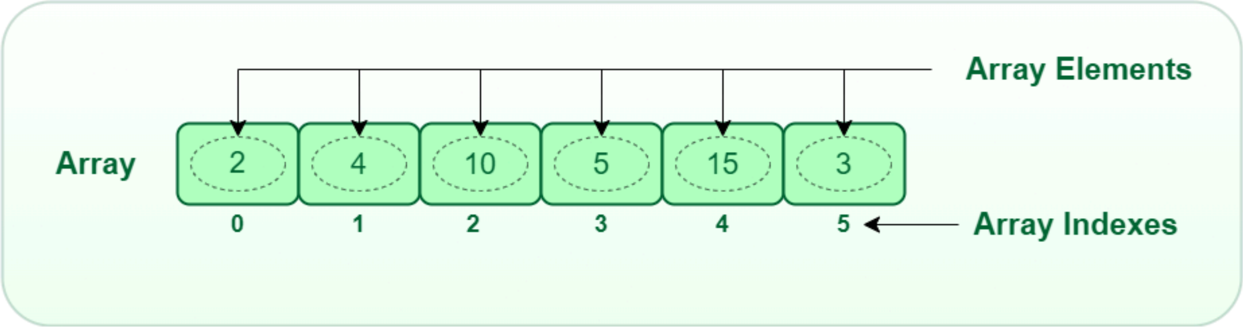
Array

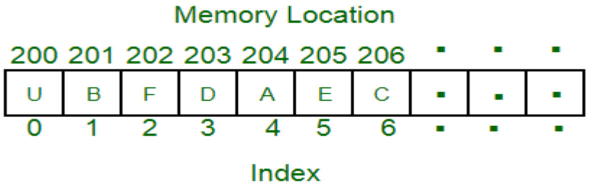
What is an array?

An array is a collection of items of the same data type stored at contiguous memory locations.



Facts about array :

- Fixed size
  - Arrays have a fixed size which needs to be defined while declaring an array.
  - In bytes total size of an n sized array is *n*(size of data type).*
- Zero based indexing
  - The first element of an array starts from index-0. For example, to access the first element of an array we need to write : name_of_array[0]
- Homogeneous elements
  - All elements in an array must be of the same type
  - Example : Integer , Double , String , Any class
- Contiguous memory allocation
  - The subsequent elements of an array are kept in the same sequence.
  - For example , for an integer array arr if the first value is kept at the memory location 40 then the second element will be kept at the memory location 40+4 (4 being the size of an integer).



Here is an array of characters.As characters take one byte memory, as the first character is kept at the location 200,the second element is kept at the location 201 , then 202 and so on.

- Random access

    - Array elements can be accessed at constant time.To access the 5th element of the array we just need to call name_of_array[4].This is an O(1) operation.

Pros:

- Constant time access to elements : Read operations take constant time.
- Simplicity of use : Very simple to understand and use
- Less overhead : Doesn't have any additional memory overhead
- Supports multidimensional arrays: Multidimensional arrays are used to build other data structures

Cons:

- Fixed size : Can't change size based on number of elements.
- Inefficient insertion and deletion : Insertion and deletion is O(n) operation.
- Wasted memory for sparse data : For empty or 0 valued data a lot of memory is wasted.
- Homogeneous : Requirement for all elements to be of same data type means less flexibility.

Code Example:

```
//declaring an array of size 10
    int array[10];
    //declaring an array of size 10 and initializing it with 0
    int array2[10] = {0};
    //declaring an array of size 10 and initializing it with 1,2,3,4,5,6,7,8,9,10
    int array3[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9,10};
    //Taking a single input in an array
    cin >> array[0];
    //Taking input for the whole array
    for (int i = 0; i < 10; i++)
    {
        cin >> array[i];
    }
    //Printing the whole array
    for (int i = 0; i < 10; i++)
    {
        //accessing and printing the ith element of the array
        cout << array[i] << " ";
    }
```