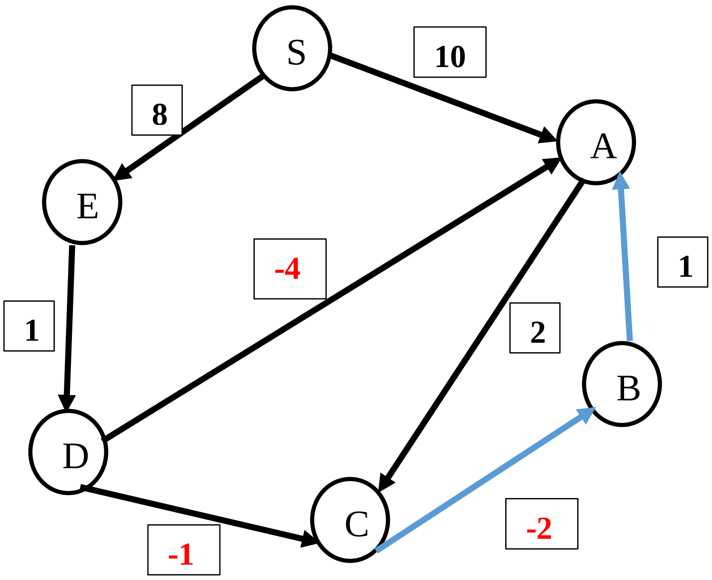
Bellman-Ford Algorithm

Swarup Kr Ghosh

Bellman Ford Algorithm: Single source multiple destination shortest path

- It follows DP approach
- Applicable for both positive and negative edges.



(S,A)= 10, (C,B)=-2
(S,E)=8, (B,A) =1
(A,C)=2, (E,D) = 1
(D,C)=-1, (D,A)=-4

Iteration	S	A	B	C	D	E
0	0	INF	INF	INF	INF	INF
1	0	10	INF	INF	INF	8
2	0	10	10	12	9	8
3	0	5	6	8	9	8
4	0	5	5	7	9	8
5	0	5	5	7	9	8

Number of iteration = n-1

Algorithm: Bellman-Ford

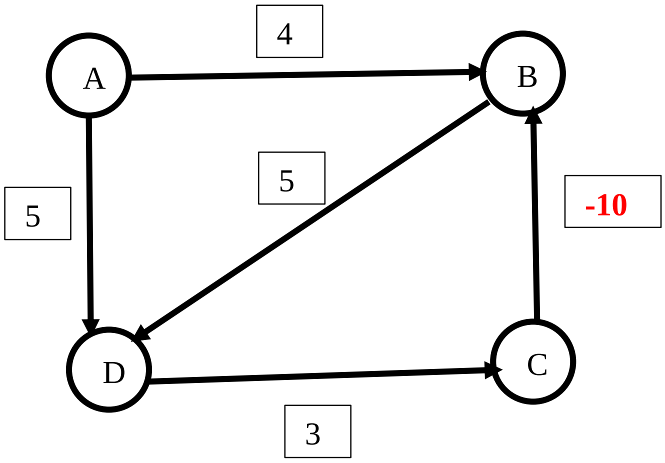
Procedure: Shortest_path(G, w, s)

Input: Directed graph G= (V, E); edge weight w; and source vertex s ε V
Output: For all vertices u reachable from s, dist (u) is the distance from s to u.
For all u ε V
    dist (u)= INF
    prev (u) = NULL
dist (s) = 0
repeat |V|-1 times:
    for all e ε E
    update (e)
End procedure

Procedure: update ((u,v) ε E)
dist (v) = min { dist (v), dist (u) + w (u,v) }
End procedure

Time Complexity: O (|V|.|E|)
Since we have visited source to all nodes.

Drawback:



Iteration	A	B	C	D
0	0	INF	INF	INF
1	0	4	INF	5
2	0	-2	8	5
3	0	-2	8	3
	0	-4	6	3
	0			

B-D-C: total weigh= -2