

JOHNSON(G, w)

```
1  compute  $G'$ , where  $G'.V = G.V \cup \{s\}$ ,  
     $G'.E = G.E \cup \{(s, v) : v \in G.V\}$ , and  
     $w(s, v) = 0$  for all  $v \in G.V$   
2  if BELLMAN-FORD( $G', w, s$ ) == FALSE  
3      print “the input graph contains a negative-weight cycle”  
4  else for each vertex  $v \in G'.V$   
5      set  $h(v)$  to the value of  $\delta(s, v)$   
        computed by the Bellman-Ford algorithm  
6  for each edge  $(u, v) \in G'.E$   
7       $\hat{w}(u, v) = w(u, v) + h(u) - h(v)$   
8  let  $D = (d_{uv})$  be a new  $n \times n$  matrix  
9  for each vertex  $u \in G.V$   
10     run DIJKSTRA( $G, \hat{w}, u$ ) to compute  $\hat{\delta}(u, v)$  for all  $v \in G.V$   
11     for each vertex  $v \in G.V$   
12          $d_{uv} = \hat{\delta}(u, v) + h(v) - h(u)$   
13  return  $D$ 
```