

Date

Subject DSA

IIMT

Assignment : 3

Ques: Write the Algorithm for counting Sort and bucket Sort with the help of an example.

Ans: Counting Sort Algorithm

- find the maximum element in the array to determine the size of the count array
- Create a count array to store count of each element
- Count the occurrences of each element in the array
- calculate the cumulative count of determining the position of element in the sorted array
- Build the stored array based on the cumulative count.

Ex: Suppose $[4, 2, 2, 8, 3, 3, 1]$

find the maximum element : Max = 8

Calculate cumulative counts

$[0, 1, 3, 5, 6, 6, 6, 7]$

Build stored array

$[1, 2, 2, 3, 3, 4, 0]$

Bucket Sort

- Create empty bucket
- Distribute element into buckets based on their values
- Sort each bucket individually
- Merge the sorted buckets

Example : Suppose

$[0.897, 0.565, 0.656, 0.1234, 0.665, 0.3434]$

- Create empty buckets
- Distribute element into buckets

Bucket 1 $[0.1234]$

" 2 $[0.3434]$

" 3 $[0.565, 0.656]$

" 4 $[0.665]$

" 5 (0.897) .

Sort each bucket individually

Merge the sorted buckets

[0.1234, 0.3434, 0.565, 0.656, 0.665, 0.897]

Q :- Write an algorithm for selection sort & bubble sort with the help of example.

Selection Sort Algo

- Start from the first element of array
- Find the minimum element in unsorted part of array
- Swap the minimum element with the first element of the unsorted part.
- Repeat process until the entire array is sorted.

Example. Suppose $[64, 25, 12, 22, 11]$

$[25, 64, 12, 22, 11]$

$[25, 12, 64, 22, 11]$

$[25, 12, 22, 64, 11]$

$[25, 12, 22, 11, 64]$

$[12, 25, 22, 11, 64]$

$[12, 22, 25, 11, 64]$

$[12, 22, 11, 25, 64]$

$[12, 22, 11, 25, 64]$

$[12, 11, 22, 25, 64]$

$[11, 12, 22, 25, 64]$

Ques: What do you mean by the term sorting?
Define diff types of sorting techniques

Sort the following using heap sort

$[25, 30, 59, 10, 92, 85, 30]$

Sorting refers the process of arranging a collection of elements in a specific order either ascending or descending.

Types of Sorting Techniques

- Bubble Sort:- Repeatedly compares adjacent elements and swap them if they are in wrong order.
- Selection Sort:- Repeatedly find the minimum element from the unsorted part of the array & Swap it with first unsorted element.
- Insertion Sort:- Build the sorted array one element at a time by inserting each element into its proper position.

Bucket Sort:- Distribute element into bucket and then sort each bucket individually

Heap Sort

[25, 30, 59, 10, 92, 85, 35]

Final Sorted Ascending Order

[10, 25, 30, 35, 59, 85, 92]

Ques: Write an algorithm to determine the Connected Components in a given graph.

Connected Components (Algo)

1. Initialize a visited array to keep track of visited vertices
2. Initialize a components ID array to assign a unique ID to each connected component
3. Iterate through all vertices in the graph
4. For each unvisited vertex, perform a DFS traversal & assign a unique component ID to all vertices in the same connected component.
5. Repeat step 4 until all vertices have been visited

Ex: Suppose

$$A \rightarrow B$$

$$B \rightarrow A$$

$$C \rightarrow D$$

$$D \rightarrow C$$

$$E \rightarrow F$$

$$F \rightarrow E$$

The connected components

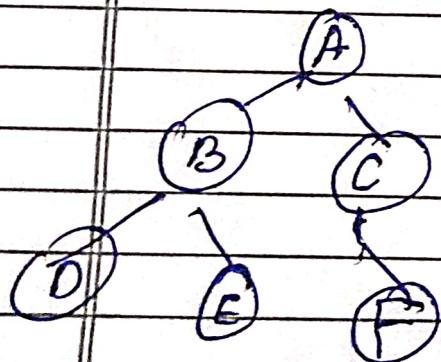
$\{A, B\}$, $\{C, D\}$, $\{E, F\}$.

Ques: Explain the Breadth-first search & Depth search algorithm with examples.

Breadth First search:-

BFS is a graph traversal algorithm that visits all the nodes at the current depth level before moving on the next level. It uses a queue data structure to keep track of the nodes to be visited.

Suppose we have



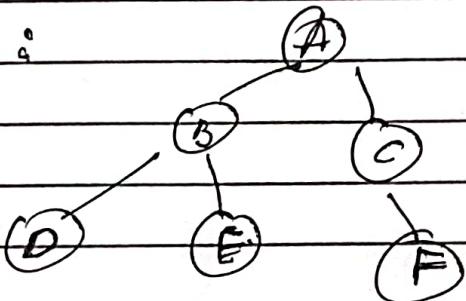
If we start the BFS travel from node A, the Order of Visited node would be.

A, B, C, D, E, F

Depth-First Search (DFS)

It is a graph traversal algorithm that visits as far as possible along each branch before backtracking. It uses a stack data structure to keep track of the nodes to be visited.

Example:



If we started the DFS traversal from node A, one possible order of visited nodes would be

A, B, D, E, C, F