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ANALYSIS AND COMPARATIVE STUDY OF SEARCHING TECHNIQUES

Ayush Pathak
Acropolis Institute of Technology & Research, Indore, India

ABSTRACT

The current age is the age of technology. In this technical era researchers are focusing on new development and comparing the existing technologies. Software engineering is the dominant branch of Computer Science that is associated 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 complexity for given set of data.

KEYWORDS: searching, linear search, binary search.

INTRODUCTION

A searching algorithm is that type of algorithm that allows the efficient retrieval of a particular item from a set of many items. Searching is the algorithm process of finding a specific item in a collection of item. A search typically answers the user whether the item he searched for 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 means searching the records using keys where there are many records, which resides in the files stored on disks. This is the type of searching in which the data on which searching is done resides in the secondary memory storage like hard disk or any other external storage peripheral device.

2. **Internal searching:** Internal searching is that type of searching technique in which there is less amount of data which entirely resides within the computer's main memory. In this technique data resides within the main memory on

WORKING PROCEDURE

Linear search: Linear search is the type of searching algorithm in which each element of the array is compared with the desired item to be searched for, one by one. This method, which traverses the array sequentially to locate the desired item, hence it is called sequential search or linear search. Linear search is the least efficient search technique among the quantity dependent search techniques. This technique is chosen for searching the records 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 is an extremely efficient algorithm. This search technique searches the required item in minimum number of comparisons. The binary search requires the array, to be scanned, must be stored in any order that is either ascending or descending. In binary search, we first compare the key with the item in the middle position of the array. If there is a match, we can return immediately. If the key is less than middle key, then the item must lie in the lower half of the array; if it is greater, then the item must lie in the upper half of the 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: For a list with **n** items**,** 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 needed. Worst case is when the value is not in the list or occurs only once at the end of the list, in this case **n** comparisons are needed.

If the value to be searched occurs k times in the list, the expected number of comparisons to take place is

$$\begin{cases} n & \text{if } k=0 \\ \frac{n+1}{k+1} & \text{if } 1\leq k\leq n. \end{cases}$$

For example, if the value occurs 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 it occurs once, then at most n-1 comparisons are needed and the expected number of comparisons is $\frac{(n+1)(n-1)}{2}$.

Binary search: For a list with **n** items, the best in binary search algorithm is when the item to be searched is found in first comparison only. The worst case is same as the linear search when the value is not in the list (or is found in 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
Worst case
Average 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, easy to understand and easy to implement. It searches the element in the list, no matter whether the list is sorted or not.	It is comparatively fast than linear search. It can be used for large amount of data. It takes lesser amount of time.
Disadvantages	It is a slow process. It is used for small amount of data. It is a very time consuming method.	Binary search requires that the items in the array should be sorted. Binary search cannot be used where there are many insertions or deletions.

CONCLUSION

In this paper we have discussed about the different searching techniques. The time complexity of binary search is less as compared to linear search. The linear search algorithm is suitable only for that type of list which is small and is not sorted while the binary search can be used for large amount of data needed the data must be in sorted form.

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