

LAB EXERCISE 6

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Exercise 1

index
DATA

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

unsorted

(A)

a) i) 49

search-key = 49
array size = 9

step 1

index -1

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 49

step 2

index 0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 49

$p = 0$

$\therefore$ search for key 49 is successful.

ii) 4

search-key = 4
array size = 9

step 1

index -1

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 2

index 0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 3

index 1

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 4

index 2

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 5

index 3

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 6

index 4

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 7

index 5

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 8

index 6

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 9

index 7

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 10

index 8

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

step 11

index 9

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 4

$p = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9$

$\therefore$ search for key 4 is successful.

iii) 37

search-key = 37
array size = 9

step 1

index -1

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]

49	21	34	35	40	7	15	26	12	4
----	----	----	----	----	---	----	----	----	---

search-key 37

step 2

index 0

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]

49	21	34	35	40	7	15	26	12	4
----	----	----	----	----	---	----	----	----	---

search-key 37

step 3

index 1

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]

49	21	34	35	40	7	15	26	12	4
----	----	----	----	----	---	----	----	----	---

search-key 37

step 4

index 2

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]

49	21	34	35	40	7	15	26	12	4
----	----	----	----	----	---	----	----	----	---

search-key 37

step 5

index 3

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 6

index 4

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 7

index 5

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 8

index 6

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 9

index 7

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 10

index 8

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

step 11

index 9

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
49	21	34	35	40	7	15	26	12	4

search-key 37

$p = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \Rightarrow$ search key is not matched

$\therefore$ search for key 37 is unsuccessful.

(b)

Searching time for search_key = 49 is faster than searching time for search key (4) and search key (37). This can be proved by the efficiency of searching techniques for search key (49) is **$O(1)$** .

Meanwhile, efficiency of searching time for search key(4) and search key (37) is **$O(n)$**

Thus, efficiency of search key (4) is **more efficient** than others search key.

(c)

The function of break statement is It will terminate searching when the search key is found or until the search process has reach the last element of the array

①

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA	4	7	12	15	21	26	34	35	40	49

sorted

int SortedSeqSearch (int search key, int array[], int array_size)

```
{  int p;
    int index = -1;    //-1 means record not found
    for (p = 0; p < array_size; p++)
    {
        // loop terminats when the value of
        // search key is smaller than the current array
        // element
        else // key is found
        {
            index = p;
            // assign current index
            break;
        } // end else-if
    } //end for
    return index;
    // return the value of index
} //end function
```

② i) 4

search-key = 4
array size = 9

step 1

index -1

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA	4	7	12	15	21	26	34	35	40	49

search-key 4

step 2

index 0

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA	4	7	12	15	21	26	34	35	40	49

↖
search-key 4

$p=0$

∴ search for key 4 is successful.

ii) 37

search-key =
array size = 9

step 1

index -1

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 2

index 0

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 3

index 1

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 4

index 2

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 5

index 3

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 6

index 4

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 7

index 5

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 8

index 6

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 9

index 7

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

step 10

index 8

index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DATA1	4	7	12	15	21	26	34	35	40	49

search-key 37

$p = 0, 1, 2, 3, 4, 5, 6, 7, 8 \Rightarrow$ search key is not matched

$\therefore$ search for key 37 is unsuccessful.

(f)

Sequential search on a sorted list is better than unsorted list if the value is being searched is not on the list because the loop terminated is **earlier** than unsorted list.

For sequential search in unsorted list, it takes longer time because every element of the array will be examined to the last element of the array.

For sequential search in sorted list, it takes **earlier** because when $p=8$, the searching of search key (37) is smaller than current element (40) of the array.

Thus, loop repetition is terminated earlier using "break" statement. It will minimize the searching process.

Exercise 3

- a) In a **sequential search**, every element in the array will be examined sequentially, starting from the first element.

In a **binary search**, the searching process started at middle of the list, then the algorithm determine which half of the item is in.

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	
49	21	34	35	40	7	15	26	12	4	- unsorted

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	
4	7	12	15	21	26	34	35	40	49	- sorted

i) search key = 4

Step 1	found	false	LEFT	0																			
	index	-1	RIGHT	9																			
	search_key	4	MIDDLE	4																			
	<table><tr><td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td></tr><tr><td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td></tr></table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

Step 2	found	false	LEFT	0																			
	index	-1	RIGHT	3																			
	search_key	4	MIDDLE	1																			
	<table><tr><td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td></tr><tr><td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td></tr></table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

Step 3	found	true	LEFT	0																			
	index	0	RIGHT	1																			
	search_key	4	MIDDLE	0																			
	<table><tr><td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td></tr><tr><td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td></tr></table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

* The search is **successful**. The search key, 4 is found at index 0.

ii) search - key = 37

Step 1	found	false	LEFT	0																			
	index	-1	RIGHT	9																			
	search_key	37	MIDDLE	4																			
	<table border="1"> <tr> <td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td> </tr> <tr> <td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td> </tr> </table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

Step 2	found	false	LEFT	5																			
	index	-1	RIGHT	9																			
	search_key	37	MIDDLE	7																			
	<table border="1"> <tr> <td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td> </tr> <tr> <td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td> </tr> </table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

Step 3	found	false	LEFT	8																			
	index	-1	RIGHT	9																			
	search_key	37	MIDDLE	8																			
	<table border="1"> <tr> <td>[0]</td><td>[1]</td><td>[2]</td><td>[3]</td><td>[4]</td><td>[5]</td><td>[6]</td><td>[7]</td><td>[8]</td><td>[9]</td> </tr> <tr> <td>4</td><td>7</td><td>12</td><td>15</td><td>21</td><td>26</td><td>34</td><td>35</td><td>40</td><td>49</td> </tr> </table>				[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	4	7	12	15	21	26	34	35	40
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]														
4	7	12	15	21	26	34	35	40	49														

* The search is **unsuccessful**. The index returned is -1, therefore search key = 37 is not found.