1. **Each question carries 2 marks:**

I). **What is Algorithm?**

Answer: An algorithm is a set of steps of operations to solve a problem performing calculation, data processing, and automated reasoning tasks. An algorithm is an efficient method that can be expressed within finite amount of time and space.

An algorithm is the best way to represent the solution of a particular problem in a very simple and efficient way. If we have an algorithm for a specific problem, then we can implement it in any programming language, meaning that the algorithm is independent from any programming languages.

II). **Explain aboutTime Complexity of Algorithm?**

Answer: Time complexity is defined as the amount of time taken by an algorithm to run, as a function of the length of the input.

It measures the time taken to execute each statement of code in an algorithm. It is not going to examine the total execution time of an algorithm. It is generally expressed by using the **big O** notation.

III). **What is Growth Function?**

Answer: Growth functions are used to estimate the number of steps an algorithm uses as its input grows.

The growth function of an algorithm represents the exact relationship between the problem size and the time complexity of the solution. The order of the algorithm is the asymptotic time complexity.

IV). What is Recursion?

Answer: The process in which a function calls itself directly or indirectly is called recursion and the corresponding function is called a recursive function. Using a recursive algorithm, certain problems can be solved quite easily. Examples of such problems are Towers of Hanoi (TOH), Inorder/Preorder/Postorder Tree Traversals, DFS of Graph, etc.

A recursive function solves a particular problem by calling a copy of itself and solving smaller subproblems of the original problems.

V). What are the advantages of using Greedy Methods?

Answer: Following are the advantages of using Greedy Method:
- The greedy method produces a feasible solution
- The greedy method is very easy to solve a problem
- The greedy method implements an optimal solution directly

VI). Explain about M-Way Tree?

Answer: The m-way tree or multi-way tree where each node contains multiple elements. In an M-Way tree of order m, each node contains a maximum of m-1elements and m children.

The nodes in an m-way tree will be made up of key fields, in this case m-1 key fields and pointers to children.

A m-way treehas following properties:
- Each node has m children and m-1 key fields
- The keys in each node are in ascending order.
- The keys in the first i children are smaller than the ith key
- The keys in the last m-i children are larger than the ith key.

VII). What is Hamiltonian cycle?

Answer:A Hamiltonian cycle or Hamilton cycle, or Hamilton circuit, is a graph cycle (i.e., closed loop) through a graph that visits each node exactly once. A graph possessing a Hamiltonian cycle is said to be a Hamiltonian graph. There is an edge (in the graph) from the last vertex to the first vertex of the Hamiltonian Path.

The Hamiltonian cycle problem has many applications. It helps in time scheduling, and the choice of travel routes and network topology. It also plays an important role in other areas such as graph theory, algorithm design, and computational complexity.

VIII). Describe the Graph Colouring.

Answer:Graph colouring is the procedure of assignment of colors to each vertex of a graph G such that no adjacent vertices get same color. The objective is to minimize the number of colors while coloring a graph. The smallest number of colors required to color a graph G is called its chromatic number of that graph. Graph coloring problem is a NP Complete problem.

Method to Color a Graph:

The steps required to color a graph G with n number of vertices are as follows –

Step-1: Arrange the vertices of the graph in some order.

Step-2: Choose the first vertex and color it with the first color.

Step-3: Choose the next vertex and color it with the lowest numbered color that has not been colored on any vertices adjacent to it. If all the adjacent vertices are colored with this color, assign a new color to it. Repeat this step until all the vertices are colored.

Example
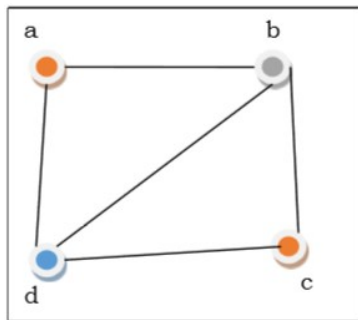
IX). What is Vertex Cover?

Answer: A Vertex Cover of a graph G is a set of vertices such that each edge in G is incident to at least one of these vertices.

The decision vertex-cover problem was proven NPC. When, we want to solve the optimal version of the vertex cover problem, i.e., we have to find a minimum size vertex cover of a given graph. We calls such vertex cover an optimal vertex cover C*.
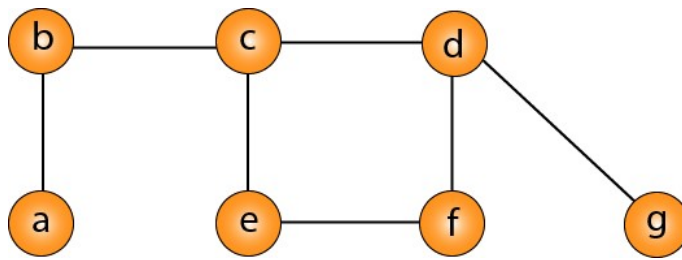
X).   **Explain about Clique problem.**

Answer: The clique problem is a kind of computation problem for finding the cliques or the subsets of the vertices which when all of them are adjacent to each other are also called complete sub-graphs.

The clique problem has many formulations based on which the cliques and about the cliques the information should be found. There are some common formulations based on which the cliques are based such as finding the maximum clique, finding the maximum weight of the clique in a weighted graph, then listing all the maximum or maximal cliques, and finally solving the problem based on the decision of testing whether the graph has the larger cliques than that of the given size.

Maximum clique: a particular clique that has the largest possible number of vertices.

Maximal cliques: the cliques which further cannot be enlarged.

PART-B

2. **What is the use of Asymptotic Notations in the study of algorithms? Briefly describe the commonly used Asymptotic Notations.**

OR

What is Divide and Conquer Technique? Give the use of it for Binary Search Method. Analyze it's Time Complexity.

Answer: Description in detail as per the content covered…

3. Explain Greedy method in detail with a suitable example and differentiate it with dynamic method.

OR

Using greedy algorithm find an optimal schedule for following jobs with n = 6.

Profits: (P1, P2, P3, P4, P5, P6) = (20, 15, 10, 7, 5, 3)

Deadline: (d1, d2, d3, d4, d5, d6) = (3, 1, 1, 3, 1, 3).

Answer: Description in detail as per the content covered…

4. Solve the following knapsack problem using dynamic programming algorithm with given capacity W = 5, where (Weight, Value) are as follows:

(2, 12), (1, 10), (3, 20), (2, 15)

OR

Explain travelling salesman problem with a proper example.

Answer: Description in detail as per the content covered…

5. Explain Backtracking Method. What is 8-Queens Problem? Give solution of 8-Queens Problem using Backtracking Method.

OR

Explain about NP Completeness and NP – Hard Problems in detail.

Answer: Description in detail as per the content covered…