Floyd Warshall Algorithm:

The Floyd-Warshall algorithm, named after its creators Robert Floyd and Stephen Warshall, is a fundamental algorithm in computer science and graph theory. It is used to find the shortest paths between all pairs of nodes in a weighted graph. This algorithm is highly efficient and can handle graphs with both positive and negative edge weights, making it a versatile tool for solving a wide range of network and connectivity problems.

The Floyd-Warshall algorithm is a dynamic programming algorithm used to discover the shortest paths in a weighted graph, which includes negative weight cycles. The algorithm works with the aid of computing the shortest direction between every pair of vertices within the graph, the usage of a matrix of intermediate vertices to keep music of the exceptional-recognized route thus far.

Understanding Dynamic Programming:

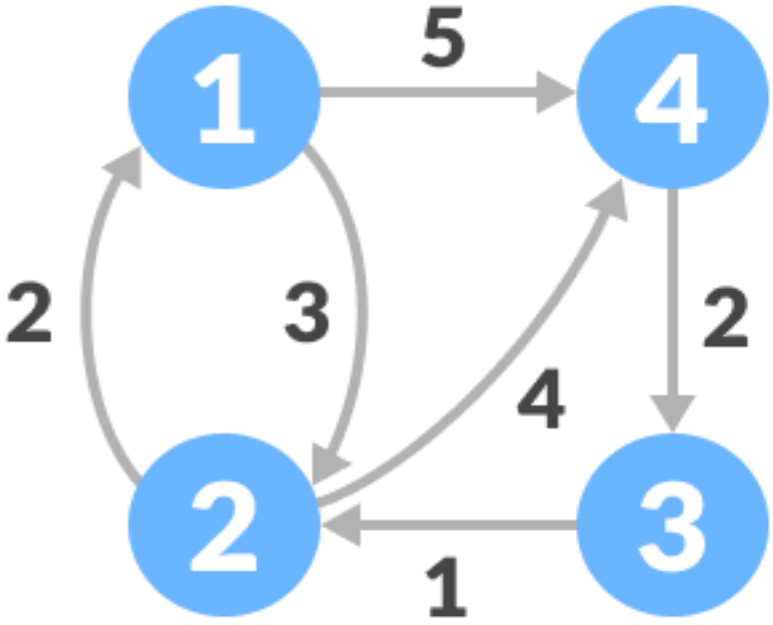
Dynamic programming is a technique used in computer science and mathematics to remedy complicated troubles with the aid of breaking them down into smaller subproblems and solving each subproblem as simple as soon as. It is a technique of optimization that can be used to locate the pleasant technique to a hassle with the aid of utilizing the solutions to its subproblems.

The key idea behind dynamic programming is to keep the solutions to the subproblems in memory, so they can be reused later whilst solving larger problems. This reduces the time and area complexity of the set of rules and lets it resolve tons larger and extra complex issues than a brute force approach might.

Working of Floyd-Warshall Algorithm:

1. Initialize a distance matrix D wherein D[i][j] represents the shortest distance between vertex i and vertex j.
2. Set the diagonal entries of the matrix to 0, and all other entries to infinity.
3. For every area (u,v) inside the graph, replace the gap matrix to mirror the weight of the brink: D[u][v] = weight(u,v).
4. For every vertex okay in the graph, bear in mind all pairs of vertices (i,j) and check if the path from i to j through k is shorter than the current best path. If it is, update the gap matrix: D[i][j] = min(D[i][j], D[i][k] D[k][j]).

5. After all iterations, the matrix D will contain the shortest course distances between all pairs of vertices.



Real World Applications of Floyd-Warshall Algorithm:
In computer networking, the algorithm can be used to find the shortest path between all pairs of nodes in a network. This is termed as network routing.
Flight Connectivity In the aviation industry to find the shortest path between the airports.
GIS(Geographic Information Systems) applications often involve analyzing spatial data, such as road networks, to find the shortest paths between locations.
Kleene's algorithm which is a generalization of floyd warshall, can be used to find regular expression for a regular language.

Complexity Analysis of Floyd Warshall Algorithm:

Time Complexity: O(V3), where V is the number of vertices in the graph and we run three nested loops each of size V
Auxiliary Space: O(V2), to create a 2-D matrix in order to store the shortest distance for each pair of nodes.