

The Dijkstra Algorithm

Antonio Carzaniga

Faculty of Informatics
Università della Svizzera italiana

May 11, 2016

Dijkstra's Algorithm

- Executing locally at node u

Dijkstra's Algorithm

- Executing locally at node u
- Variables storing values known at each iteration

Dijkstra's Algorithm

- Executing locally at node u
- Variables storing values known at each iteration
 - ▶ $D[v]$, cost of the least-cost path from u to v

Dijkstra's Algorithm

- Executing locally at node u
- Variables storing values known at each iteration
 - ▶ $D[v]$, cost of the least-cost path from u to v
 - ▶ $p[v]$, node preceding v (neighbor of v) on the least-cost path from u to v

Dijkstra's Algorithm

- Executing locally at node u
- Variables storing values known at each iteration
 - ▶ $D[v]$, cost of the least-cost path from u to v
 - ▶ $p[v]$, node preceding v (neighbor of v) on the least-cost path from u to v
 - ▶ N , nodes of G whose least-cost path from u is definitely known

Dijkstra's Algorithm

DIJKSTRA($G = (V, E), u$)

```
1   $N = \{u\}$ 
2  for all  $v \in V$ 
3      if  $v \in neighbors(u)$ 
4           $D[v] = c(u, v)$ 
5           $p[v] = u$ 
6      else  $D[v] = \infty$ 
7  while  $N \neq V$ 
8      find  $w \notin N$  such that  $D[w]$  is minimum
9       $N = N \cup \{w\}$ 
10     for all  $v \in neighbors(w) \setminus N$ 
11         if  $D[w] + c(w, v) < D[v]$ 
12              $D[v] = D[w] + c(w, v)$ 
13              $p[v] = w$ 
```

Example

DIJKSTRA($G = (V, E), u$)

```
1   $N = \{u\}$ 
2  for all  $v \in V$ 
3      if  $v \in neighbors(u)$ 
4           $D[v] = c(u, v)$ 
5           $p[v] = u$ 
6      else  $D[v] = \infty$ 
7  while  $N \neq V$ 
8      find  $w \notin N$  such that  $D[w]$  is minimum
9       $N = N \cup \{w\}$ 
10     for all  $v \in neighbors(w) \setminus N$ 
11         if  $D[w] + c(w, v) < D[v]$ 
12              $D[v] = D[w] + c(w, v)$ 
13              $p[v] = w$ 
```

