

Assignment 8.

33213

Problem Statement

Write a problem/program to implement Bellman-Ford algorithm using Dynamic programming.

Objective :-

1. To understand dynamic programming.
2. To understand implementation of Bellman Ford.
3. To understand concept of relaxation.

Bellman Ford Algorithm:-

- Used to solve single source shortest path problem using DP.
- It checks for principle of optimality.
- Relaxes edges to determine nearest neighbour of them, estimates the shortest path from single source to all other nodes.
- It can solve ssSP problem for a graph with negative edges.
- As -ve weight cycle in graph defines set of edges that for a cycle & sum of them will result in negative value.
- Since objective of algorithm is to find shortest path algorithm moves around -ve weight cycle for infinite amount of time.
- Algo does not terminate for graph with negative edge cycle.

-It identifies presence of -ve weight cycle in graph.

Pseudocode for Bellman ford algorithm.

```
// Initialization
```

```
for (i = 1 to n)
```

```
{ dist[v] = ∞
```

```
  pred[v] = NULL
```

```
}
```

```
dist[s] = 0
```

```
pred[s] = s
```

```
// edge relaxation
```

```
for (i = 0 to |V| - 1)
```

```
{
```

```
  for (each edge  $\langle u, v \rangle \in E$ ) do
```

```
  {
```

```
    if (dist[v] > dist[u] + w(u, v))
```

```
    {
```

```
      dist[v] = dist[u] + w(u, v)
```

```
      pred[v] = u;
```

```
    }
```

```
  }
```

```
}
```

```
// detection of -ve edges
```

```
for (each edge  $\langle u, v \rangle \in E$ ) do
```

```
{
```

```
  if (dist[v] > dist[u] + w[u, v]) then
```

```
  { print (negative cycle present);
```

```
  }
```

```
}
```


Analysis.

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- Initialization stage needs $O(|V|)$
- edge relaxation stage needs $O(|V|/E)$ time.
- detection of -ve cycle taken $O(E)$

Thus, the time complexity of Bellman Ford algorithm is $O(|V|E)$

Conclusion:- Thus we studied Bellman-Ford algorithm successfully & implement it -