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Assignment: HW\_06

Ans:2)) Each time I will add the edge with the following steps:

1. I will run the modified function edge\_complete(u,v) to check, if the edge (u,v) completes negative cycle or not.
2. If it does, then I will not populate the corresponding entry in the matrix.
3. Otherwise, I will insert a random weight from [-w, w] at corresponding position.
4. After the graph is completed, I will check whether the random graph has a negative cycle using Bellmen-Ford algorithm.
5. If it does, I will delete the allocated memory and call the random\_grapgh function again.

Ans:3))b Bellmen-Ford Algorithm running time is:

1. O(VE), Where V is the number of vertices and E is the number of edges.

If V = E = n, then time = n^2O(n^2)

1. For complete graph it will take O(VE)

Where E = (V(V-1))/2

Say V=E=n, then it will take time: n^3O(n^3)

Ans:3 a)) **Bellmen Ford**:

1. It works on negative weight edges.
2. Bellman-Ford is also simpler than Dijkstra and suites well for distributed systems. But time complexity of Bellman-Ford is O(VE), which is more than Dijkstra
3. Bellmen ford returns true if no negative weight cycles are reachable form source else return false.

Working of Bellmen Ford:

![Diagram

Description automatically generated]()

Ans 4)) **Floyd-Warshall:** Floyd-Warshall Algorithm is an algorithm for finding the shortest path between all the pairs of vertices in a weighted graph. This algorithm works for both the directed and undirected weighted graphs. But, it does not work for the graphs with negative cycles (where the sum of the edges in a cycle is negative).

It works on formula:

Ak[i, j] = min (Ak-1[i, j], Ak-1[i, k] + Ak-1[k, j])

Where k is the intermediate vertices.

Running time for Floyd Warshall is O(V^3).