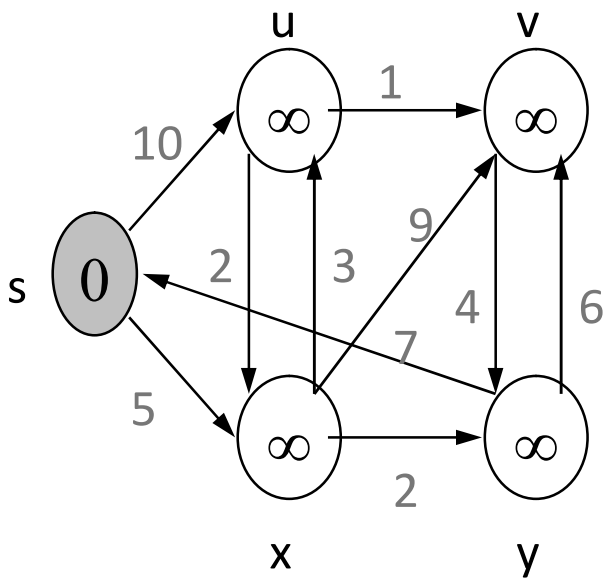
SEGMENT-6

Shortest Path

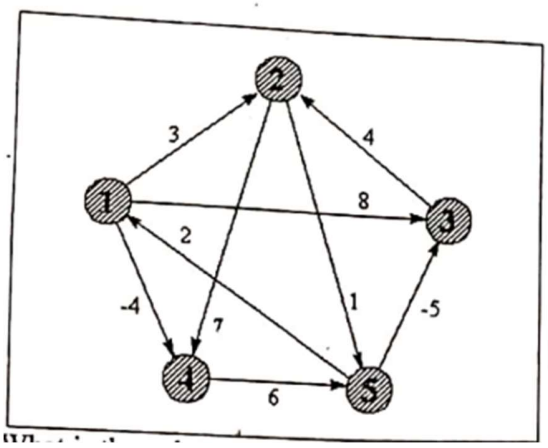
1. **a)** Run the Dijkstra's algorithm to find single source shortest path on the weighted directed graph in the following figure.



b) Describe the Bellman-Ford algorithm with necessary figure.

OR

Consider the following graph for finding all pair shortest path using Floyd-warshall algorithm.

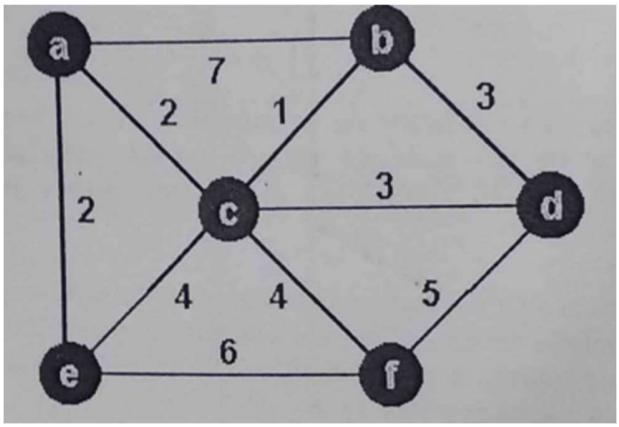


	0	3	8	7	-4
	inf	0	Inf	1	7
D(3) =	inf	4	0	5	11
	2	-1	-5	0	-2
	inf	inf	Inf	6	0

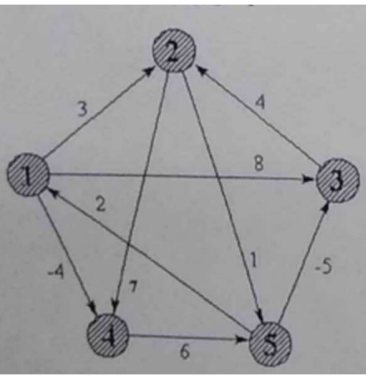
What is the value of matrix D(4) calculated from matrix D(3) given above.

2. **a) Why the outermost loop of Bellman-Ford's single source shortest path algorithm should run at least V-1 times where V is the number of vertices of graph**

b) Illustrate the operation of Dijkstra's algorithm for finding shortest path on the following directed graph. Assume a as the source.



c) Consider the following graph for finding all pair shortest path using Floyd-Warshall algorithm.



D(3) =

0	3	8	7	-4
inf	0	inf	1	7
inf	4	0	5	11
2	-1	-5	0	-2
inf	inf	inf	6	0

What is the value of matrix D(4) calculated from matrix D(3) given above.

3. a) How can the concept of intermediate vertex be used to formulate a recursive solution of All-pairs shortest paths problem.

b) Illustrate the operation of Bellman-Ford's algorithm for finding shortest path on the graph shown in Figure 2. Assume vertex 1 as the source.

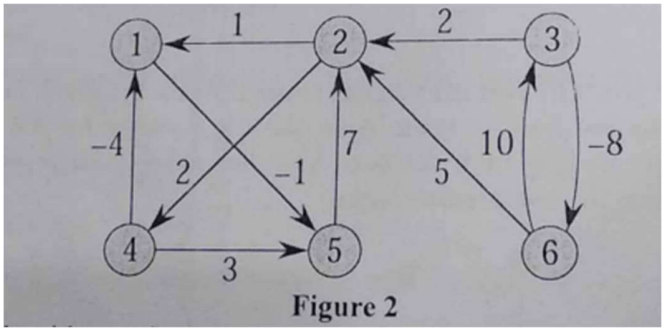
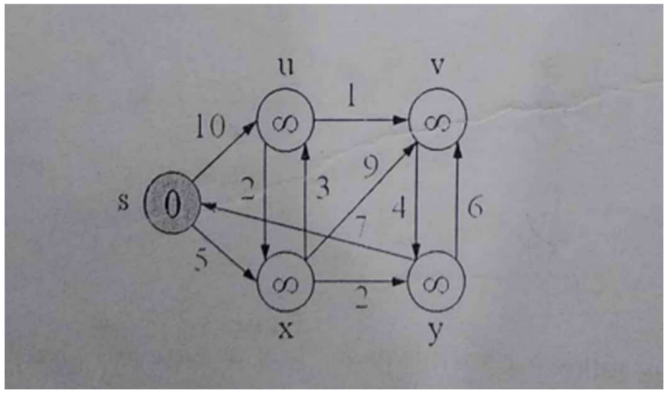


Figure 2

c) Run the Dijkstra's algorithm to find single source shortest path on the weighted directed graph in following figure.



4. a) What are the four variants of shortest path algorithm? Please describe.

b) Illustrate the operation of Dijkstra's algorithm for finding the shortest path on the directed graph shown in **Figure 2**. Assume **a** as the source. Write down the **d** and π value of each vertex after each iteration.

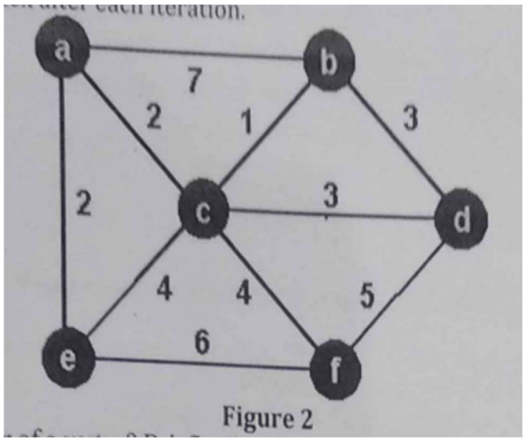
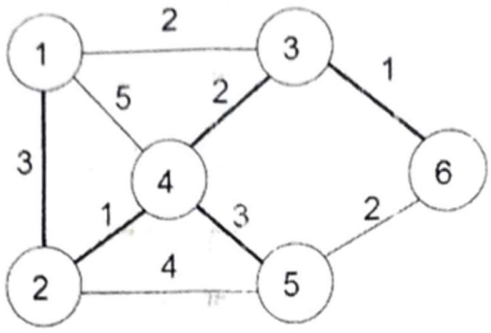


Figure 2

c) What is the relaxation of a vertex? Briefly discuss with necessary figure.

5.a) What is a negative weight cycle?

b) Illustrate the operation of Dijkstra's algorithm for finding the shortest path from vertex (1) on the following graph. Show how the distance and parent change in each step.

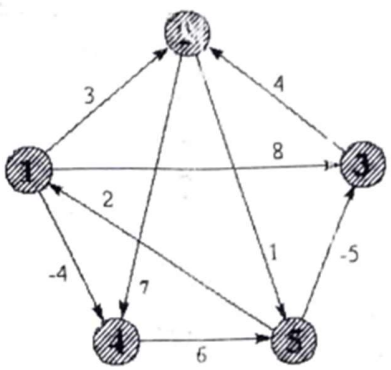


c) A student has been asked to write down the Floyd-Warshall's algorithm for finding the All-Pairs Shortest Paths. So, he has written the following.

```
Floyd-Warshell(W)
        n = W.rows
        D = W
        for I = 1 to n
            for j = 1 to n
                for k = 1 to n
                    dij = min(dij, dik + dkj)
return D
```

He did a small mistake in writing the algorithm. Can you find it? Why the above algorithm is not going to work?

6. Find D(1) for the graph of the following using the Floyd-Warshall algorithm.



7. a) What is negative weight cycle? Give a simple example of a directed graph with negative-weight edges but not with any negative-weight cycle.

b) Write down the differences between Dijkstra's Algorithm and Bellman-Ford algorithm?