Unit 4- Bellman Ford Examples

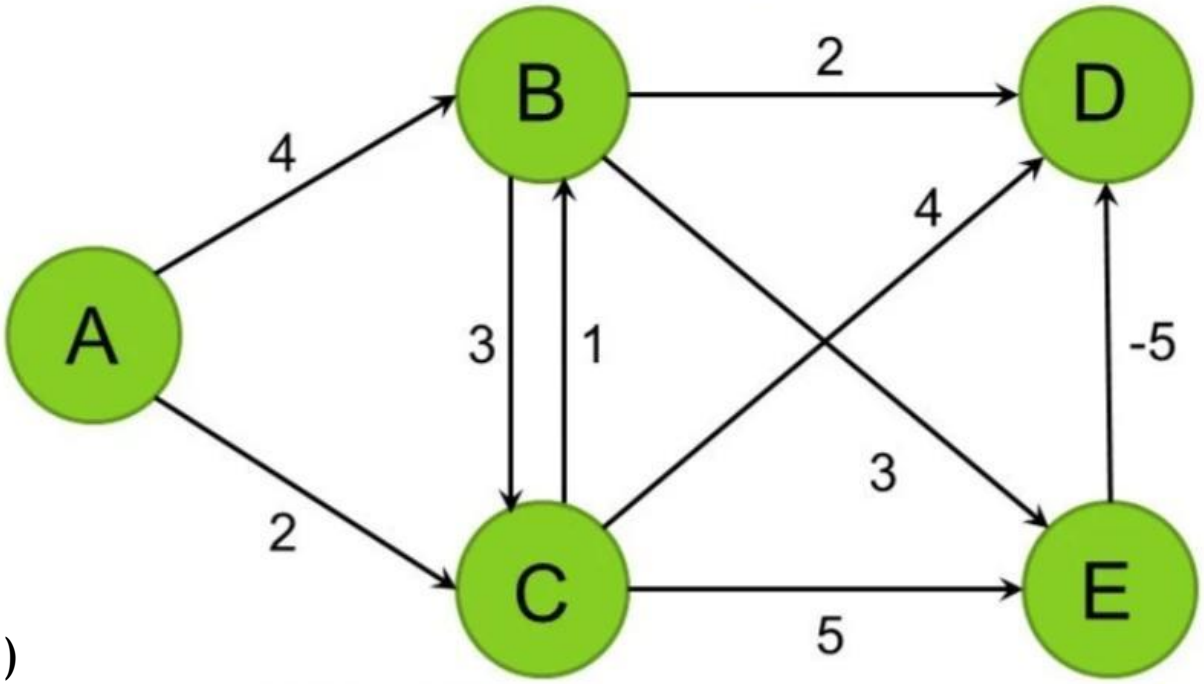
Single source shortest path

Basic Steps

- List all the edges of graph
- For No. Of vertices N, do the following steps N-1 times
  - Consider starting node of an edge as u and ending node as v

```
Relax(u, v, w)
 if d[v] > d[u] + w(u, v)
    then  d[v] := d[u] + w(u, v)
          parent[v] := u
```

Example 1 – Initial State

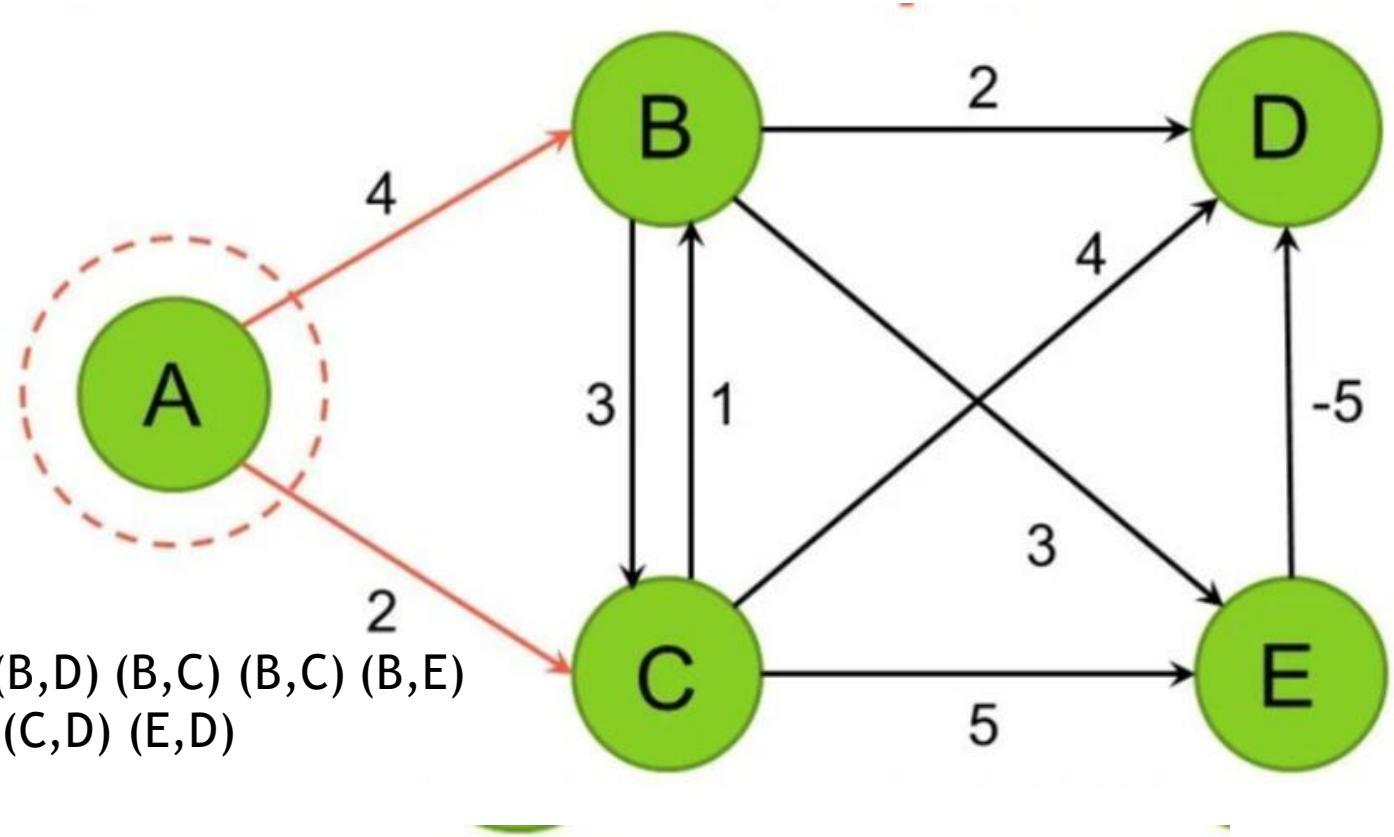


A	B	C	D	E
0	∞	∞	∞	∞

Edge list

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

Example 1 – Pass 1

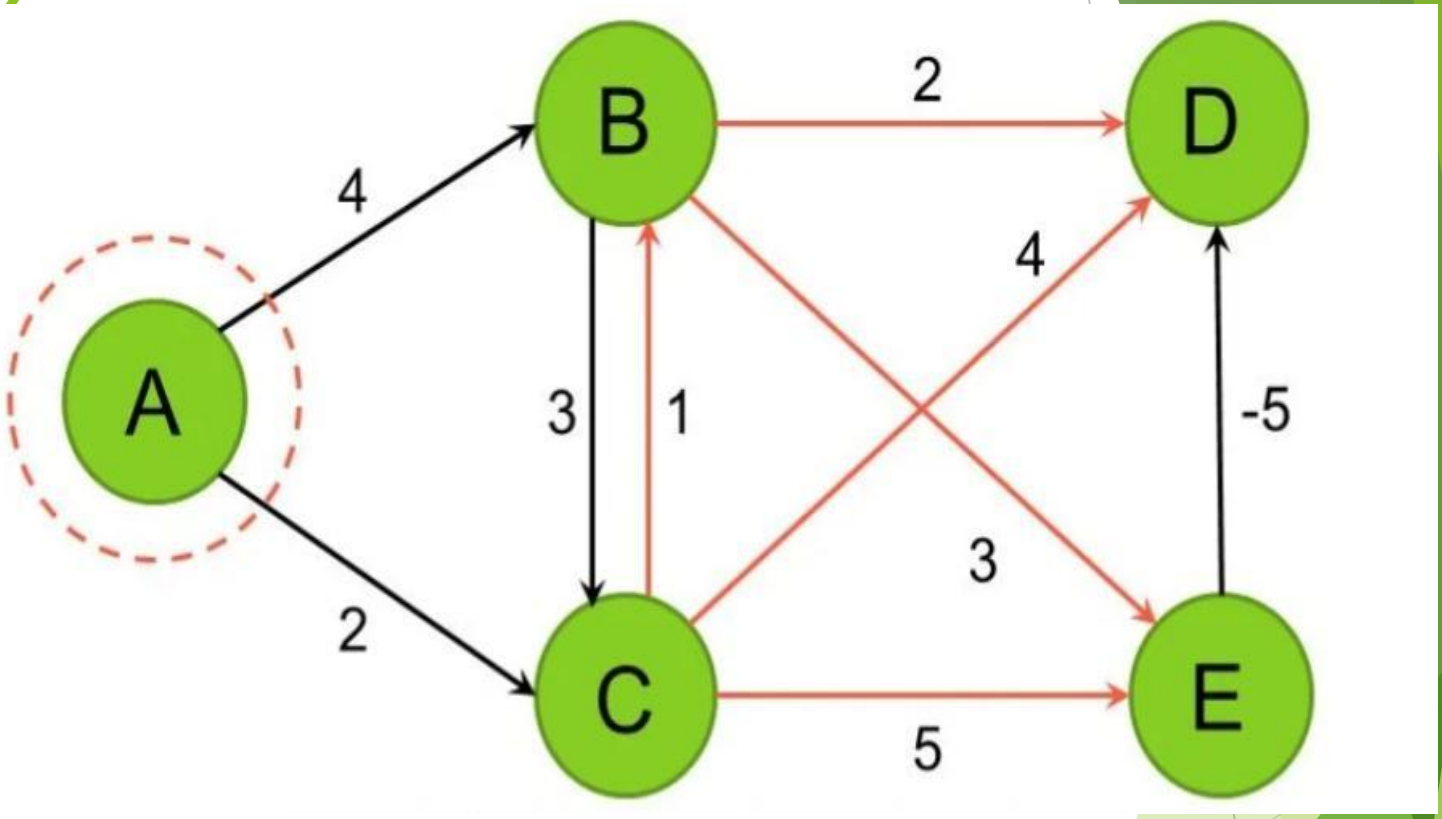


Edge list

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

A	B	C	D	E
0	4	2	∞	∞

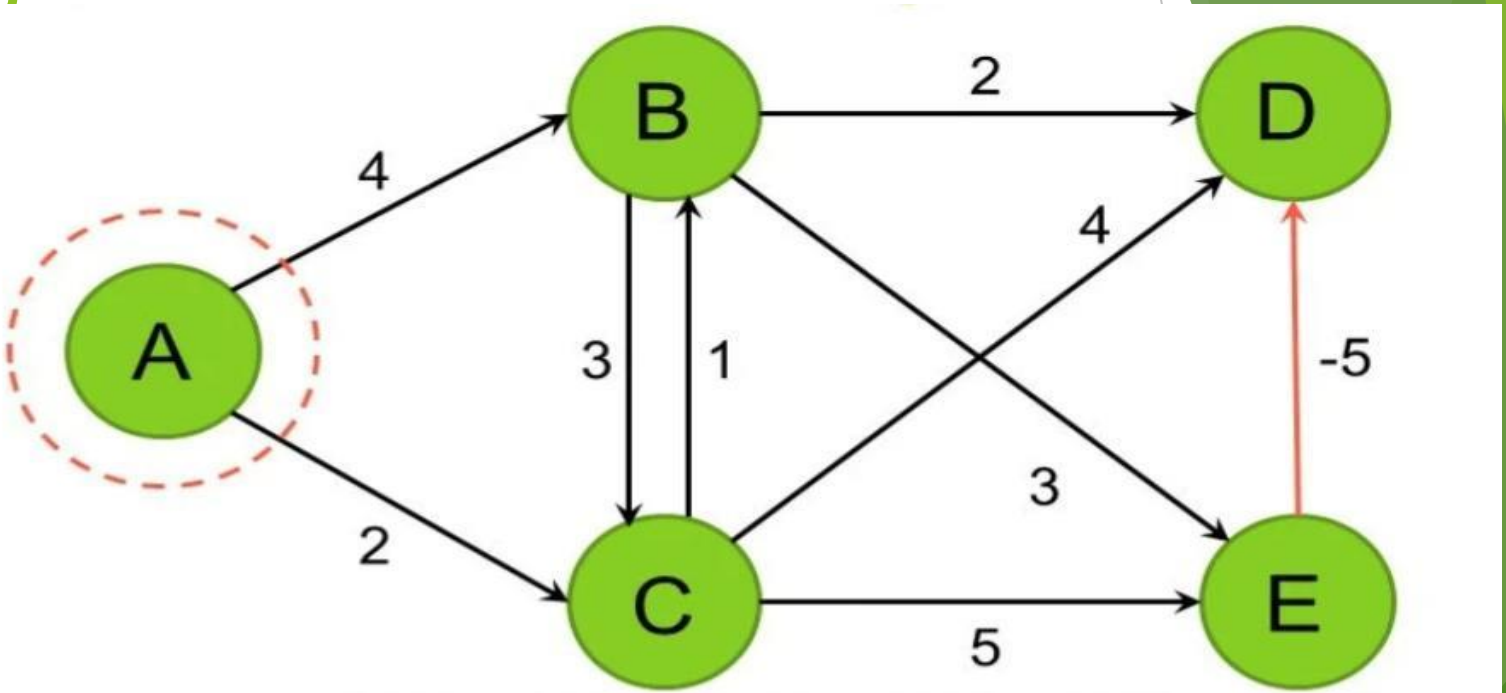
Example 1 – Pass 2



Edge list
(A,C) (A,B) (B,D) (B,C) (B,C) (B,E)
(C,B) (C,E) (C,D) (E,D)

A	B	C	D	E
0	3	2	6	6

Example 1 – Pass 3

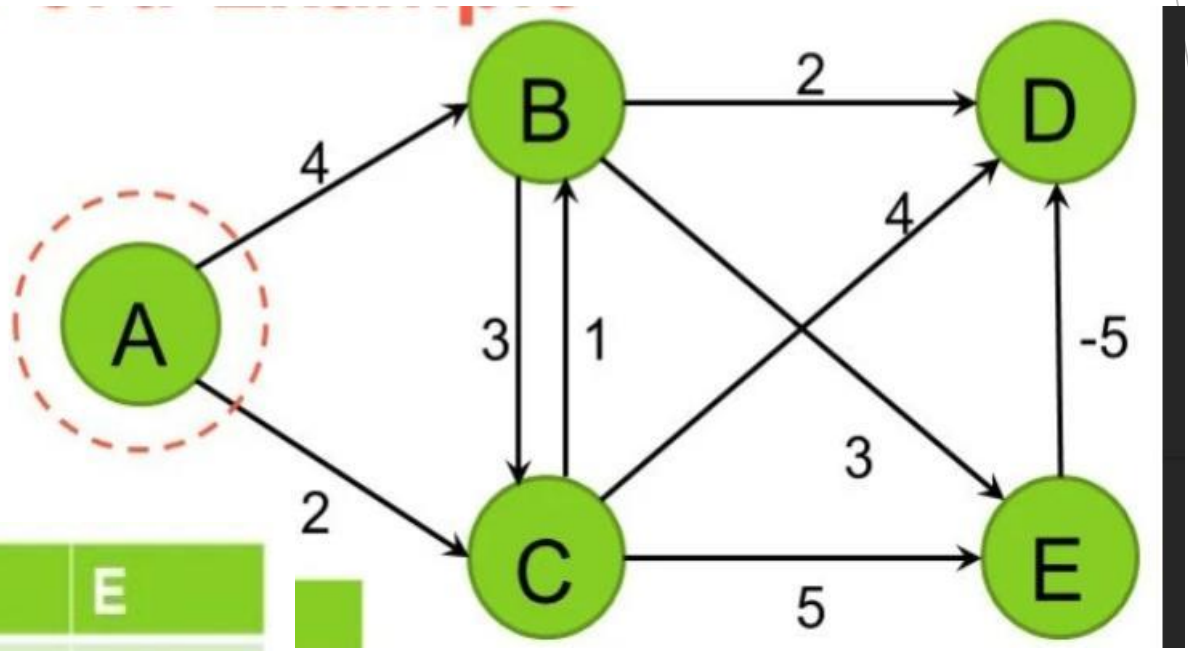


Edge list

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

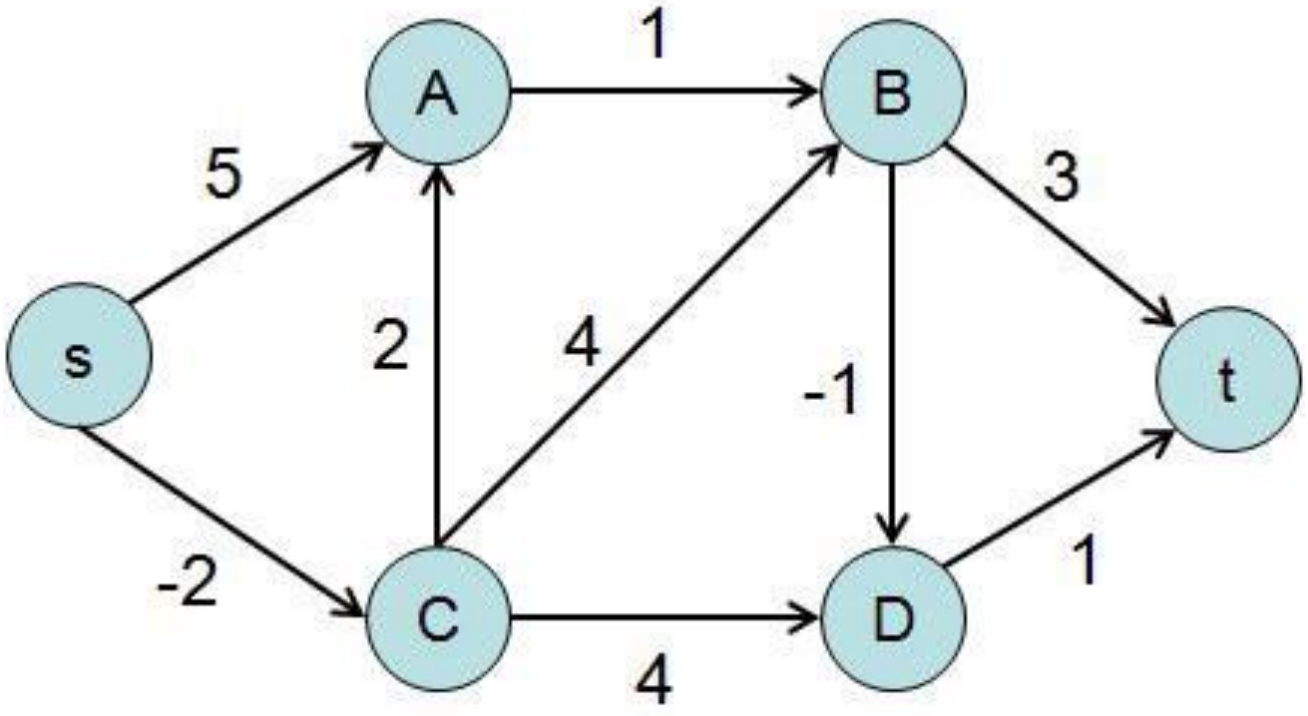
A	B	C	D	E
0	3	2	1	6

Example 1 – Pass 4

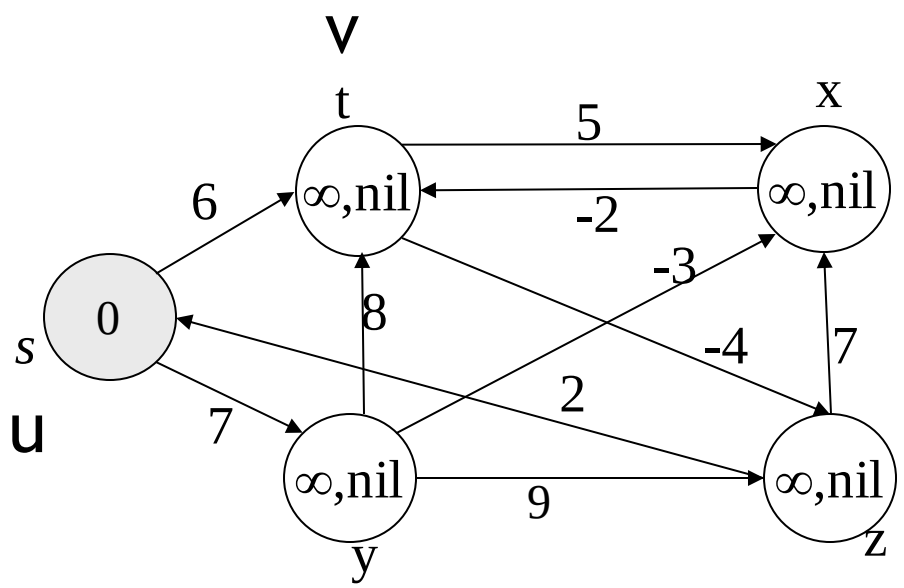


A	B	C	D	E
0	∞	∞	∞	∞
0	**4**	**2**	∞	∞
0	**3**	**2**	6	6
0	**3**	**2**	1	6
0	**3**	**2**	1	6

Example 2



The Bellman-Ford Algorithm



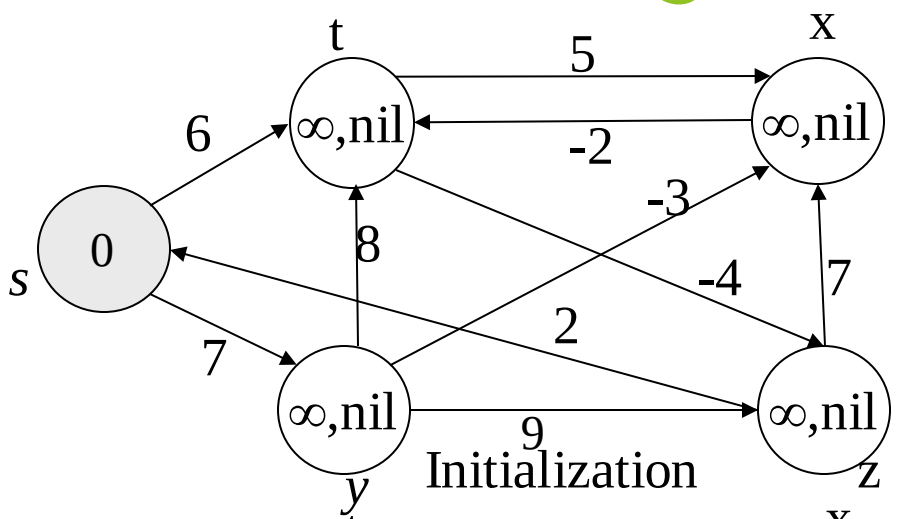
Relax(u, v, w)

if d[v] > d[u] + w(u, v)

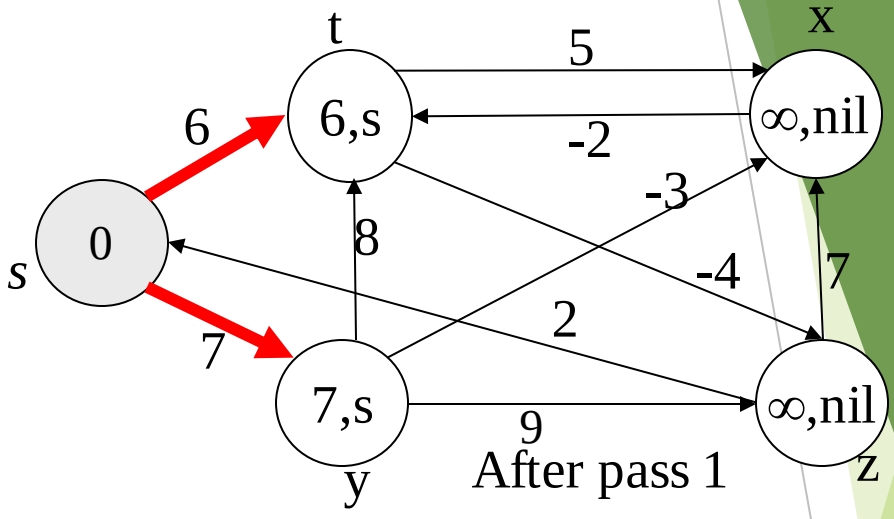
  then d[v] := d[u] + w(u, v)

  parent[v] := u

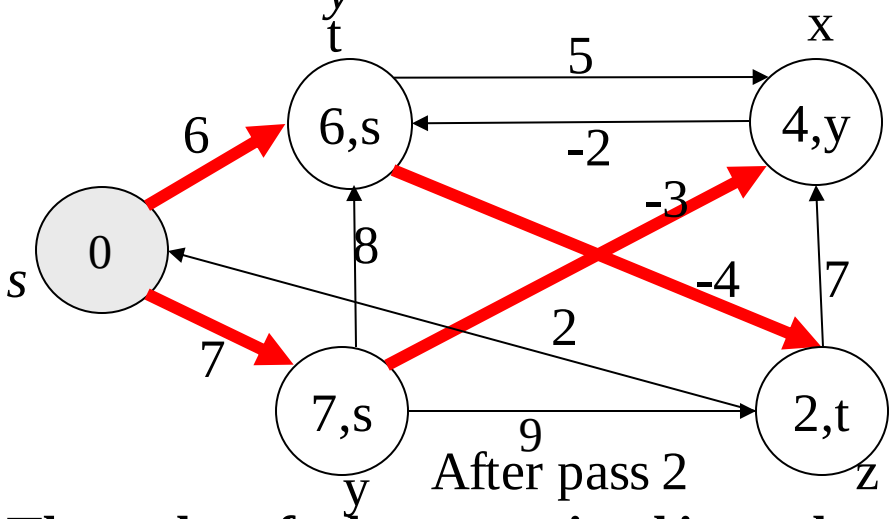
The Bellman-Ford Algorithm



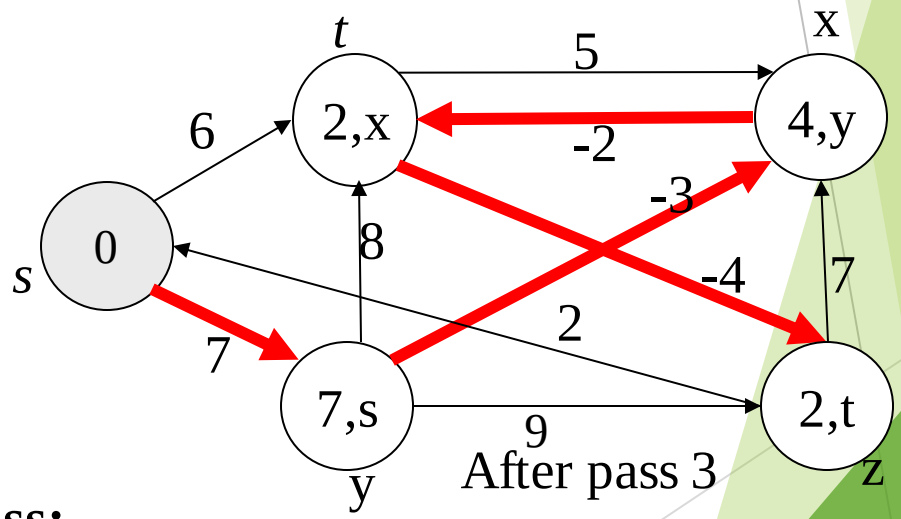
Initialization



After pass 1



After pass 2

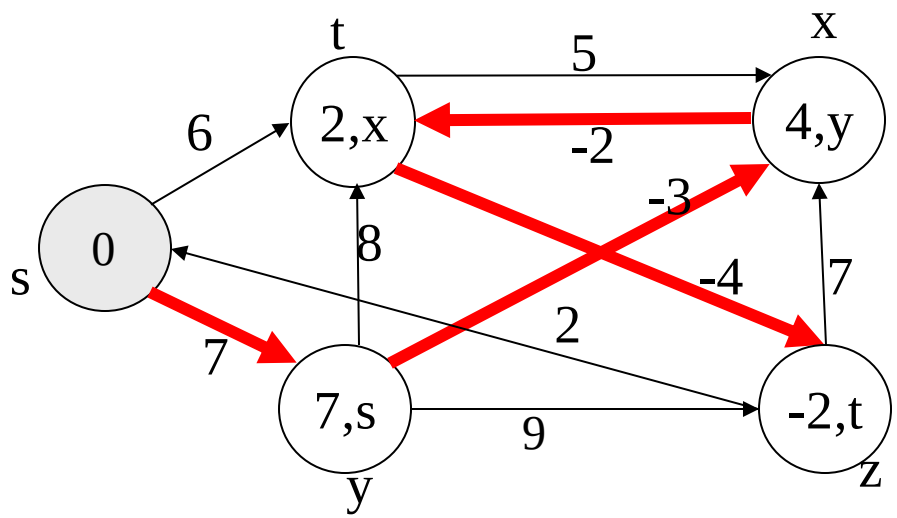


After pass 3

The order of edges examined in each pass:

(t, x), (t, z), (x, t), (y, x), (y, t), (y, z), (z, x), (z, s), (s, t), (s, y)

The Bellman-Ford Algorithm



After pass 4

The order of edges examined in each pass:

(t, x), (t, z), (x, t), (y, x), (y, t), (y, z), (z, x), (z, s), (s, t), (s, y)