Difference between Array and Linked List

Both Linked List and Array are used to store linear data of similar type, but an array consumes contiguous memory locations allocated at compile time, i.e. at the time of declaration of array, while for a linked list, memory is assigned as and when data is added to it, which means at runtime.

Before we proceed further with the differences between Array and Linked List, if you are not familiar with Array or Linked list or both, you can check these topics first:

- Array in C
- Linked List

This is the basic and the most important difference between a linked list and an array. In the section below, we will discuss this in details along with highlighting other differences.

Linked List vs. Array

Array is a datatype which is widely implemented as a default type, in almost all the modern programming languages, and is used to store data of similar type.

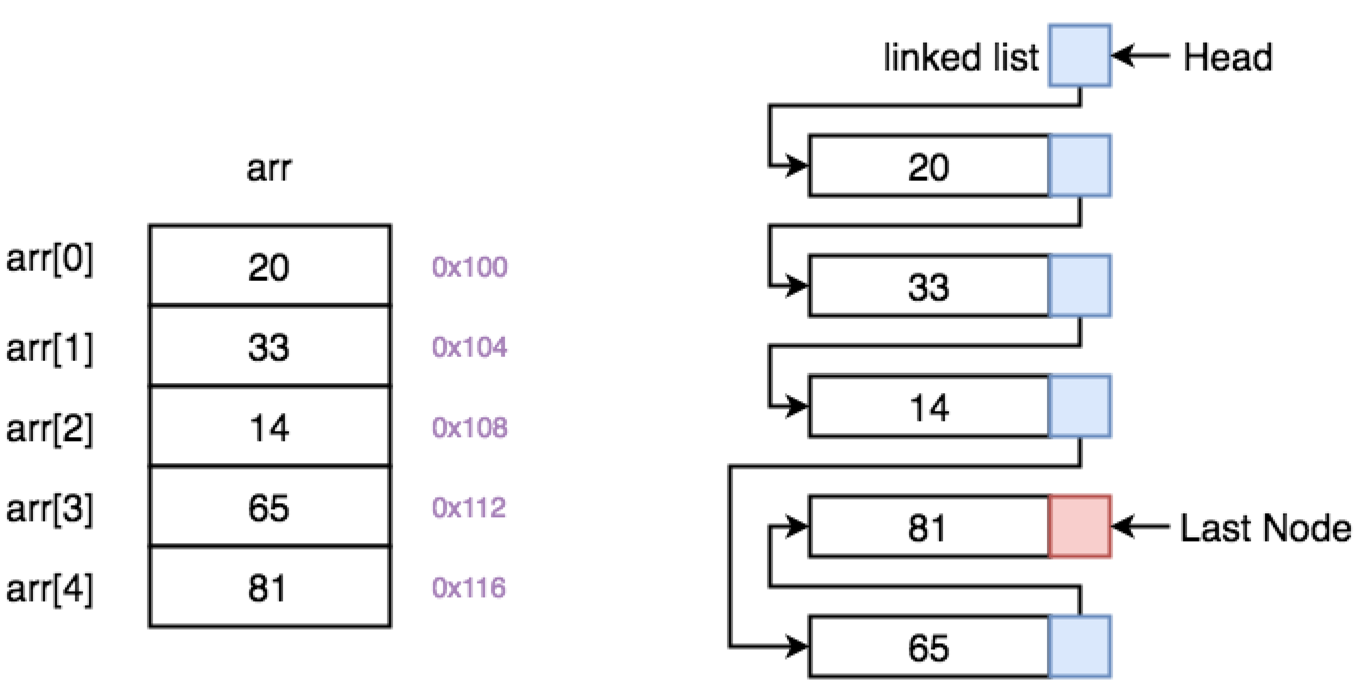
But there are many usecases, like the one where we don't know the quantity of data to be stored, for which advanced data structures are required, and one such data structure is **linked list**.

Let's understand how array is different from Linked list.

ARRAY	LINKED LIST
Array is a collection of elements of similar data type.	Linked List is an ordered collection of elements of same type, which are connected to each other using pointers.
Array supports **Random Access**, which means elements can be accessed directly using their index, like `arr[0]` for 1st element, `arr[6]` for 7th element etc. Hence, accessing elements in an array is **fast** with a constant time complexity of `O(1)`.	Linked List supports **Sequential Access**, which means to access any element/node in a linked list, we have to sequentially traverse the complete linked list, upto that element. To access **nth** element of a linked list, time complexity is `O(n)`.
In an array, elements are stored in **contiguous memory location** or consecutive manner in the memory.	In a linked list, new elements can be stored anywhere in the memory. Address of the memory location allocated to the new element is stored in the previous node of linked list, hence formaing a link between the two nodes/elements.

In array, **Insertion and Deletion** operation takes more time, as the memory locations are consecutive and fixed.	In case of linked list, a new element is stored at the first free and available memory location, with only a single overhead step of storing the address of memory location in the previous node of linked list. Insertion and Deletion operations are **fast** in linked list.
Memory is allocated as soon as the array is declared, at **compile time**. It's also known as **Static Memory Allocation**.	Memory is allocated at **runtime**, as and when a new node is added. It's also known as **Dynamic Memory Allocation**.
In array, each element is independent and can be accessed using it's index value.	In case of a linked list, each node/element points to the next, previous, or maybe both nodes.
Array can be **single dimensional**, **two dimensional** or **multidimensional**	Linked list can be **Linear(Singly) linked list**, **Doubly linked list** or **Circular linked list** linked list.
Size of the array must be specified at time of array decalaration.	Size of a Linked list is variable. It grows at runtime, as more nodes are added to it.
Array gets memory allocated in the **Stack** section.	Whereas, linked list gets memory allocated in **Heap** section.

Below we have a pictorial representation showing how consecutive memory locations are allocated for array, while in case of linked list random memory locations are assigned to nodes, but each node is connected to its next node using **pointer**.



Array representation

On the left, we have **Array** and on the right, we have **Linked List**.

Why we need pointers in Linked List? [Deep Dive]

In case of array, memory is allocated in contiguous manner, hence array elements get stored in consecutive memory locations. So when you have to access any array element, all we have to do is use the array index, for example `arr[4]` will directly access the 5th memory location, returning the data stored there.

But in case of linked list, data elements are allocated memory at runtime, hence the memory location can be anywhere. Therefore to be able to access every node of the linked list, address of every node is stored in the previous node, hence forming a link between every node.

We need this additional **pointer** because without it, the data stored at random memory locations will be lost. We need to store somewhere all the memory locations where elements are getting stored.

Yes, this requires an additional memory space with each node, which means an additional space of `O(n)` for every `n` node linked list.
