

## 4. GREEDY ALGORITHMS II

---

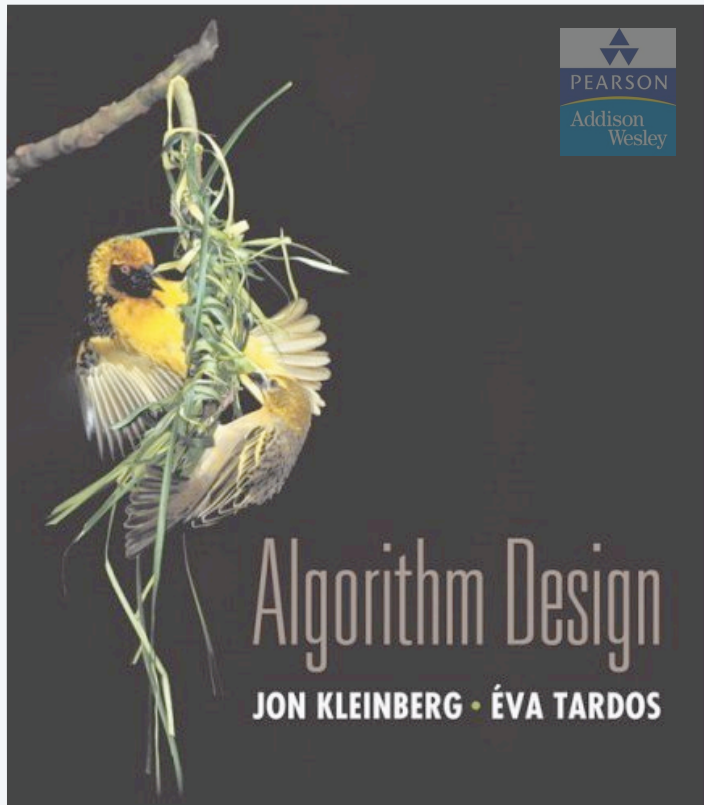
- ▶ *Dijkstra's algorithm demo*
- ▶ *improved Dijkstra's algorithm demo*

Lecture slides by Kevin Wayne

Copyright © 2005 Pearson-Addison Wesley

Copyright © 2013 Kevin Wayne

<http://www.cs.princeton.edu/~wayne/kleinberg-tardos>



## SECTION 4.4

# 4. GREEDY ALGORITHMS II

---

- ▶ *Dijkstra's algorithm demo*
- ▶ *improved Dijkstra's algorithm demo*

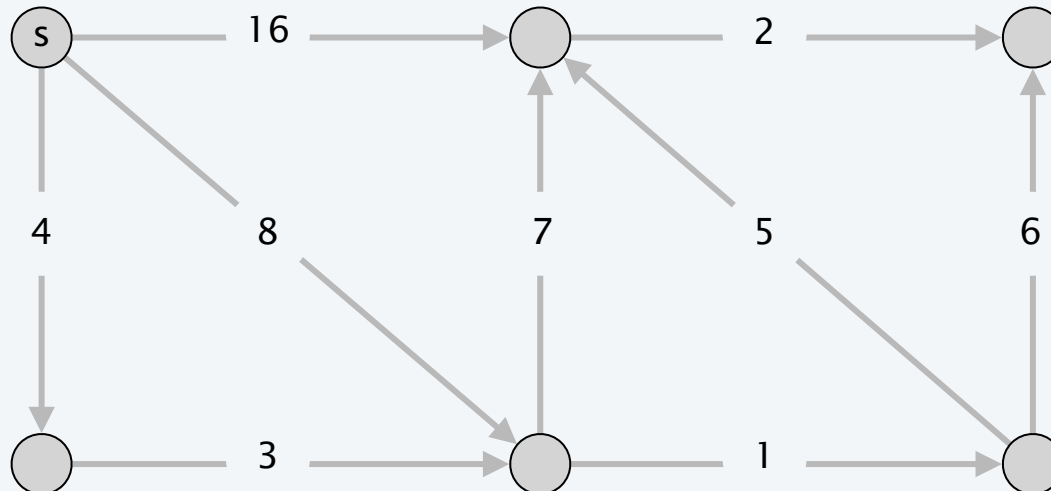
# Dijkstra's algorithm demo

---

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .



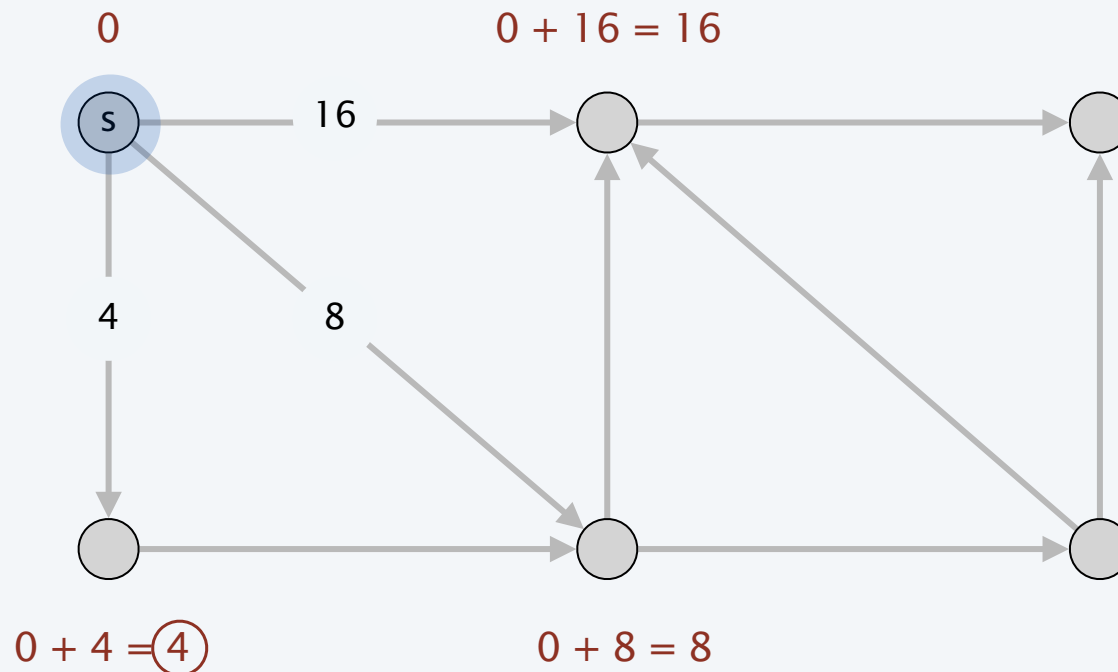
# Dijkstra's algorithm demo

---

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .

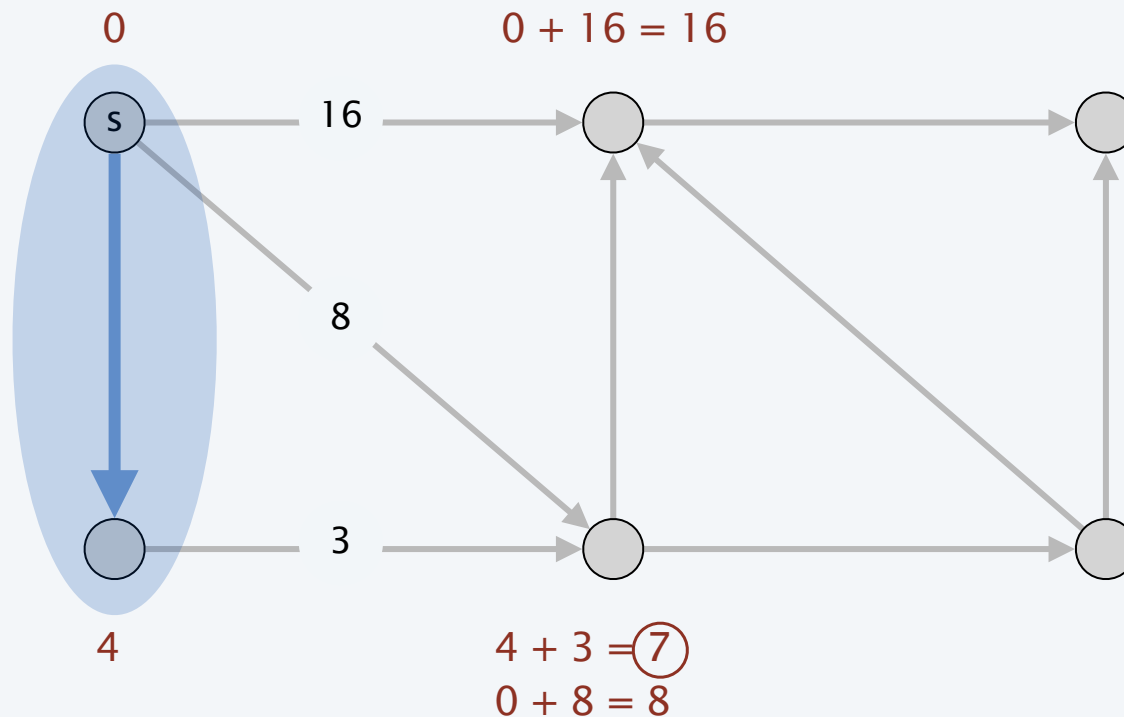


# Dijkstra's algorithm demo

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .

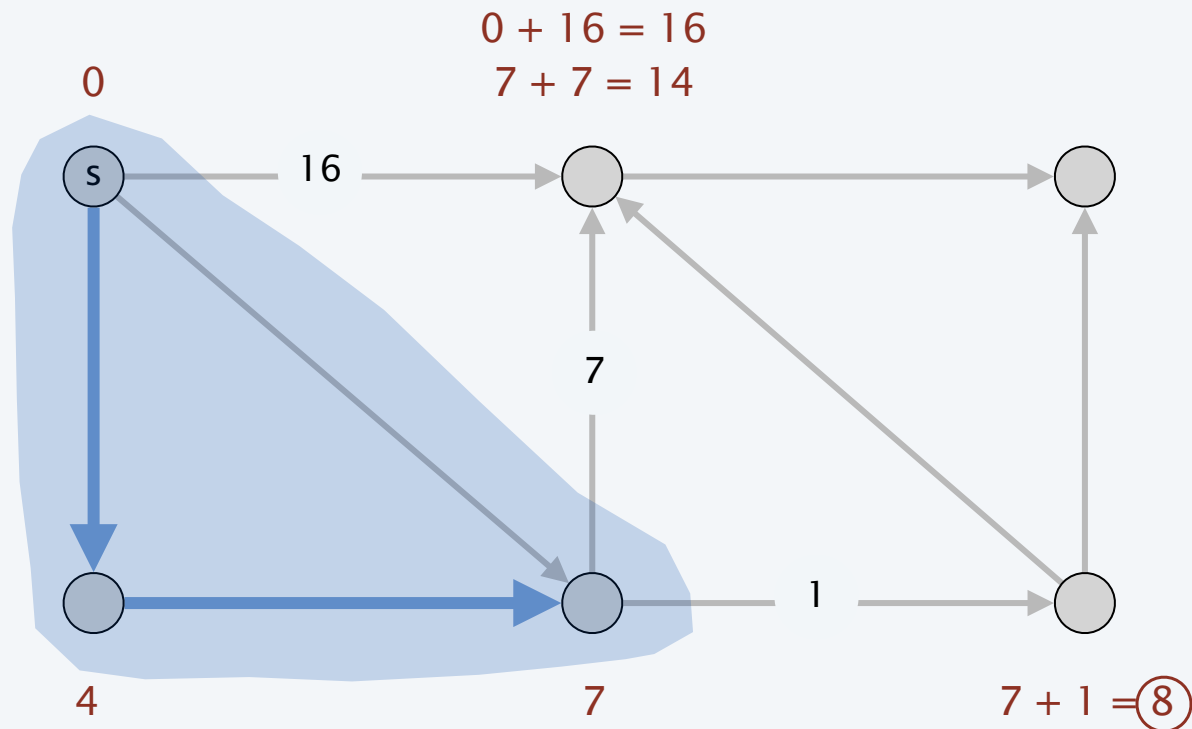


# Dijkstra's algorithm demo

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .

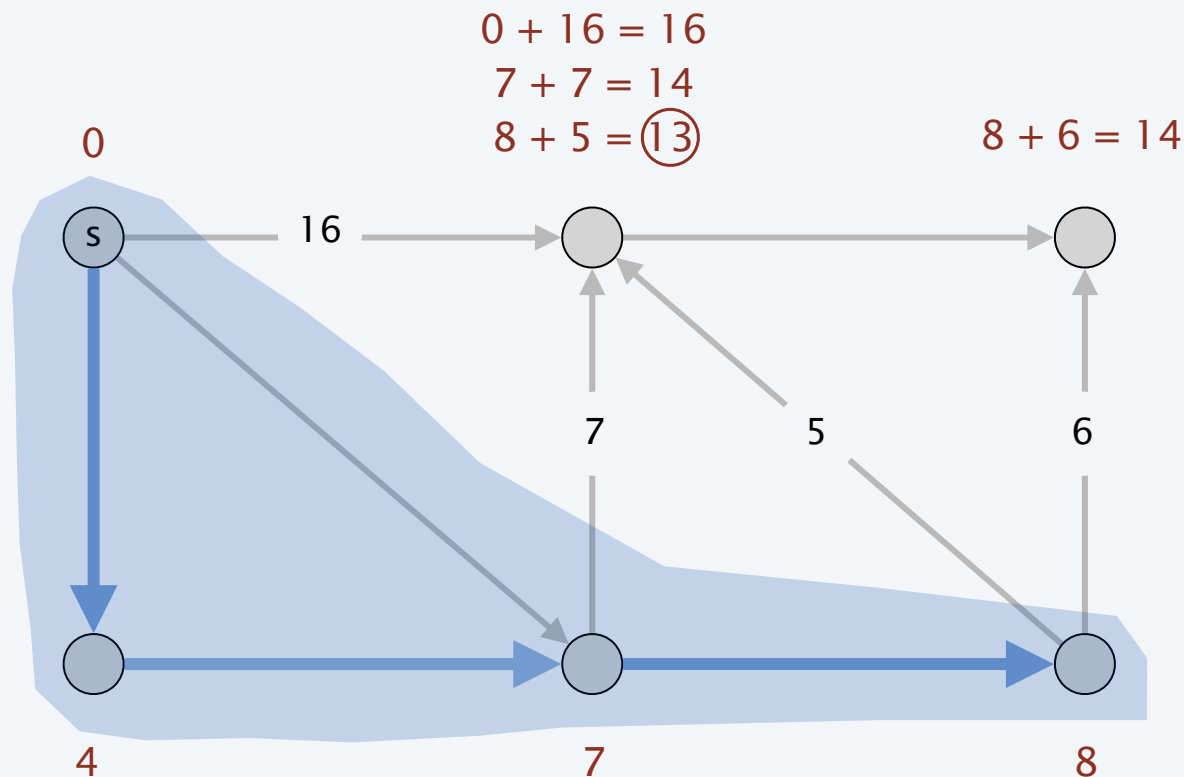


# Dijkstra's algorithm demo

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .

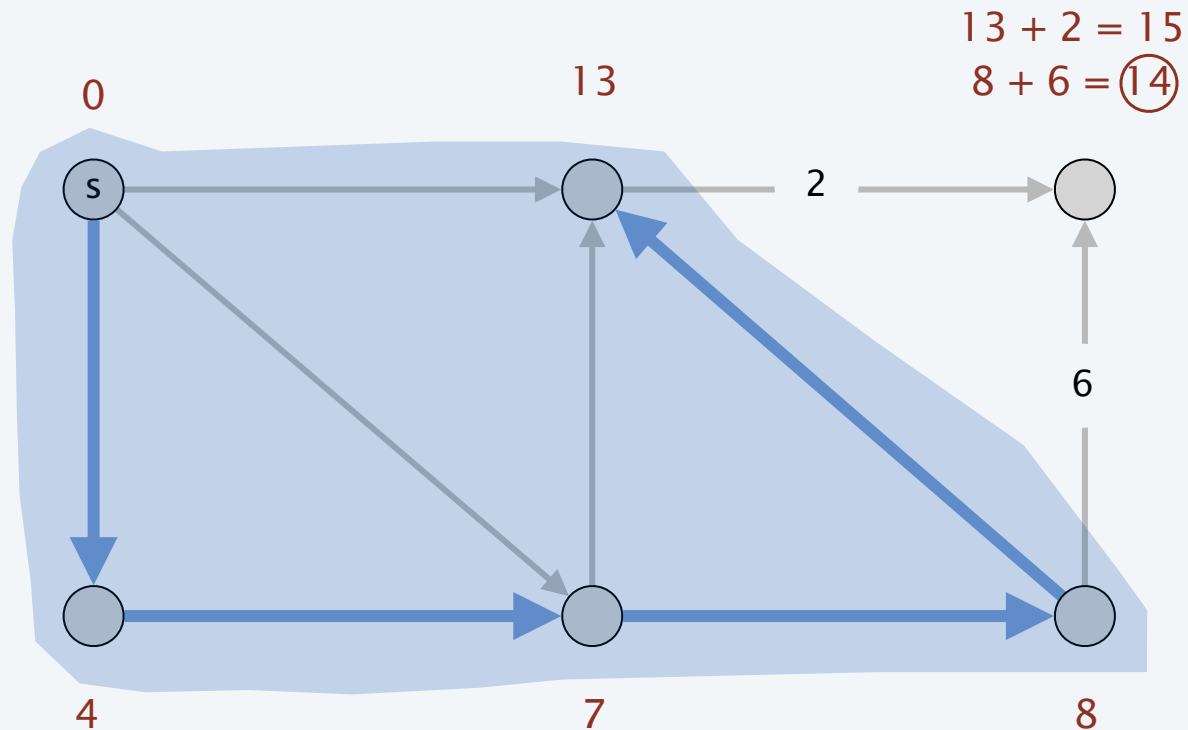


# Dijkstra's algorithm demo

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .





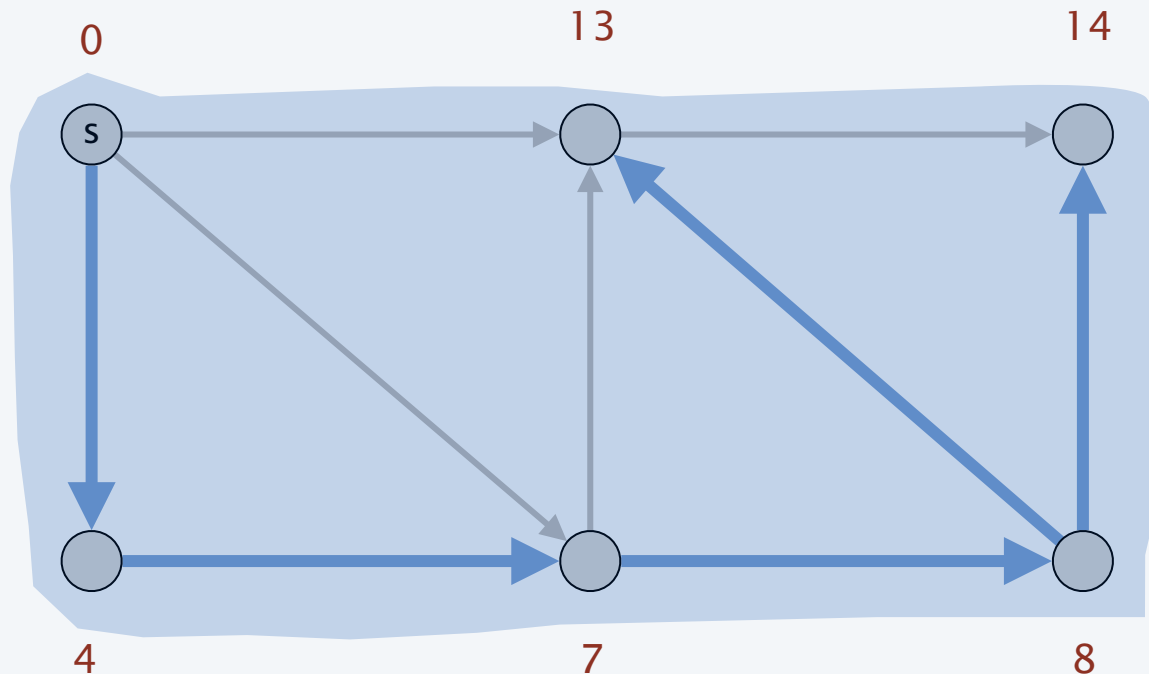
# Dijkstra's algorithm demo

---

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .



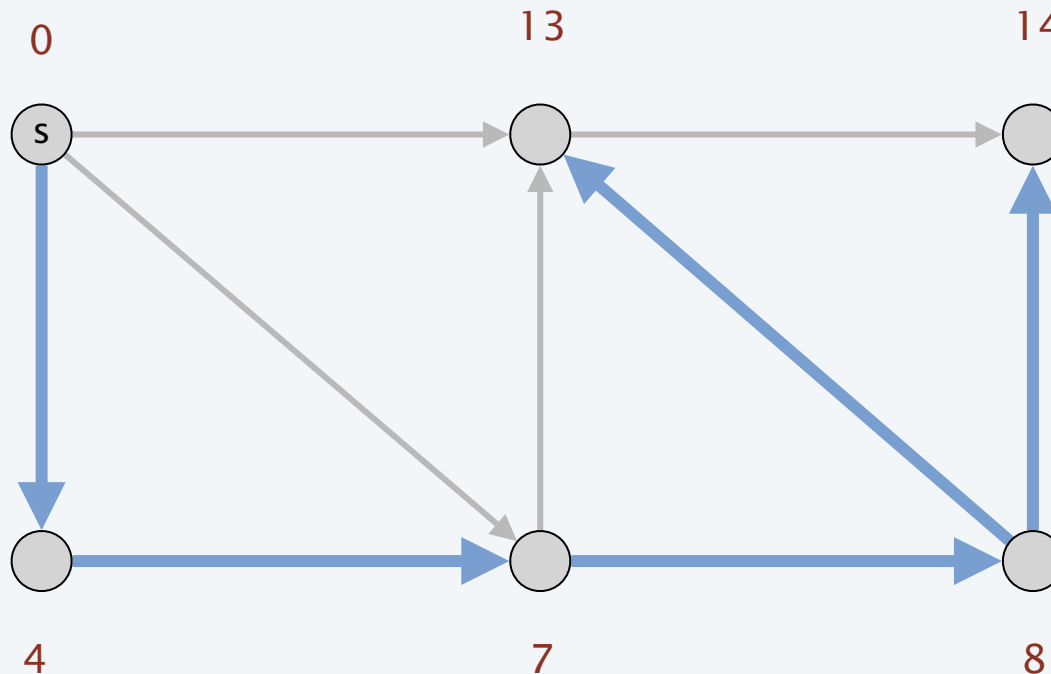
# Dijkstra's algorithm demo

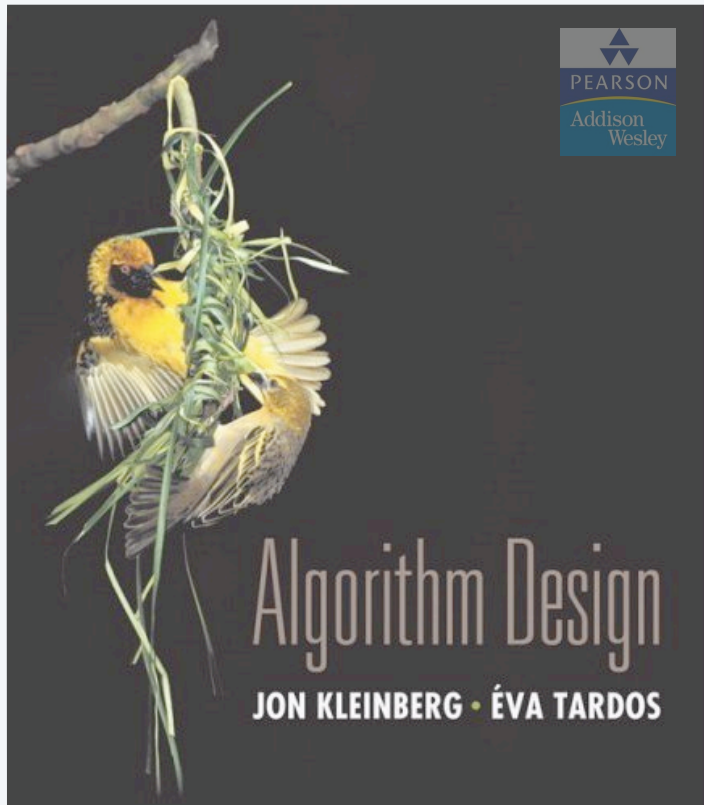
---

- Initialize  $S = \{ s \}$ ,  $d(s) = 0$ .
- Repeatedly choose unexplored node  $v$  which minimizes

$$\pi(v) = \min_{e = (u,v) : u \in S} d(u) + \ell_e,$$

add  $v$  to  $S$ ; set  $d(v) = \pi(v)$ .





## SECTION 4.4

# 4. GREEDY ALGORITHMS II

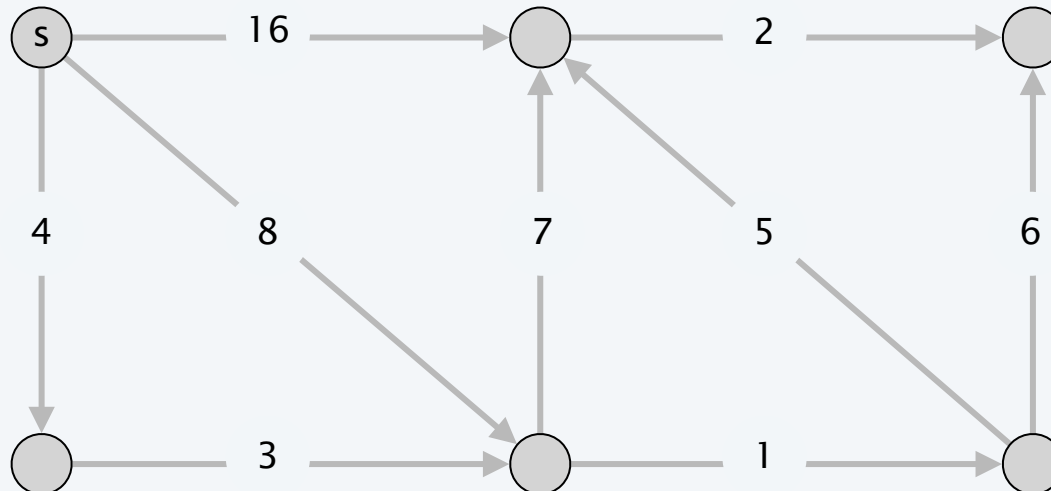
---

- ▶ *Dijkstra's algorithm demo*
- ▶ *improved Dijkstra's algorithm demo*

# Improved Dijkstra's algorithm demo

---

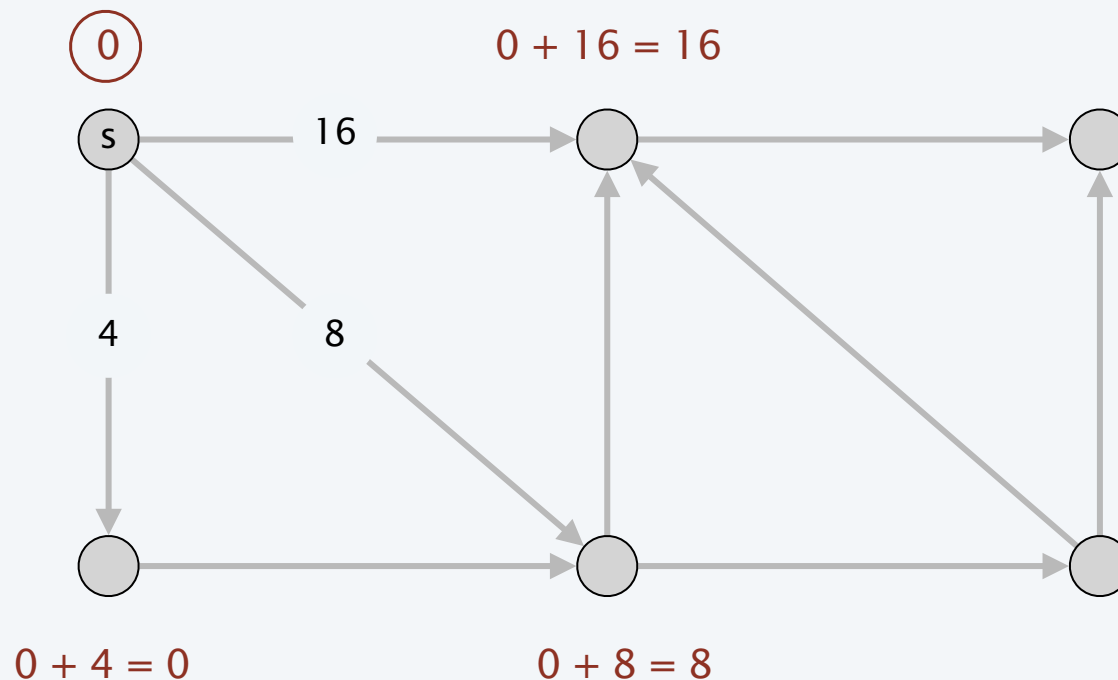
- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(u)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

---

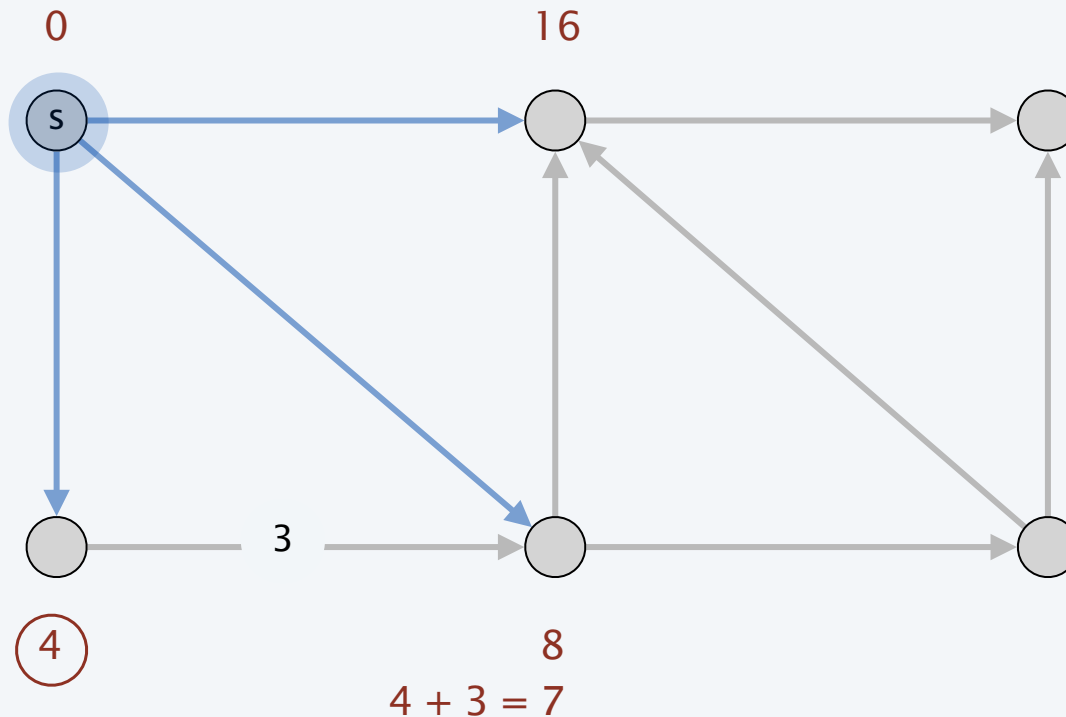
- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

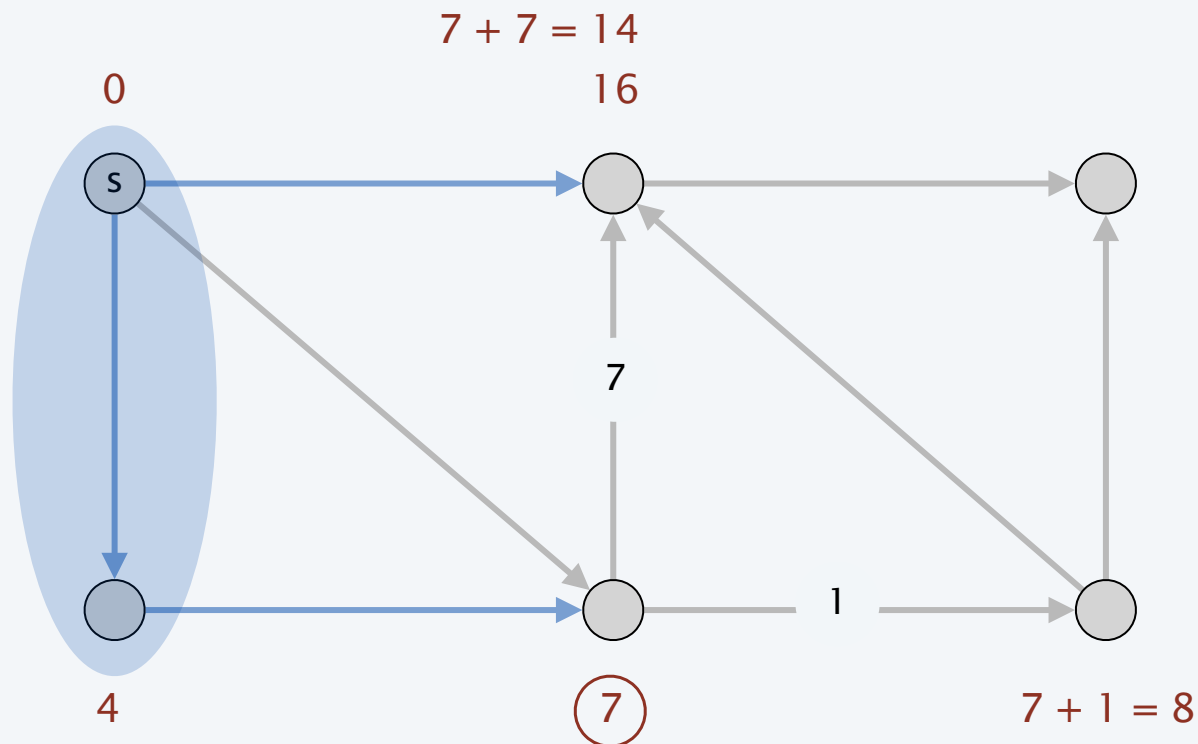
---

- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



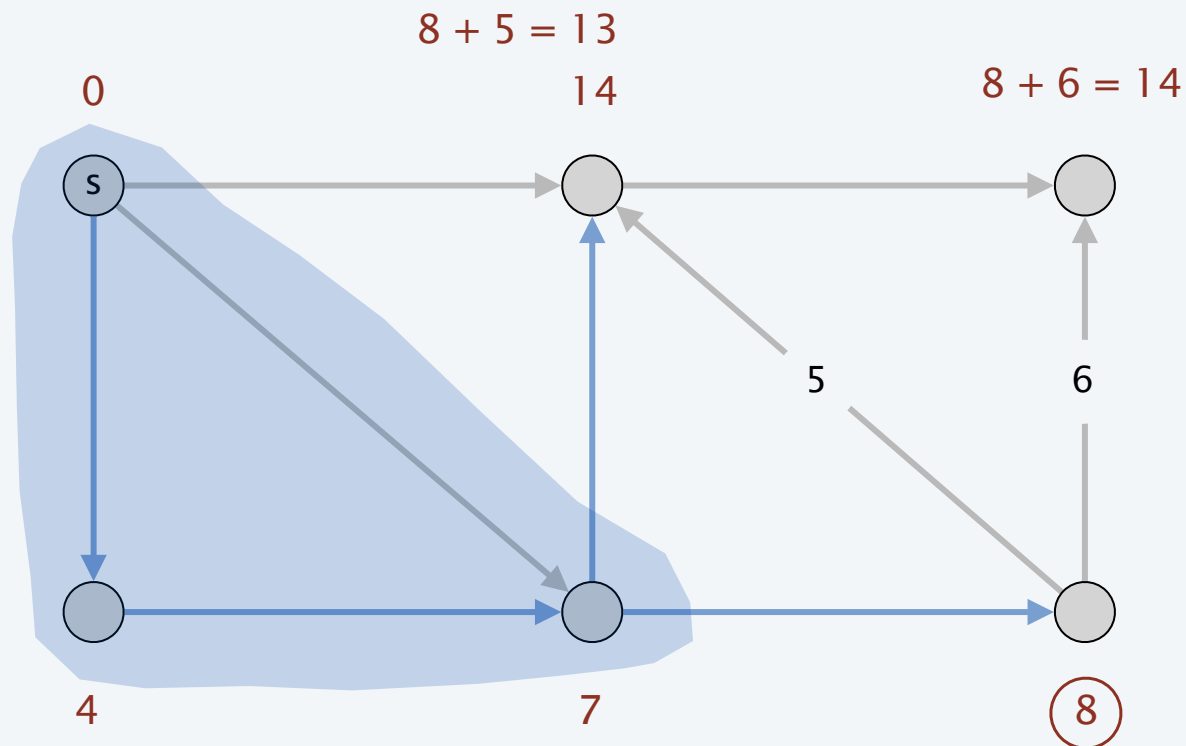
# Improved Dijkstra's algorithm demo

- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

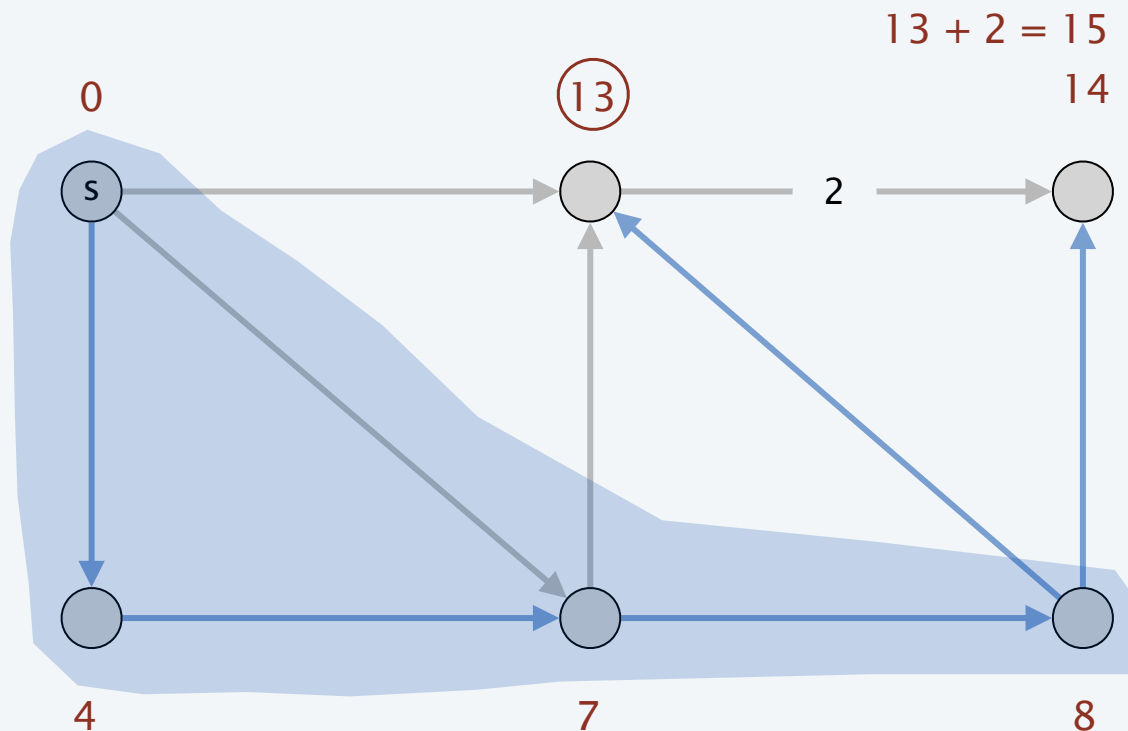
- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$





# Improved Dijkstra's algorithm demo

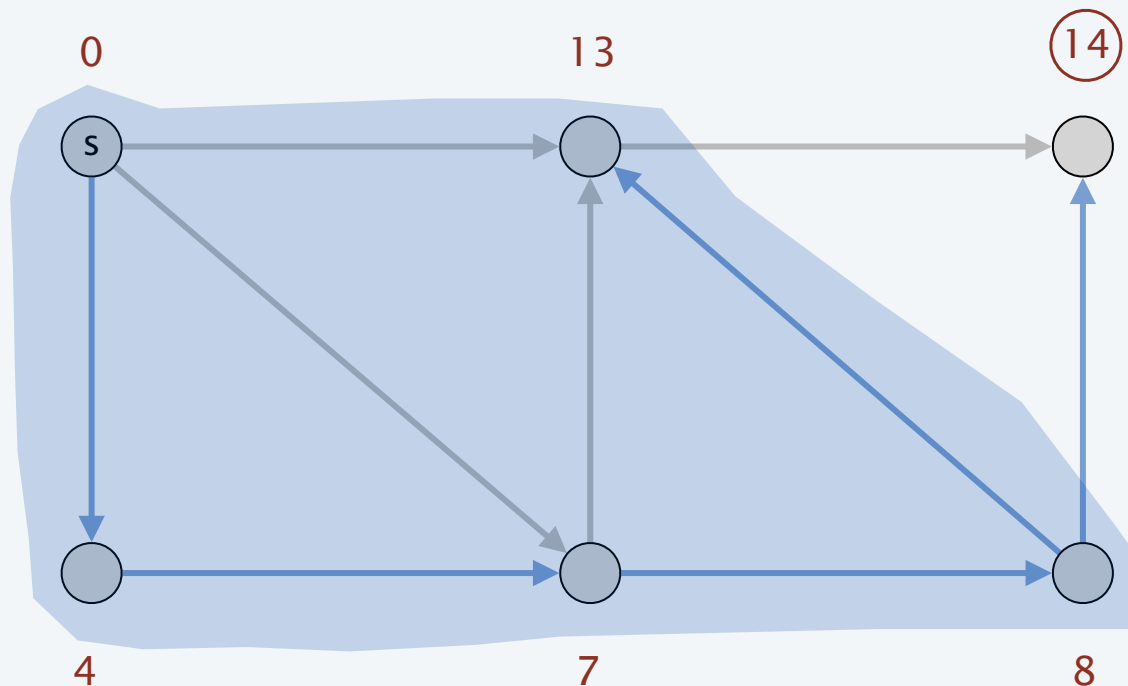
- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

---

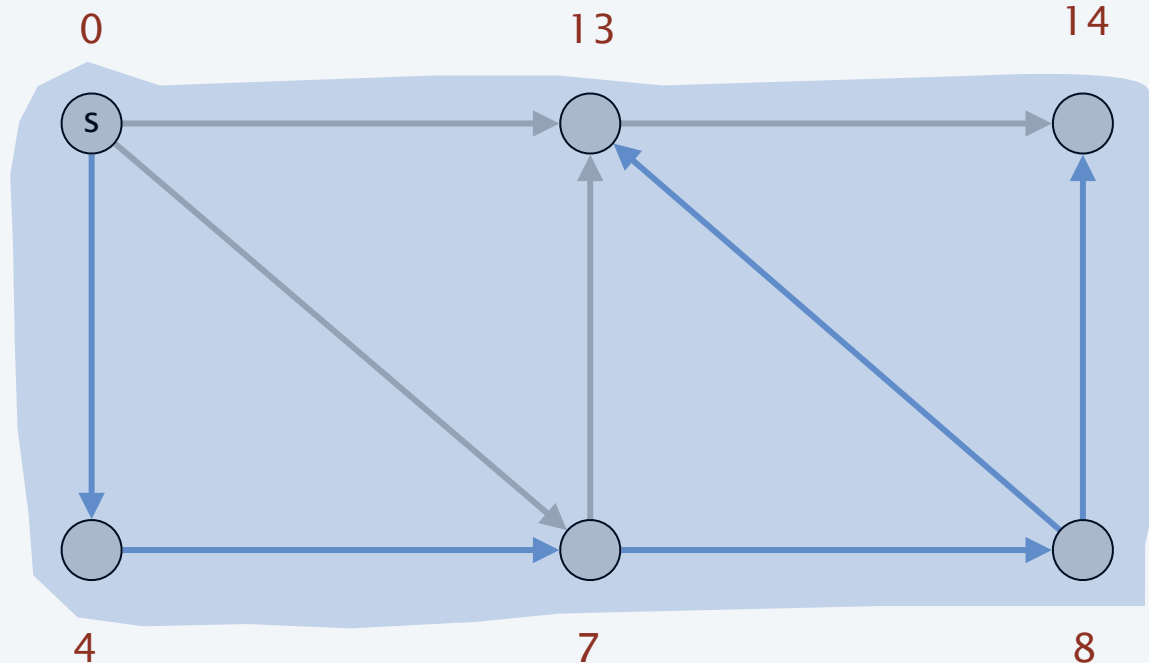
- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

---

- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$



# Improved Dijkstra's algorithm demo

---

- Initialize  $\pi(s) = 0$ .
- Repeatedly choose  $u \notin S$  with minimum  $\pi(v)$ .
  - for each edge  $(u, v)$  leaving  $u$ , set  $\pi(v) = \min \{ \pi(v), \pi(u) + \ell(u, v) \}$
  - add  $u$  to  $S$

