Array Operation

Sample Declaration of an array:

```
// A sample program for Array Declaration
#include <stdio.h>
int main()
{
int one_dim [10];    # declaration of 1D array
int two_dim [2][2];  #declaration of 2D array
int three_dim [2][3][4] = {
                 { {3, 4, 2, 3}, {0, -3, 9, 11}, {23, 12, 23, 2} },
                 { {13, 4, 56, 3}, {5, 9, 3, 5}, {3, 1, 4, 9} }
              }; #declaration of 3D array. Here the elements are also defined.
return 0;
}
```

various operations that can be performed on arrays.

- **Traverse** − Print all the elements in the array one by one.
- **Insertion** − Adds an element at the given index.
- **Deletion** − Deletes an element at the given index.
- **Search** − Searches an element in the array using the given index or the value.
- **Update** − Updates an element at the given index.

```
For(c=lb;c<=ub;c++)

Printf("%d", A[c]);
```

Insertion

It is not always necessary that an element is inserted at the end of an array. Various situation for insertion in Array:

- Insertion at the beginning of an array
- Insertion at the given index of an array
- Insertion after the given index of an array
- Insertion before the given index of an array

Insertion at the Beginning of an Array

- When the insertion happens at the beginning, it causes all the existing data items to shift one step downward.

Here, we design and implement an algorithm to insert an element at the beginning of an array.

Example:

Initial	Itr 1	Itr 2	Itr 3	Itr 4	Itr 4	Itr5	Insert
10	10	10	10	10	10		X
20	20	20	20	20		10	10
30	30	30	30		20	20	20
40	40	40		30	30	30	30
50	50		40	40	40	40	40
60		50	50	50	50	50	50
	60	60	60	60	60	60	60

Algorithm

Insert(A, New_Element)

- We assume **A** is an array with **N** elements.
- The maximum numbers of elements it can store is defined by **MAX**
- We shall first check if an array has any empty space to store any element and then we proceed with the insertion process.

```
begin

IF N = MAX, display “Error”, return
ELSE
  N = N + 1
```

```
FIRST = 1

//   For All Elements in A
//      Move to next adjacent location
      For C = 1 to N-1
             A[C+1] = A[C]

A[FIRST] = New_Element

end
```

Will the loop Work? (New Element = 5)

```
     For C = 1 to N-1
             A[C+1] = A[C]
```

Initial	C = 1	C=2	C=3	C=4	C=5	New Value
10	10	10	10	10	10	5...
20	10	10	10	10	10	10
30	30	10	10	10	10	10
40	40	40	10	10	10	10
50	50	50	50	10	10	10
60	60	60	60	60	10	10
						10

Actual Expected Loop

Initial	C=5	C=4	Itr 3	Itr 4	Itr 4	Itr5	Goal
10	10	10	10	10	10	10	X..
20	20	20	20	20	20	10	10
30	30	30	30	30	20	20	20
40	40	40	40	30	30	30	30
50	50	50	40	40	40	40	40
60	60	50	50	50	50	50	50
	60	60	60	60	60	60	60

```
begin

IF N = MAX, return
ELSE
   N = N + 1

FIRST = 1

//   For All Elements in A
//      Move to next adjacent location
         For C = N-1 to 1                        N              C              A
               A[C+1] = A[C]                     5              -              10,20,30,40,50,0
                                                  6             5              10,20.30,40,50,50
 //          For C = N to 2                      6              4              10,20,30,40,40,50
//             A[C] = A[C-1]

A[FIRST] = New_Element

end
```

Implementation in C

Live Demo

```
#include <stdio.h>

#define MAX 5

void main() {
   int array[MAX] = {2, 3, 4, 5};
   int N = 4;        // number of elements in array
   int i = 0;        // loop variable
   int value = 1;    // new data element to be stored in array

   // print array before insertion
   printf("Printing array before insertion −\n");

   for(i = 0; i < N; i++) {
      printf("array[%d] = %d \n", i, array[i]);
   }

   // now shift rest of the elements downwards
   for(i = N; i >= 0; i--) {
      array[i+1] = array[i];
   }

   // add new element at first position
   array[0] = value;

   // increase N to reflect number of elements
   N++;

   // print to confirm
   printf("Printing array after insertion −\n");

   for(i = 0; i < N; i++) {
      printf("array[%d] = %d\n", i, array[i]);
   }
}
```

This program should yield the following output −

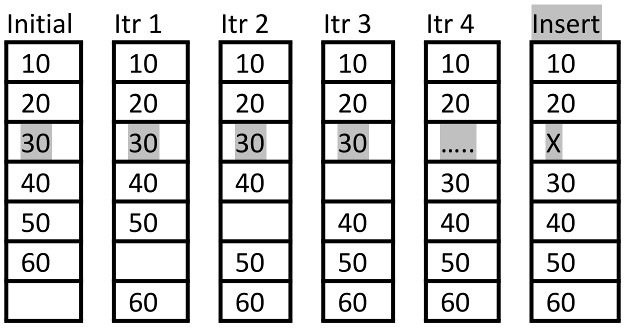
Output

```
Printing array before insertion −
array[0] = 2
array[1] = 3
array[2] = 4
array[3] = 5
Printing array after insertion −
array[0] = 0
array[1] = 2
array[2] = 3
array[3] = 4
array[4] = 5
```

Insertion at the Given Index of an Array

- Given the exact location (**index**) of an array where a new data element (**value**) needs to be inserted.
- First we shall check if the array is full, if it is not, then we shall move all data elements from that location one step downward.
- This will make room for a new data element.

Example: (with insertion POS = 3)



Algorithm

- We assume **A** is an array with **N** elements.
- The maximum numbers of elements it can store is defined by **MAX**.
- POS indicates the Index of Insert

```
begin
IF N = MAX, return
// ELSE
 //  N = N + 1
//   SEEK Location index

  For All Elements from A[index] to A[N]
    Move to next adjacent location

      For C = N to POS  Step -1
           A[C+1] = A[C]

  A[POS] = New_Element
```

```
end
```

Implementation in C

Live Demo

```
#include <stdio.h>

#define MAX 5

void main() {
   int array[MAX] = {1, 2, 4, 5};

   int N = 4;        // number of elements in array
   int i = 0;        // loop variable
   int index = 2;    // index location to insert new value
   int value = 3;    // new data element to be inserted

   // print array before insertion
   printf("Printing array before insertion −\n");

   for(i = 0; i < N; i++) {
      printf("array[%d] = %d \n", i, array[i]);
   }

   // now shift rest of the elements downwards
   for(i = N; i >= index; i--) {
      array[i+1] = array[i];
   }

   // add new element at first position
   array[index] = value;

   // increase N to reflect number of elements
   N++;

   // print to confirm
   printf("Printing array after insertion −\n");

   for(i = 0; i < N; i++) {
      printf("array[%d] = %d\n", i, array[i]);
   }
}
```

If we compile and run the above program, it will produce the following result −

Output

```
Printing array before insertion −
array[0] = 1
array[1] = 2
array[2] = 4
array[3] = 5
Printing array after insertion −
array[0] = 1
array[1] = 2
array[2] = 3
array[3] = 4
array[4] = 5
```

Insertion After the Given Index of an Array

In this scenario we are given a location (**index**) of an array after which a new data element (**value**) has to be inserted.

Only the seek process varies, the rest of the activities are the same as in the previous example.

Algorithm

We assume **A** is an array with **N** elements. The maximum numbers of elements it can store is defined by **MAX**.

```
begin

IF N = MAX, return
//ELSE
//   N = N + 1

   SEEK Location index

//   For All Elements from A[index + 1] to A[N]
//      Move to next adjacent location
   For C = N to POS+1
               A[C+1] = A[C]


   A[POS+1] = New_Element
// Or I can write A[C-1] = New Element

end
```

Insertion Before the Given Index of an Array

In this scenario we are given a location (**index**) of an array before which a new data element (**value**) has to be inserted. This time we seek till **index-1** i.e., one location ahead of given index, rest of the activities are same as in previous example.

Algorithm

We assume **A** is an array with **N** elements. The maximum numbers of elements it can store is defined by **MAX**.

```
begin

IF N = MAX, return
ELSE
  N = N + 1

  SEEK Location index
  If Location Index <1
     return
//    For All Elements from A[index - 1] to A[N]
//    Move to next adjacent location
  For C = N to POS-1
           A[C+1] = A[C]


  A[POS-1] = New_Element

end
```

Deletion Operation

Deletion refers to removing an existing element from the array and re-organizing all elements of an array.

Algorithm

Consider **LA** is a linear array with **N** elements and **K** is a positive integer such that **K<=N**. Following is the algorithm to delete an element available at the Kth position of LA.

```
1. Start
2. Set J = K
3. Repeat steps 4 and 5 while J < N
4.     Set LA[J] = LA[J + 1]
5.     Set J = J+1
6. Set N = N-1
7. Stop
```

Search Operation

You can perform a search for an array element based on its value or its index.

Algorithm

Consider **LA** is a linear array with **N** elements and **K** is a positive integer such that **K<=N**. Following is the algorithm to find an element with a value of ITEM using sequential search.

```
1. Start
2. Set J = 0
3. Repeat steps 4 and 5 while J < N
4.    IF LA[J] is equal ITEM THEN GOTO STEP 6
5.    Set J = J +1
6. PRINT J, ITEM
7. Stop
```

Update Operation

Update operation refers to updating an existing element from the array at a given index.

Algorithm

Consider **LA** is a linear array with **N** elements and **K** is a positive integer such that **K<=N**. Following is the algorithm to update an element available at the K^th^ position of LA.

```
1. Start
2. Set LA[K-1] = ITEM
3. Stop
```