this technique is used to search an item from a large amount of records that can not be stored in the RAM.

2. Internal searching: Internal searching is a searching technique that is used to search an item or a record from the RAM(Internal storage). Thus this technique is used to search an item from a small amount of records that can be stored in the internal
storage.

WORKING PROCEDURE

Linear search: Linear search or sequential search is used for finding a particular value in a list that checks each elements in sequence untill the desired element is found or the list is exhausted .In this searching the list need not to be ordered for searching the element.It is the simplest searching algorithm.Linear search is a special case of Brute-Force search. Its worst case cost is proportional to the number of elements in the list. Linear search is used when the list has only a few elements or when performing a single search in an unordered list. Linear search is the least efficient search technique among the quantity dependent search techniques. This technique is chosen for searching the records which are stored without considering the order.

Algorithm of linear search-:

Here A is a linear array with N elements, and ITEM is a given item of information. This algorithm finds the location LOC of ITEM in A.

1. Set ctr=L
2. Repeat steps 3 through 4 until ctr>Upper bound.
3. If A[ctr]==ITEM then
{ print "Search successful"
Print ctr, "is the location of", ITEM
Go out of loop
}
4.ctr=ctr+1
5. If ctr>Upper bound then
Print "Search unsuccessful"
6.End.

Binary search: Binary search or half- interval search
technique is a searching technique that finds the position of a target value within a sorted list.It is considered as one of the most efficient searching algorithms as it searches the required item in minimum number of comparisons. The binary search algorithm works on the principle of divide and conquer algorithm and hence executes in the logarithmic time.This algorithm begins by comparing the target value with the value of the middle element of the sorted array.

Algorithm for Binary search:
1. Input an array A of n elements in sorted form.
2. LB=0,UB=n; mid=int((LB+UB))/2)
3. Repeat step 4 and 5 while(LB<=UB) and (A[mid]!=item)
4. If (item<A[mid])
UB=mid-1
Else
LB=mid+1
5. mid=int((LB+UB)/2)
6. If (A[mid]==item)
Print" Item is found"
Else
Print "Item is not found"
7. End.

COMPLEXITY ANALYSIS

Linear Search: If a list consist of n elements, the best case is when the value of item to be searched is equal to the first element of the list, in this case only one comparison is required to search the given item. Worst case is when the item is not present in the list or occurs only once at the end of the list, in this case n comparisons are required to search the given item. If the value to be searched occurs k times in the list, the expected number of comparisons to take place is n if k=0

$n+1$

$k+1$

if $1 \leq k \leq n$.

For example, if the item occurs only once in the list, and all orderings of list are equally likely, the expected number of comparisons is

$\frac{n+1}{2}$

. However, if it is known that the item occurs only once, then at most n-1 comparisons are needed and the expected number of comparisons is

$\frac{(n+1)(n-1)}{2}$

.

Binary search: If a list consists of n elements, the best case in binary search algorithm is when the item to be searched is found in first comparison only i.e it is present at the mid position of the list. The worst case will occur when the value is not present in the list (or is found at the last comparison).

COMPARATIVE STUDY

TABLE 4.1: Comparison on the basis of various parameters

Parameter	*Linear Search*	*Binary Search*
Searching Approach	*Sequential*	*Divide and conquer*
Time complexity:- *Best case* *Average case* *Worst case*	 *O(1)* *O(n)* *O(n)*	 *O(1)* *$O(\log_2 n)$* *$O(\log_2 n)$*
Sorting Required	*No*	*Yes*

Table 4.2: Advantages and disadvantages of searching algorithms

Searching type	*Linear Search*	*Binary Search*
Advantages	*Simple, Resource Efficient,Memory Efficient.* *Operates equally well on sorted and unsorted data.*	*It is faster as compared to linear search.* *It can be used for larger amount of data.*
Disadvantages	*It is a slow searching technique.* *The average and worst case complexities are very poor.* *Very less efficient for larger lists.*	*The list must be sorted to perform binary search.* *Less efficient for the lists where large number of insertions and deletions are required.*

CONCLUSION

In this paper we have discussed about various searching techniques. Binary search is more efficient as compared to linear search as its time complexity is less as compared to linear search. The linear search algorithm is suitable only for those lists which are small while the binary search can be used for larger lists in which elements are arranged in sorted form.

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