

UNIT V

1. Define Sorting.

A sorting algorithm is an algorithm that puts elements of a list either in ascending or descending order.

2. What are the different types of sorting techniques? Give example.

There are 2 sorting techniques:

- Internal sorting eg: sorting with main memory
- External sorting eg: sorting with disk, tapes.

3. Compare internal and external sorting.

Internal sorting:

- It takes place in the main memory of a computer
- Internal sorting methods are applied for small collections of data (i.e) the entire collection of data to be sorted is small enough that the sorting can take place within main memory.

External sorting:

- External sorting methods are applied only when the number of data elements to be sorted is too large.
- These sorting methods involve as much external processing.

4. List out some of the sorting algorithms.

1. Insertion sort
2. Selection sort
3. Bubble sort
4. Shell sort
5. Merge sort
6. Heap sort
7. Quick sort
8. Radix Sort

5. Write down the limitations of Insertion sort.

- It is less efficient on list containing more number of elements.
- As the number of elements increases the performance of the program would be slow.
- Insertion sort needs a large number of element shifts.

6. What are the basic operations of Insertion sort?

We start with an empty list „S“ and
unsorted list „I“ of „n“ items. For (each item
„X“ of „I“)

```
{
    We are going to insert „X“ into „S“, in sorted order.
}
```

7. Name the sorting techniques which use Divide and Conquer strategy.

- Merge sort
- Quick sort

8. What is the best case and average case analysis for Quick sort?

- The total time in best case is : $O(n \log n)$
- The total time in worst case is : $\Theta(n^2)$

9. What is the complexity of bubble sort?

- Best case performance: $O(n)$
- Average case performance: $O(n^2)$
- Worst case performance: $O(n^2)$

10. Compare bubble and Insertion sort.

- Even though both the bubble sort and insertion sort algorithms have average case time Complexities of $O(n^2)$, bubble sort is outperformed by the insertion sort(i.e) insertion sort is faster than bubble sort.
- This is due to the number of swaps needed by the two algorithms (bubble sorts needs more swaps).
- But due to the simplicity of bubble sort, its code size is very small.
- insertion sort is very efficient for sorting "nearly sorted" lists, when compared with the bubble sort.

11. Explain the concept of merge sort.

- Divide the list in half
- Merge sort the first half
- Merge sort the second half
- Merge both halves back together in sorted order.

12. What is radix sort?

- The Radix Sort perform sorting, by using bucket sorting technique.
- In Radix Sort, first, bucket sort is performed by least significant digit, then next digit and soon. It is sometime known as Card Sort.

13. What is the main idea behind the selection sort

The idea of selection sort is rather simple which repeatedly find the next largest (or smallest) element in the array and move it to its final position in the sorted array.

14. What is the main idea in Bubble sort?

The basic idea underlying the bubble sort is to pass through the file sequentially several times.

Each pass consists of comparing each element in the file with its successor ($x[i]$ and $x[i+1]$) and interchanging the two elements if they are not in proper order.

15. When can we use insertion sort?

Insertion sort is useful only for small files or very nearly sorted files.

16. What is the main idea behind insertion sort?

The main idea of insertion sort is to insert in the i th pass the i th element in $A(1) A(2) \dots A(i)$ in its right place. An insertion sort is one that sorts a set of records by inserting records into an existing file.

17. Justify that the selection sort is diminishing increment sort. (Nov 2012)

Selection sort is diminishing increment sort. Because the Number of swapping in selection sort is better than Insertion sort.

18. Define the term sorting.

The term sorting means arranging the elements of the array so that they are placed in some relevant order which may either be ascending order or descending order.

That is, if A is an array then the elements of A are arranged in sorted order (ascending order) in such a way that, $A[0] < A[1] < A[2] < \dots < A[N]$.

19. What is sorting algorithm?

A sorting algorithm is defined as an algorithm that puts elements of a list in a certain order that can either be numerical order, lexicographical order or any user-defined order.

20. Where do we use external sorting?

External sorting is applied when there is huge data that cannot be stored in computer's memory.

21. Where do we use external sorting?

External sorting is applied when there is huge data that cannot be stored in computer's memory.

22. List out the different sorting techniques.

- Insertion sort
- Selection sort
- Shell sort
- Bubble sort
- Radix sort

23. Define Hashing.

Hashing is used for storing relatively large amounts of data in a table called a hash table. Hashing is a technique used to perform insertions, deletions, and finds the element in **constant average time**

24. What do you mean by hash table?

Hash Table is a data structure in which keys are mapped to array positions by a hash function. Hash table is usually fixed as M-size, which is larger than the amount of data that we want to store.

25. Define hash function.

Hash function is a mathematical formula, produces an integer which can be used as an index for the key in the hash table.

- **Perfect Hash Function**

Each key is transformed into a unique storage location

- **Imperfect hash Function**

Maps more than one key to the same storage location .

26. What are the different methods of hash function?

- Division Method
- Multiplication Method
- Mid Square Method
- Folding Method

27. Define Division Method

Division method is the most simple method of hashing an integer x . The method divides x by M and then use the remainder thus obtained.

In this case, the hash function can be given as

$$h(x) = x \bmod M$$

28. When collision does occur?

Collision occurs when the hash function maps two different keys to same location.

29. What are the various collision resolution techniques used?

Two major classes of collision resolution

Open Addressing

- When collision occurs, use organized method to find next open space.
- Maximum number of elements equal to table size.

Chained Addressing – Separate Chaining

- Make linked list of all element that hash to same location
- Allows number of elements to exceed table size

30. What are the methods used in Open addressing collision technique?

- Linear Probing
- Quadratic Probing
- Double Hashing

31. What is mean by rehashing?

If the table gets too full, the insertion might fail .A solution is to build another table

that is almost twice as big & scan down the entire original table into new table.

32. When do we perform rehashing?

- Rehash as soon as table is half full.
- Rehash when insertion fails
- When table reaches certain load factor
- Performance degrades as the load factor increases

33. When do we use extendible hashing?

When the amount of data is too large to fit in main memory, the previous hashing techniques will not work properly. So we use a new technique called extendible **hashing**. It is one form of dynamic hashing.

15,25,5,40,2,70,18 – Insertion sort
5,15,30,6,3,95- Merge sort

34. What is radix sort?

- The Radix Sort perform sorting, by using bucket sorting technique.
- In Radix Sort, the numbers are sorted on the least significant digit first, followed by secondleast significant digit and so on till the most significant digit. It is sometime called as Card Sort.

37. What is bubble sort?

- Bubble sort is otherwise called as sinking sorts.
- The idea of bubble sort is to move the highest element to **nth** position.
- The principle of bubble sort is to scan or read the array in (n-1) times.
- It compares two adjacent elements in the list and swaps them if they are not in the designated order. It continues until there are no swaps needed.
- It is also called as comparison sort, as it uses comparisons.

38. What is selection sort ? Why selection sort is better than insertion sort?

The idea of selection sort is rather simple which repeatedly find the next largest (or smallest) element in the array and move it to its final position in the sorted array.

40. What is insertion sort ?

- In insertion sort the elements are inserted at an appropriate place similar to card insertion.
- The elements in the list is divided into two parts- sorted and unsorted sub-lists.
- In each pass, the first element of unsorted sub-list is picked up and moved into the sorted sub-list by inserting it in suitable position.

41. What is shell sort?

The shell sort improves upon bubble sort and insertion sort, by moving out of order elements more than one position at a time.

It compares the elements that are at a specific distance from each other, and interchanges them if necessary. The shell sort divides the list into smaller sub lists, and then sorts the sub lists separately using the insertion sort

42. What is Selection sort?

Selection sort is sorted by scanning the entire list to find the smallest element and exchange it with the first element, putting the first element in the final position in the sorted list. Then the scan starts from the second element to find the smallest among $n-1$ elements and exchange it with the second element.

43. What is Merge sort?

- It follows divide and conquer method for its operation.
- In Dividing phase, the problem is divided into smaller problem and solved recursively.
- In conquering phase, the partitioned array is merged together recursively.
- Merge sort is applied to first half and second half of the array.
- It gives two sorted halves which can then be recursively merged together using the merging algorithm.

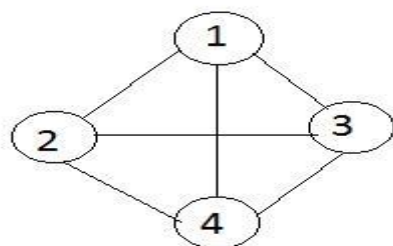
44. What is the performance analysis of merge sort?

- Best case Performance: $O(n \log n)$
- Average Case Performance: $O(n \log n)$
- Worst case performance: $O(n \log n)$

45. Define graph

- A graph consists of two sets V, E .
- V is a finite and non empty set of vertices.
- E is a set of pair of vertices; each pair is called an edge. ○ $V(G), E(G)$ represents set of vertices, set of edges.

$G = (V, E)$



46. Define digraph (Nov 13)

If an edge between any two nodes in a graph is directionally oriented, a graph is called as directed. It is also referred as digraph.

47. Define undirected graph.

If an edge between any two nodes in a graph is not directionally oriented, a graph is called as undirected. It is also referred as unqualified graph.

48. Define path in a graph

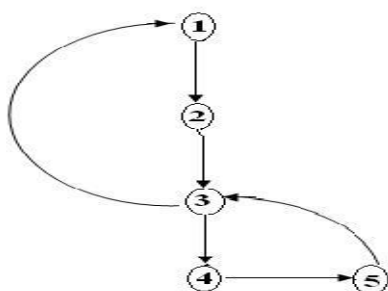
A path in a graph is defined as a sequence of distinct vertices each adjacent to the next except possibly the first vertex and last vertex is different.

49. Define a cycle in a graph

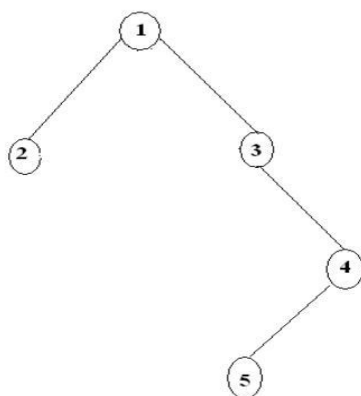
A cycle is a path containing atleast three vertices such that the starting and the ending vertices are the same. The cycles are (1, 2, 3, 1), (1, 2, 3, 4, 5, 3, 1)

50. Define a strongly connected graph (Nov 14)

A graph is said to be a strongly connected graph, if for every pair of distinct vertices there is a directed path from every vertex to every other vertex. It is also referred as a complete graph.

**51. Define a weakly connected graph. (May 14)**

A directed graph is said to be a weakly connected graph if any vertex doesn't have a directed path to any other vertices.

**52. Define a weighted graph.**

A graph is said to be a weighted graph if every edge in the graph is assigned some weight or value. The weight of an edge is a positive value that may be representing the distance between the vertices or the weights of the edges along the path.

53. How we can represent the graph?

We can represent the graph by three ways

1. adjacent matrix
2. adjacent list
3. adjacent multi list

54. Define adjacency matrix

Adjacency matrix is a representation used to represent a graph with zeros and ones.

A graph containing n vertices can be represented by a matrix with n rows and n columns.

The matrix is formed by storing 1 in its i^{th} and j^{th} column of the matrix, if there exists an edge between i^{th} and j^{th} vertex of the graph and 0 if there is no edge between i^{th} and j^{th} vertex of the graph.

Adjacency matrix is also referred as incidence matrix.

55. What is meant by traversing a graph? State the different ways of traversing a graph. (Nov 12)

In undirected graph, $G=(V,E)$

The vertex V in $V(G)$

To visit all the vertices that are reached from the vertex V , that is all the vertices are connected to vertex V

There are two types of graph traversals

- 1) Depth first search
- 2) Breadth first search

56. Define depth first search?

In DFS, we don't have any special vertex, we can start from any vertex.

Let us start from vertex (v) , its adjacent vertex is selected and DFS is initialized.

Let us consider the adjacent vertices to V are V_1, V_2 , and $V_3 \dots V_k$.

Now pick V_1 and visit its adjacent vertices then pick V_2 and visit the adjacent vertices. to continue and process till the nodes are visited.

57. Define breadth first search?

In BFS, an adjacent vertex is selected then visit its adjacent vertices then backtrack the unvisited adjacent vertex

In BFS, to visit all the vertices of the start vertex, then visit the unvisited vertices to those adjacent vertices

58. Define topological sort?

A directed graph G in which the vertices represent tasks or activities and the edges represent activities to move from one event to another then the task is known as *activity on vertex network* or AOV-network/pert network