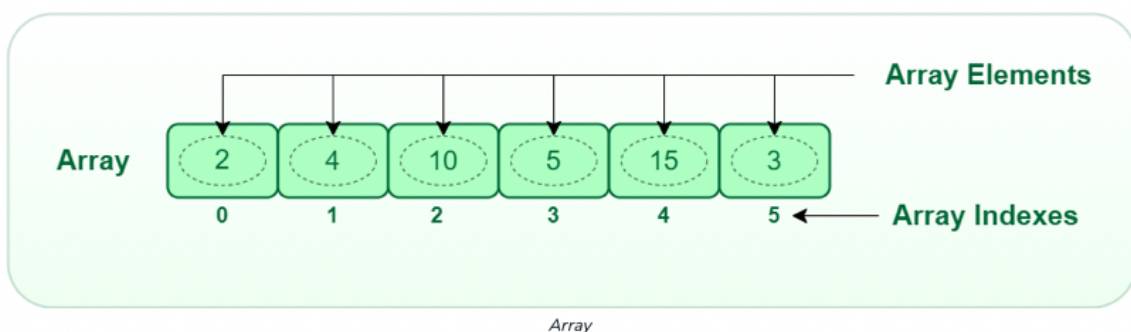




Array



An array is a collection of items of same data type stored at contiguous memory locations. It's one of the most popular and simple data structures and is often used to implement other data structures. Each item in an array is indexed starting with 0.



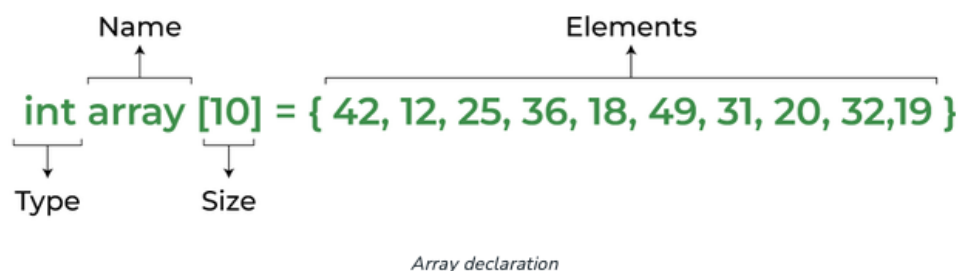
- **Element** – Each item stored in an array is called an element.
- **Index** – Each location of an element in an array has a numerical index, which is used to identify the element.

Basic operations of Array

- **Traverse** – print all the array elements one by one.
- **Insertion** – Adds an element at the given index.
- **Deletion** – Deletes an element at the given index.
- **Search** – Searches an element using the given index or by the value.
- **Update** – Updates an element at the given index.
- **Display** – Displays the contents of the array.

Why is it needed?

The idea of an array is to represent many instances in one variable..



Advantages

- Arrays allow random access to elements. This makes accessing elements by position faster.
- Arrays have better cache locality which makes a pretty big difference in performance.
- Arrays represent multiple data items of the same type using a single name.
- Array data structures are used to implement the other data structures like linked lists, stacks, queues, trees, graphs, etc.

Disadvantages

- As arrays have a fixed size, once the memory is allocated to them, it cannot be increased or decreased, making it impossible to store extra data if required. An array of fixed size is referred to as a static array.
- Allocating less memory than required to an array leads to loss of data. An array is homogeneous in nature so, a

single array cannot store values of different data types.

- Arrays store data in contiguous memory locations, which makes deletion and insertion very difficult to implement. This problem is overcome by implementing linked lists, which allow elements to be accessed sequentially.

Array Types

There are 3 types of arrays

- 1) One-dimensional Arrays : You can imagine a 1d array as a row, where elements are stored one after another.
- 2) Two-dimensional Arrays : 2-D multidimensional arrays can be considered as an array of arrays or as a matrix consisting of rows and columns.
- 3) Three-dimensional Arrays : A 3-D multidimensional arrays contains three dimensions, so it can be considered an array of two-dimensional arrays.

Application Of Arrays

- They are used in the implementation of other data structures such as array lists, heaps, hash tables, vectors, and matrices.
- Database records are usually implemented as arrays.
- It is used in lookup tables by computer.
- It is used for different sorting algorithms such as bubble sort insertion sort, merge sort, and quick sort.

Real-time Applications of Arrays

- **Signal Processing:** Arrays are used in signal processing to represent a set of samples that are collected over time. This can be used in applications such as speech recognition, image processing, and radar systems.

- **Multimedia Applications:** Arrays are used in multimedia applications such as video and audio processing, where they are used to store the pixel or audio samples. For example, an array can be used to store the RGB values of an image.
- **Data Mining:** Arrays are used in data mining applications to represent large datasets. This allows for efficient data access and processing, which is important in real-time applications.
- **Robotics:** Arrays are used in robotics to represent the position and orientation of objects in 3D space. This can be used in applications such as motion planning and object recognition.
- **Real-time Monitoring and Control Systems:** Arrays are used in real-time monitoring and control systems to store sensor data and control signals. This allows for real-time processing and decision-making, which is important in applications such as industrial automation and aerospace systems.
- **Financial Analysis:** Arrays are used in financial analysis to store historical stock prices and other financial data. This allows for efficient data access and analysis, which is important in real-time trading systems.
- **Scientific Computing:** Arrays are used in scientific computing to represent numerical data, such as measurements from experiments and simulations. This allows for efficient data processing and visualization, which is important in real-time scientific analysis and experimentation.

References

GeeksforGeeks | A computer science portal for geeks

A Computer Science portal for geeks. It contains well written, well thought and well explained computer science and programming articles, quizzes and practice/competitive

 <https://www.geeksforgeeks.org/>



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SerhatKumas - Overview

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