



Searching

Lab Assignment

Implement the two searching approaches (more specifically, linear search and binary search) discussed in the following. You are supposed to compare these two searching approaches based on the average number of comparisons. Execute these approaches (at least) 10 times for (at least) 50 numbers.

Input: Number of elements in the array and a key to search.

Output: Average number of comparisons by both approaches. For each run print, whether the key has been found or not.

-- You are encouraged to use random number generator to generate the elements of the array.

-- You are encouraged to use dynamically allocated arrays.

[Helps provided at the end].

[Search approaches are described in the following].

Search I

- No information about the elements



Search I

- No information about the elements



Search I

- No information about the elements



Search I

- No information about the elements



Search II



$$a_i \leq a_{i+1}$$

Search II

6

11

14

18

24

26

29

34

38

44

49

51

83

Search II

<i>6</i>	<i>11</i>	<i>14</i>	<i>18</i>	<i>24</i>	<i>26</i>	<i>29</i>	<i>34</i>	<i>38</i>	<i>44</i>	<i>49</i>	<i>51</i>	<i>83</i>
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Search key = 38

Search II



6	11	14	18	24	26	29	34	38	44	49	51	83
---	----	----	----	----	----	----	----	----	----	----	----	----

Search key = 38

Compare with element in middle = 29

Same?

Search II



6	11	14	18	24	26	29	34	38	44	49	51	83
---	----	----	----	----	----	----	----	----	----	----	----	----

Search key = 38

Compare with element in middle = 29

Same? No

Search II



6	11	14	18	24	26	29	34	38	44	49	51	83
---	----	----	----	----	----	----	----	----	----	----	----	----

Search key = 38

Compare with element in middle = 29

Same? No

Smaller or Larger than key?

Search II



6	11	14	18	24	26	29	34	38	44	49	51	83
---	----	----	----	----	----	----	----	----	----	----	----	----

Search key = 38

Compare with element in middle

Same? No

Smaller or Larger than key? Smaller

Search II



6	11	14	18	24	26	29	34	38	44	49	51	83
---	----	----	----	----	----	----	----	----	----	----	----	----

Search key = 38

Compare with element in middle

Same? No

Smaller or Larger than key? Smaller
Search in right subarray

Search II



Search key = 38

Only right subarray to be considered

Search II



Search key = 38

Compare with element in middle = 44

Same?

Search II



Search key = 38

Compare with element in middle = 44

Same? No

Search II



Search key = 38

Compare with element in middle = 44

Same? No

Smaller or Larger than key?

Search II



Search key = 38

Compare with element in middle = 44

Same? No

Smaller or Larger than key? Larger

Search II



Search key = 38

Compare with element in middle = 44

Same? No

Smaller or Larger than key? Larger

Search in left subarray

Search II



Search key = 38

Compare with element in middle = 44

Same? No

Smaller or Larger than key? Larger

Search in left subarray

Search II



Search key = 38

Compare with element in middle = 38

Same? Yes

Success

Search II

Binary Search (A, n, key)

$l = 0$

$r = n - 1$

while $l \leq r$ do

$mid = \text{floor}((l + r)/2)$

 if $A[mid] < key$ then

$l = mid + 1$

 else if $A[mid] > key$ then

$r = mid - 1$

 else

 return mid

return unsuccessful

Random Number Generation

```
#include <stdlib.h>
#include <time.h>
```

```
srand(time(NULL)); //once
```

```
rand()%30; // everytime
```

Generating in sorted order

```
arr[0] = rand()%100;
```

```
//for sorted order
```

```
for(int i = 1; i < arr_size; i++){
    arr[i] = arr[i - 1] + rand()%30;
}
```

Dynamic Array Allocation

```
int *arr;
```

```
int arr_size;
```

```
printf("enter number of elements\n");
scanf("%d",&arr_size);
```

```
arr = (int*)malloc(arr_size*sizeof(int));
```

```
if(arr == NULL){
    printf("MEMORY ALLOCATION ERROR\n");
    exit(0);
}
```


Whiteboard