Bellman-Ford

Algorithm 1: Bellman-Ford

Data: A weighted graph $G(V, E)$ with weight function $W : E \to R$ and the source vertex s

Result: Distance array d which contains minimum distances from s to all other vertices. If a negative cycle is found, then it is reported

1 begin

2   /* Initialize distance array   */

3   for $i \leftarrow 1$ to $|V|$ do

4 $d[i] \leftarrow \infty$

5   end

6 $d[s] \leftarrow 0$

7   /* Relax all edges $|V| - 1$ times   */

8   for $i \leftarrow 1$ to $|V| - 1$ do

9   for each edge $e(u, v) \in E$ do

10   RelaxEdge(u, v, W)

11   end

12   end

13   /* Check for negative cycle   */

14   for each edge $e(u, v) \in E$ do

15   if $RelaxEdge(u, v, W) = True$ then

16   Report negative cycle

17   end

18   end

19   Return d

20 end

Algorithm 2: RelaxEdge

Data: An edge $e(u, v)$ and weight function W

Result: Returns true if the edge e is relaxed, else false

1 begin

2   if $d[u] + W(u, v) < d[v]$ then

3 $d[v] \leftarrow d[u] + W(u, v)$

4   Return True

5   end

6   Return False

7 end

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1 Proof of Correctness

1.1 Invariant

1.2 Initialization

1.3 Maintenance

1.4 Termination