What are Linked Lists?

Like arrays, linked lists are also linear data structures but in linked lists elements are not stored at contiguous memory locations. They can be stored anywhere in the memory but for sequential access, the nodes are linked to each other using pointers.

Advantages of Linked Lists over Arrays: Arrays can be used to store linear data of similar types, but arrays have the following limitations:

1. The size of the arrays is fixed, so we must know the upper limit on the number of elements in advance. Also, generally, the allocated memory is equal to the upper limit irrespective of the usage. On the other hand, linked lists are dynamic and the size of the linked list can be incremented or decremented during runtime.
2. Inserting a new element in an array of elements is expensive, because a room has to be created for the new elements, and to create room, existing elements have to shift.

   For example, in a system, if we maintain a sorted list of IDs in an array id[].

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   id[] = [1000, 1010, 1050, 2000, 2040].
   ```

   And if we want to insert a new ID 1005, then to maintain the sorted order, we have to move all the elements after 1000 (excluding 1000). Deletion is also expensive with arrays unless some special techniques are used. For example, to delete 1010 in id[], everything after 1010 has to be moved.

   On the other hand, nodes in linked lists can be inserted or deleted without any shift operation and is efficient than that of arrays.

Disadvantages of Linked Lists:

1. Random access is not allowed in Linked Lists. We have to access elements sequentially starting from the first node. So, we cannot do a binary search with linked lists efficiently with its default implementation. Therefore, lookup or search operation is costly in linked lists in comparison to arrays.
2. Extra memory space for a pointer is required with each element of the list.
3. Not cache-friendly. Since array elements are present at contiguous locations, there is a locality of reference which is not there in the case of linked lists.