

Searching Algorithms

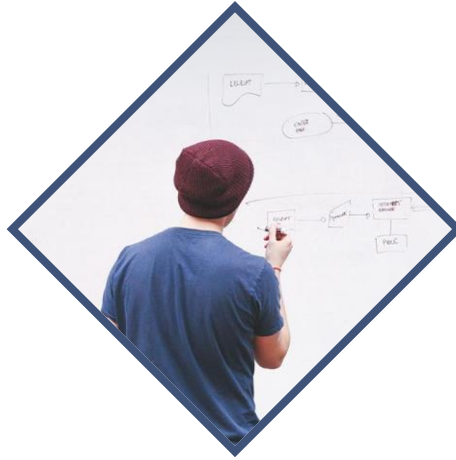




Searching Algorithms

Searching Algorithms แบ่งเป็น 2 ประเภท

1. Sequential Search
2. Binary Search



Sequential Search

ขั้นตอนวิธีนี้ จะทำการค้นหาใน List หรือ Array แบบเป็นลำดับไป
ตั้งแต่ต้นจนกว่าจะเจอ หรือจนกว่าครบทุก Element



Sequential Search

Best Case

$O(1)$

Average Case

$O(n)$

Worst Case

$O(n)$

Natural Language



Sequential Search

1. ให้ i เริ่มต้นที่ 0
2. วงลูป
3. ถ้า array ในตำแหน่ง i มีค่าเท่ากับ ค่าที่ค้นหา ให้
4. return ตำแหน่งของข้อมูลที่ค้นหา
5. จบเงื่อนไข if
6. ทำจนกระทั่งครบทุกตัวใน array // จนกว่า i จะมีค่ามากกว่าหรือเท่ากับขนาดของ array
7. return -1

Pseudocode

The background features a light blue gradient. A large, dark blue arrow-shaped shape points from the left towards the right, containing the text 'Pseudocode'. Below this, a horizontal orange bar is positioned, with a dark blue arrow-shaped shape pointing from the right towards the left, overlapping the orange bar.



Sequential Search

1. for $i=0$ to ArraySize do $i++$
2. if array[i] = find then
3. return i
4. end if
5. end of for loop
6. return -1

C Source Code Example

The background features a dark blue horizontal band with a diagonal cut on the right side. Below this band is a light blue area, and at the bottom, there is a thick orange horizontal bar with a diagonal cut on the left side.



Sequential Search

```
int linearSearch (int *array, int arrSize, int find) {  
    for(int i=0; i<arrSize; i++) {  
        if(array[i] == find) {  
            return i;  
        }  
    } // end of for loop  
    return -1;  
} // end of function
```



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

```
for(i=0;i<arrSize;i++)
```



Sequential Search

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for(i=0;i<arrSize;i++)
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Sequential Search

Array	76	1	38	55	94	89	14
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Find i ArraySize

True for(i=0;i<arrSize;i++)



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

```
if(array[i]==find)
```

```
return i;
```




Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

False if(array[i]==find)

return i;



Sequential Search

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Find i ArraySize

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for(i=0;i<arrSize;i++)
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Sequential Search

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Find i ArraySize

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Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

True for($i=0; i < arrSize; i++$)



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find

55

i

1

ArraySize

7

```
if(array[i]==find)
```

```
return i;
```



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find	55	i	1	ArraySize	7
------	----	---	---	-----------	---

False if(array[i]==find)

return i;



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

```
for(i=0;i<arrSize;i++)
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Sequential Search

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Sequential Search

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True for(i=0;i<arrSize;i++)



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find

55

i

2

ArraySize

7

```
if(array[i]==find)
```

```
return i;
```



Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find i ArraySize

False if(array[i]==find)

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Sequential Search

Array	76	1	38	55	94	89	14
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Find i ArraySize

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for(i=0;i<arrSize;i++)
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Sequential Search

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Find i ArraySize

True for($i=0;i<arrSize;i++$)



Sequential Search

Array	76	1	38	55	94	89	14
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Find i ArraySize

```
if(array[i]==find)
```

```
return i;
```



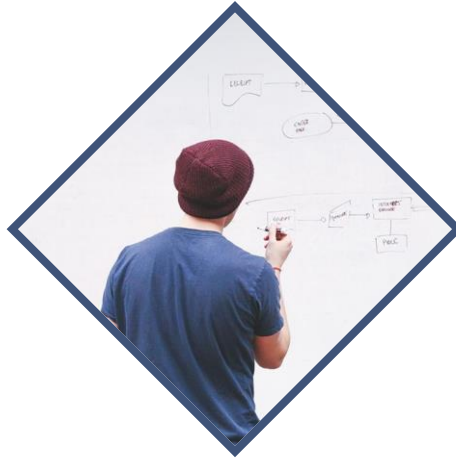
Sequential Search

Array	76	1	38	55	94	89	14
	Index 0	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6

Find	55	i	3	ArraySize	7
------	----	---	---	-----------	---

True if(array[i]==find)

return i;



Binary Search

ขั้นตอนวิธีนี้ จะค้นหาจากตรงกลางเป็นต้นมา
เหมาะสำหรับ List หรือ Array ที่ถูกเรียงลำดับแล้ว

Natural Language



Binary Search

1. ตัวบอกตำแหน่งตัวแรก = 0
2. ตัวบอกตำแหน่งตัวสุดท้าย = ขนาดของ array ลบ 1
3. ตัวบอกตำแหน่งตัวกลาง = (ตัวแรก บวก ตัวสุดท้าย) หาร 2



Binary Search

4. **while** (ตัวแรก **น้อยกว่าหรือเท่ากับ** ตัวสุดท้าย) **และ** (array ในตำแหน่งกลาง **ไม่เท่ากับ** ค่าที่ค้นหา)
5. **ถ้า** ค่าที่ค้นหา **<** array ในตำแหน่งกลาง **ให้**
6. เลื่อนตัวสุดท้ายมาอยู่ที่ตำแหน่งข้างหน้าตัวกลาง
7. **มิฉะนั้น**
8. เลื่อนตัวแรกมาอยู่ที่ตำแหน่งข้างหลังตัวกลาง
9. **จบเงื่อนไข if**
10. หาตำแหน่งกลางใหม่ โดยให้นำค่า (ตัวแรก **บวก** ตัวสุดท้าย) **หาร 2**
11. **จบ while loop**
12. **ถ้า** ค่าตัวแรก **มีค่ามากกว่า** ค่าตัวสุดท้าย **ให้**
13. **return -1**
14. **จบเงื่อนไข if**
15. **return** ตำแหน่งของข้อมูลที่ต้องการค้นหา

Pseudocode

The background features a light blue gradient. A large, dark blue arrow-shaped shape points from the left towards the right, containing the text 'Pseudocode'. Below this, a horizontal orange bar is positioned, with a dark blue arrow-shaped shape pointing from the left towards the orange bar.



Binary Search

1. `first = 0`
2. `last = ArraySize - 1`
3. `mid = (first + last) / 2`

4. `while (first <= last) AND (x[mid] != find)`
5. `if find < x[mid] then`
6. `last = mid - 1`
7. `else`
8. `first = mid + 1`
9. `end if`
10. `mid = (first + last) / 2`
11. `end while`
12. `if first > last`
13. `return -1`
14. `end if`
15. `return mid`

C Source Code Example

The background features a dark blue horizontal band on the left side, which tapers to a point on the right. Below this band, there is a light blue area and a white area. A thick orange horizontal bar is positioned at the bottom, starting from the right edge and extending towards the left, ending under the dark blue band.



Binary Search

```
int binarySearch(int *array, int arrSize, int find) {  
    int first = 0, last, mid;  
    last = arrSize - 1;  
    mid = (first + last) / 2;
```

```
    while((first <= last) && (x[mid] != find)) {  
        if(find < array[mid]) {  
            last = mid - 1;  
        }  
        else {  
            first = mid + 1;  
        }  
        mid = (first + last) / 2;  
    } //end of while loop  
    if(first > last) {  
        return -1;  
    }  
    return mid;  
} // end of function
```



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index	Index
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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Find

557



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Find

First

`first = 0;`



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Find

First

Last

```
last = arrSize - 1;
```



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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Find First Last Mid

$$\text{mid} = (\text{first} + \text{last}) / 2;$$



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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Find First Last Mid

```
while((first <= last) && (array[mid] != find))
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True while((first <= last) && (array[mid] != find))



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Find First Last Mid

```
if(find < array[mid])  
    last = mid - 1;
```



Binary Search

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Find First Last Mid

else

`first = mid + 1;`



Binary Search

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Find First Last Mid

$$\text{mid} = (\text{first} + \text{last}) / 2;$$



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Find First Last Mid

```
while((first <= last) && (array[mid] != find))
```



Binary Search

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Find First Last Mid

```
if(find < array[mid])  
    last = mid - 1;
```



Binary Search

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Find First Last Mid

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Find First Last Mid

```
while((first <= last) && (array[mid] != find))
```



Binary Search

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Find First Last Mid

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if(find < array[mid])  
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First

Last

Find

557

First

12

Last

12

Mid

13

$\text{mid} = (\text{first} + \text{last}) / 2;$



Binary Search

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First

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while((first <= last) && (array[mid] != find))
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Last

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First

Last

Find

557

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12

Last

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Mid

12

```
if(first > last)
```

```
    return -1;
```



Binary Search

Array	55	72	95	106	122	330	361	383	408	420	473	481	557	619	751	939
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First
Last

Find First Last Mid

False if(first > last)

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Binary Search

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First

Last

Find

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12

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Mid

12

```
return mid;
```


แหล่งอ้างอิง

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