**Array Applications:**

* To store the data in tabular format
* For sorting the elements
* CPU scheduling
* To implement stack and queue
* 2D arrays, commonly known as, matrix, are used in image processing.

**Sparse Matrix:**

A matrix is a two-dimensional data object made of m rows and n columns, therefore having total m x n values. If most of the elements of the matrix have 0 value, then it is called a sparse matrix.

Why to use Sparse Matrix instead of simple matrix?

**Storage**: There are lesser non-zero elements than zeros and thus lesser memory can be used to store only those elements.

**Computing time:** Computing time can be saved by logically designing a data structure traversing only non-zero elements.

**Vector**

A vector is a kind of one-dimensional array that stores multiple data values of the same type. Different from an array storing data in a fixed size, a vector stores data in a resizable array.

**Applications**:

* to represent the mathematical vector used in linear algebra

**Stack Applications:**

* Expression conversion and evaluation
* Undo operation
* Used in JVM
* History of visited website
* Message log and all messages we get are arranged using stack
* Call logs, emails, image gallery, YouTube downloads etc., notifications (latest appears first)
* Google pay Scratch card

**Queue Applications**

process scheduling,

disk scheduling,

memory management,

Spooling in printers

Queues in routers/ switches

**Merge Sort:** 0(n) extra space for storage **O(NlogN) average complexity**

**Applications of Merge Sort**

* Merge Sort is useful for sorting linked lists in O(nLogn) time.
* Inversion Count Problem
* Used in External Sorting

**Quick sort O(NlogN) average complexity**

**Applications:**

* Commercial Computing
* call optimization

**Algorithm:**

Step 1: Choose the highest index value has pivot

Step 2: Take two variables to point left and right of the list excluding pivot

Step 3: left points to the low index

Step 4: right points to the high

Step 5: while value at left is less than pivot move right

Step 6: while value at right is greater than pivot move left

Step 7: if both step 5 and step 6 does not match swap left and right

Step 8: if left ≥ right, the point where they met is new pivot

**Heap Sort:**

**Applications:**

* Dijkstra’s algorithm that finds the shortest path where Heap Sort is implemented.
* when the smallest (shortest) or highest (longest) value is needed instantly.
* Minimum spanning tree

**Linked List:**

**Advantages**

* Dynamic size
* Ease of insertion/deletion
* Dynamic Data Structure:
* No Memory Wastage:
* Insertion and Deletion Operation:
* Memory Usage:
* Random Access:
* Reverse Traversal:

**Drawbacks:**

* Random access is not allowed.
* Extra memory space for a pointer is required with each element of the list.
* Not cache friendly.

**Tree application**

* Databases also uses tree data structures for indexing.
* Domain Name Server(DNS) also uses tree structures.
* File explorer/my computer of mobile/any computer.

**Graph Application**

* Google maps
* Facebook
* operating System
* In World Wide Web, web pages are considered to be the vertices. There is an edge from a page u to other page v if there is a link of page v on page u. This is an example of Directed graph. It was the basic idea behind Google Page Ranking Algorithm.
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