Bellman Ford Algorithm

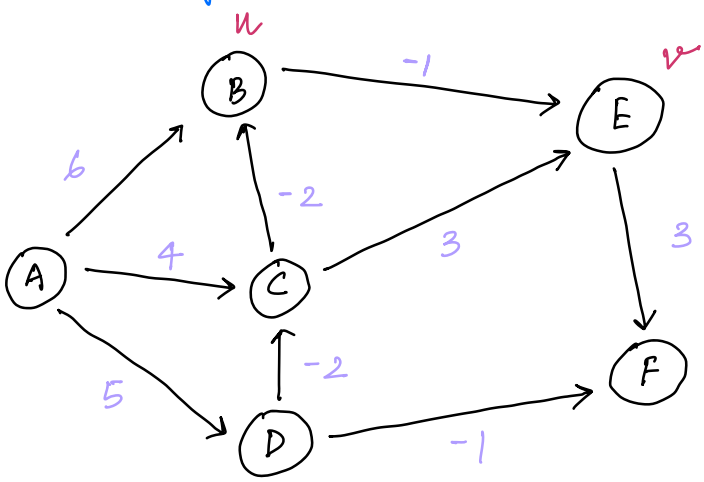
Given : graph and a src vertex

To find : shortest path from src to all vertices in the given graph

Note : Dijkstra's algorithm doesn't work for graphs with negative weights ; it may or may not give correct ans for such graph

BELLMAN FORD ALGORITHM

single source shortest path algorithm



weighted and directed graph having negative edge weights

Rule : Go on relaxing all the edges $(n-1)$ times where n is the no. of vertices

$(n = 6)$ here

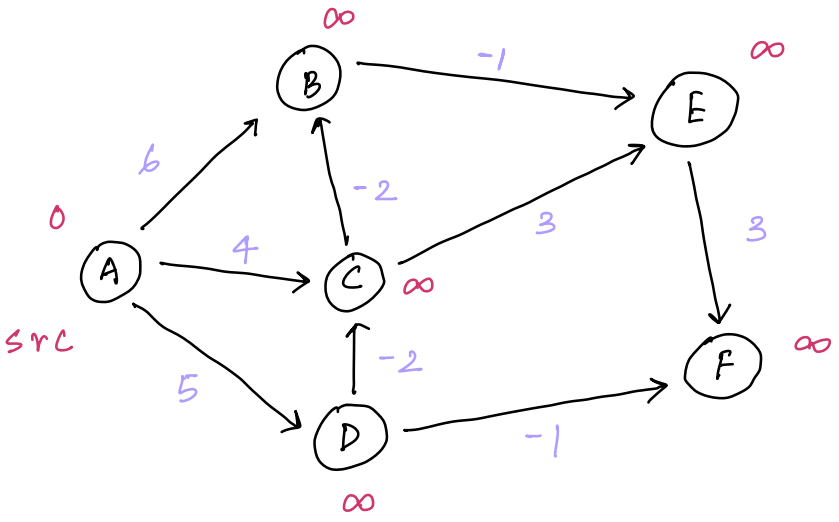
Iterating the loop more than (n-1) times will have no change in the result

Relaxing ??

```
if (d[u] + c(u, v) < d[v]) {
    d[v] = d[u] + c(u, v);
}
```

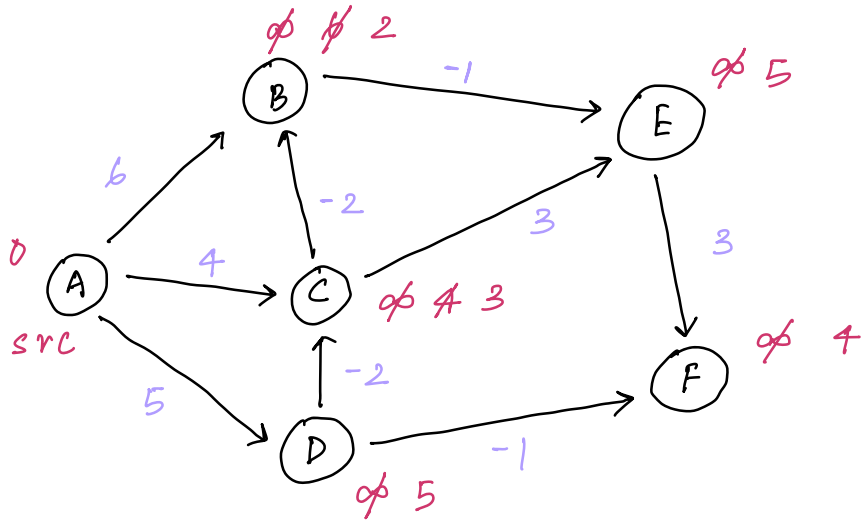
Edges

(A, B), (A, C), (A, D), (B, E), (C, B), (C, E), (D, C), (D, F), (E, F)

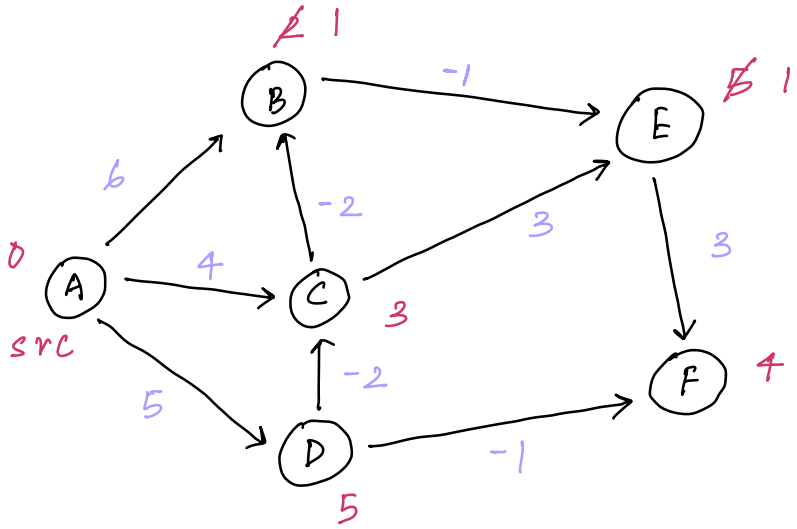


Initially all the distances from the source vertex will be infinity

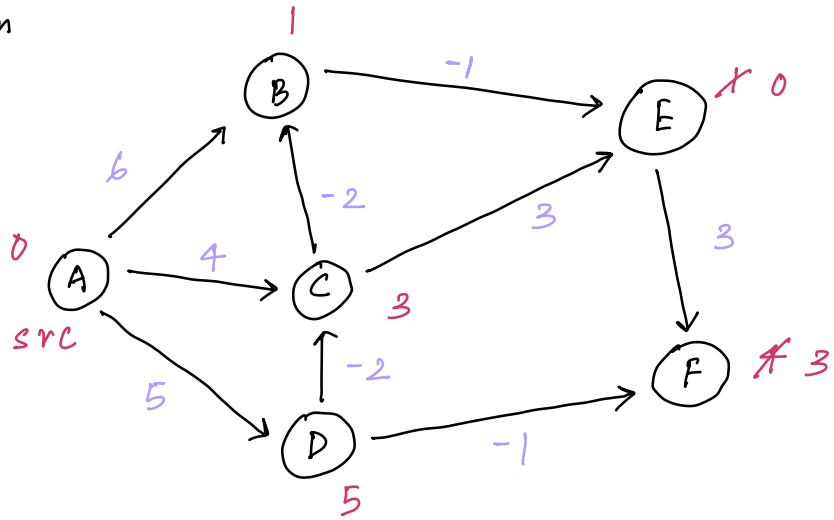
1st iteration



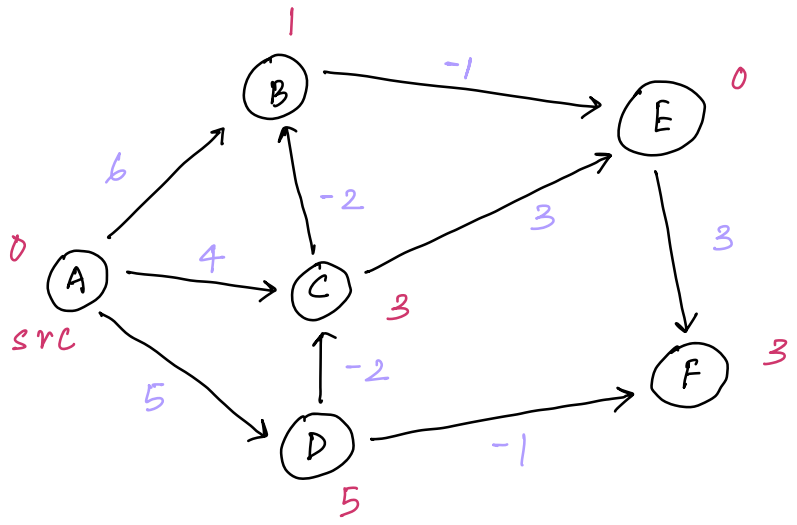
2nd iteration



3rd iteration



4th iteration



No change / updation at 4th iteration

A - 0
B - 1
C - 3
D - 5
E - 0
F - 3

Time complexity

O (E (|V| - 1)) ⟶ relaxing all edges by (n-1) times

O (E.V)

no. of edges = $\frac{V(V-1)}{2}$

O (n^3)

Drawback of Bellman Ford Algorithm

won't work if the graph contains a negative weight cycle in it

(any cycle whose sum of weighted edges is negative)