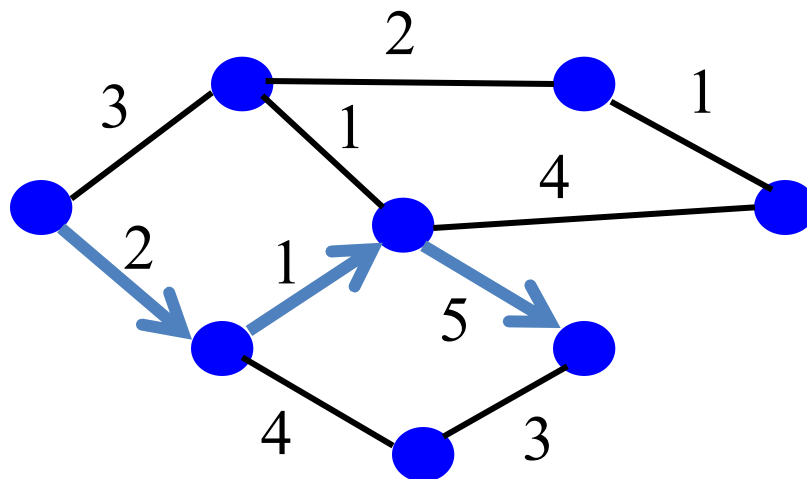# Routing

Credits: Prof. Sangtae Ha

Computing the Shortest Paths

Assuming you already know the topology
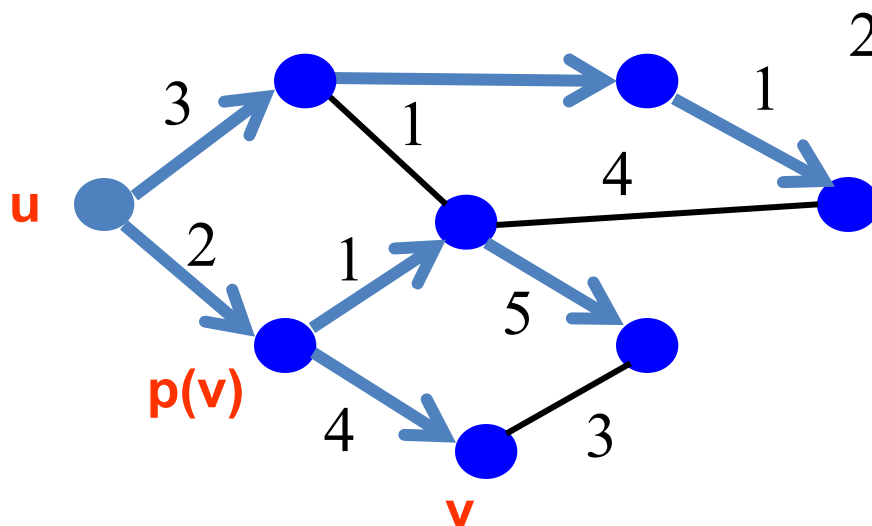
Shortest-Path Routing

- Path-selection model
  - Destination-based
  - Load-insensitive (e.g., static link weights)
  - Minimum hop count or sum of link weights

Shortest-Path Problem

- Given: network topology with link costs
  - **c(x,y)**: link cost from node x to node y
  - Infinity if x and y are not direct neighbors

- Compute: least-cost paths to all nodes
  - From a given source u to all other nodes
  - **p(v)**: predecessor node along path from source to v

Link-State Routing

Link State: Dijkstra's Algorithm

- Flood the topology information to all nodes
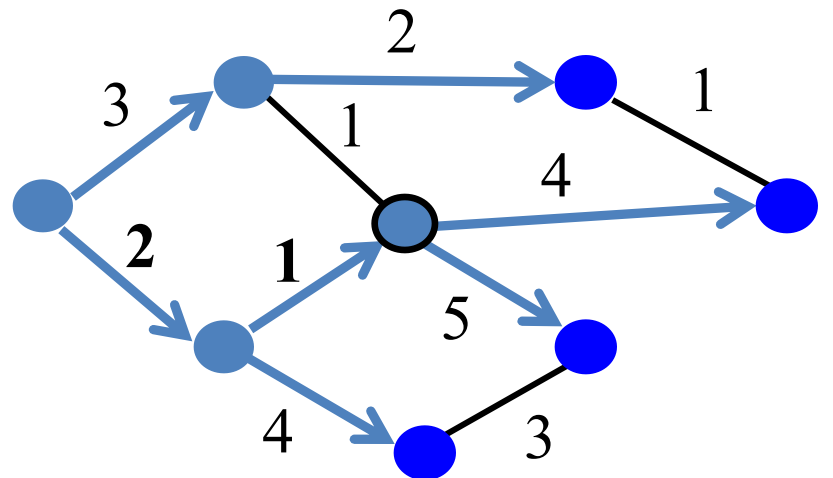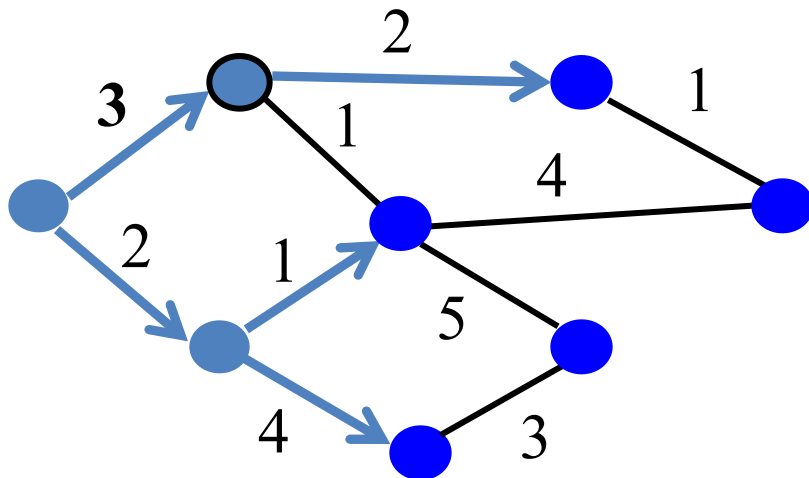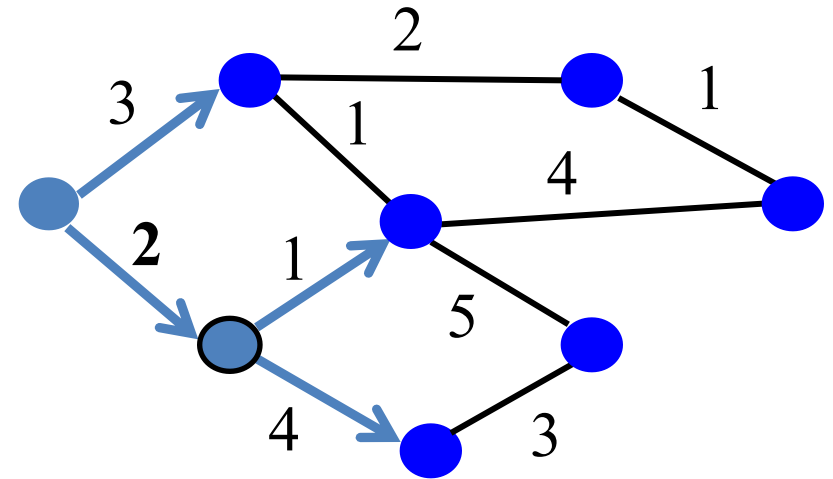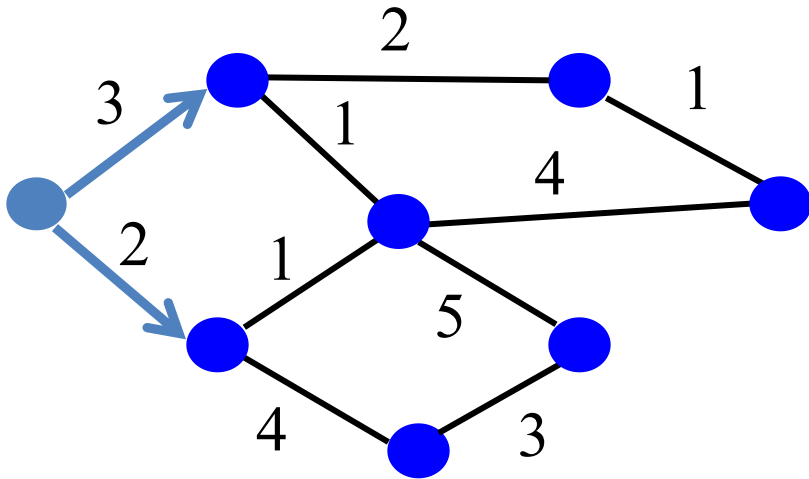- Each node computes shortest paths to other nodes

<u>Initialization</u>

S = {u}

for all nodes v

  if (v is adjacent to u)
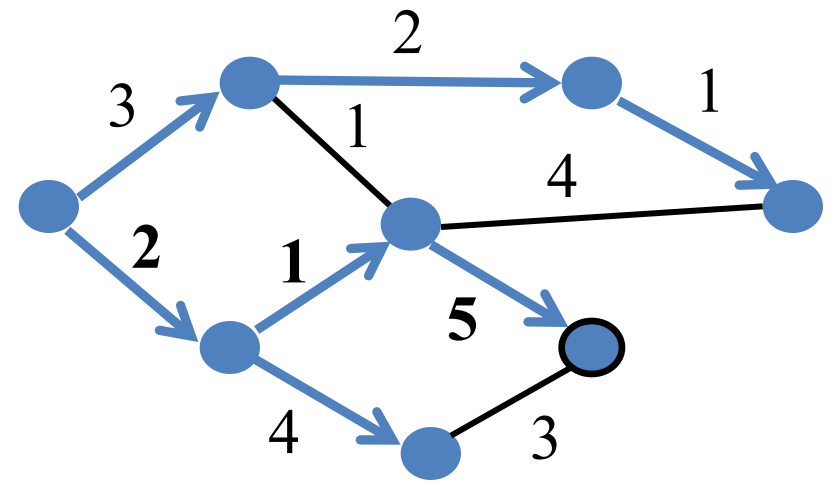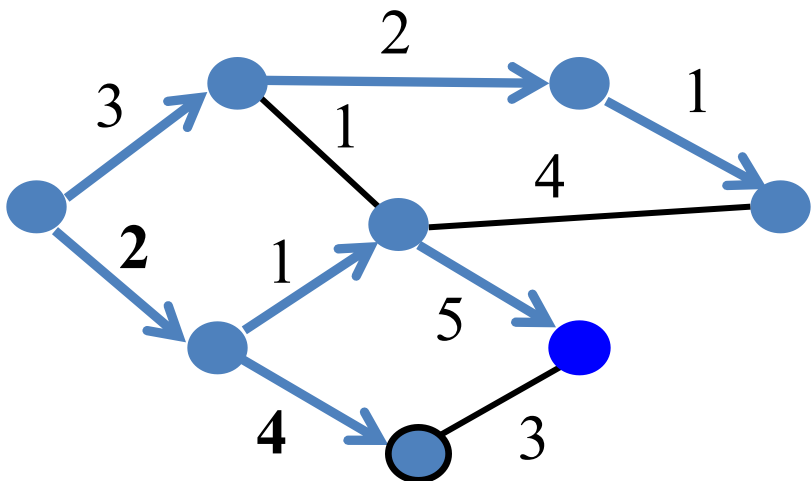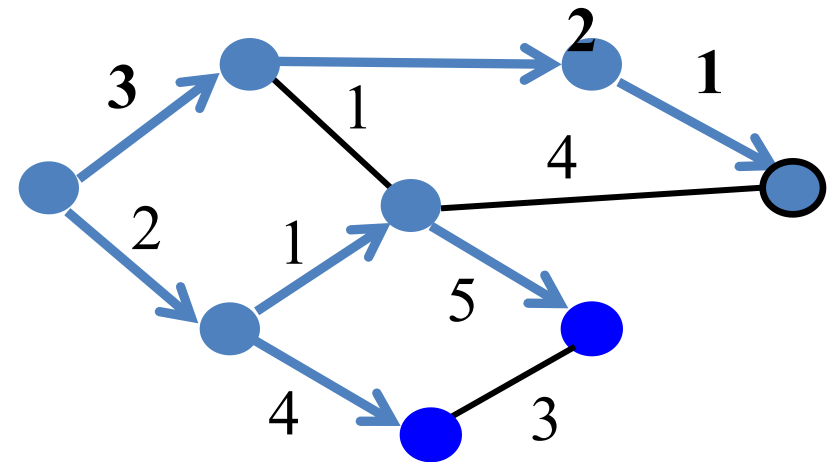
    D(v) = c(u,v)

  else D(v) = ∞
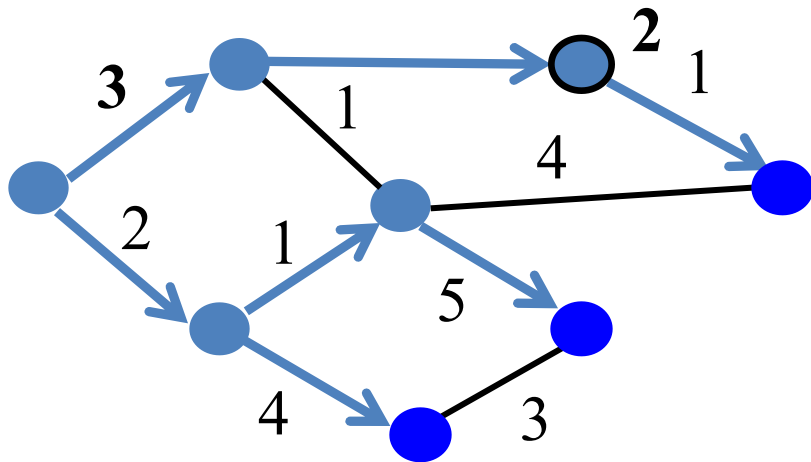
<u>Loop</u>

add w with smallest D(w) to S

update D(v) for all adjacent v: D(v) =

  min{D(v), D(w) + c(w,v)}

until all nodes are in S

Used in OSPF and IS-IS
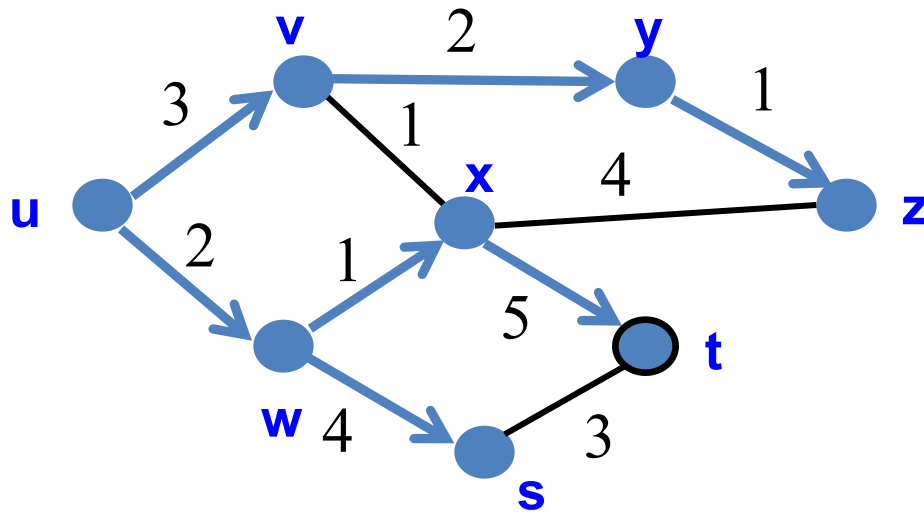
Link-State Routing Example
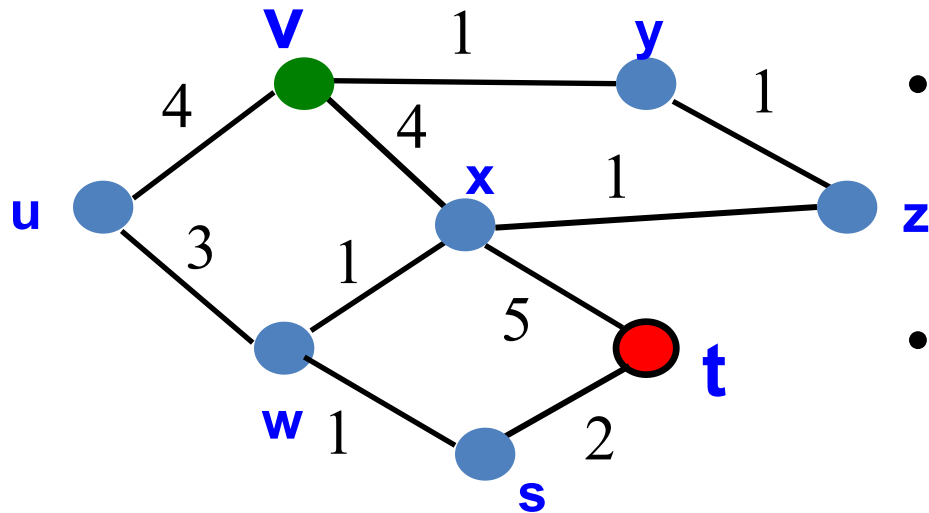
Link-State Routing Example (cont.)

Link State: Shortest-Path Tree

- Shortest-path tree from u
- Forwarding table at u

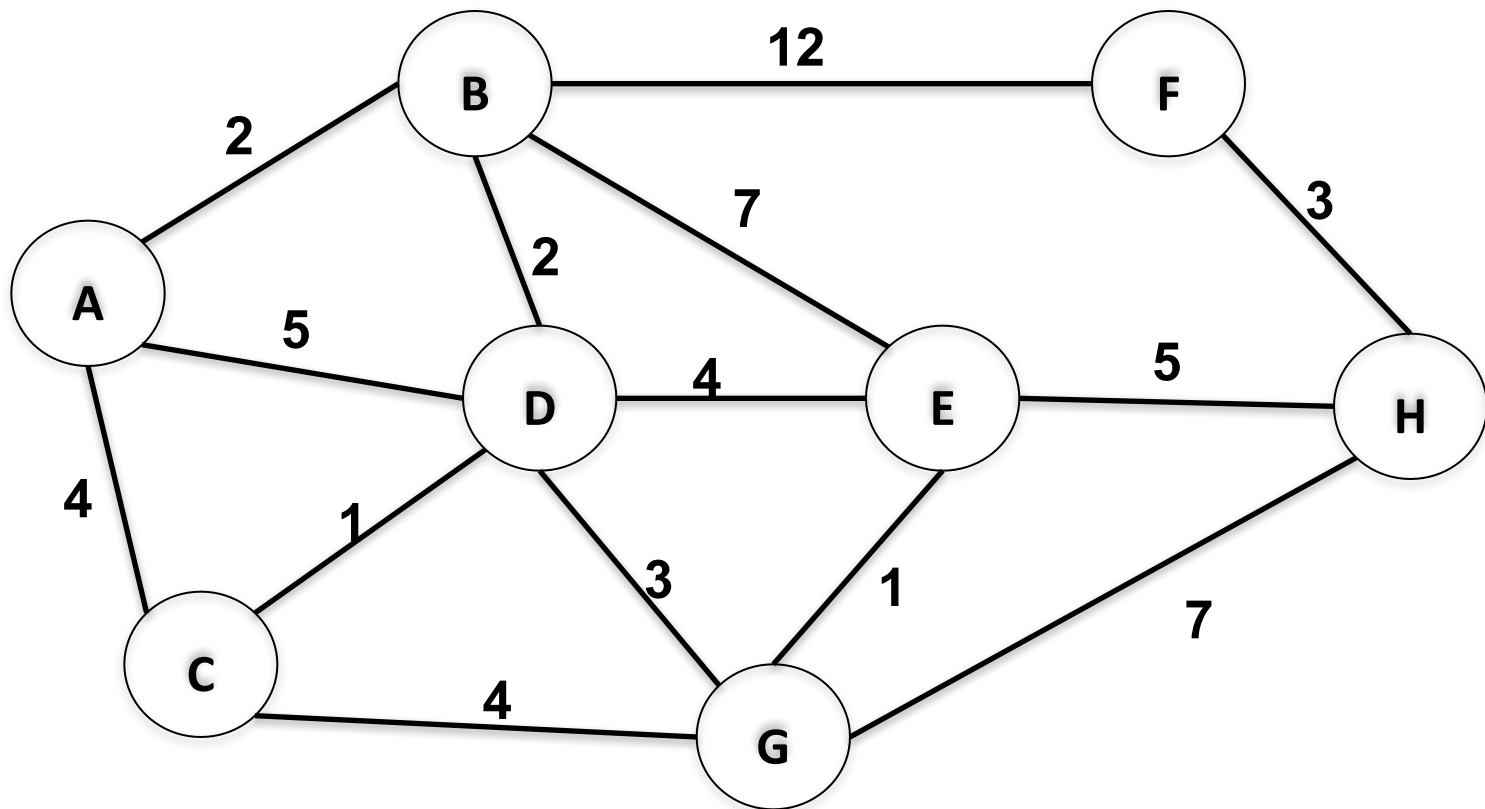|	link
v	(u,v)
w	(u,w)
x	(u,w)
y	(u,v)
z	(u,v)
s	(u,w)
t	(u,w)

Link State: Shortest-Path Tree
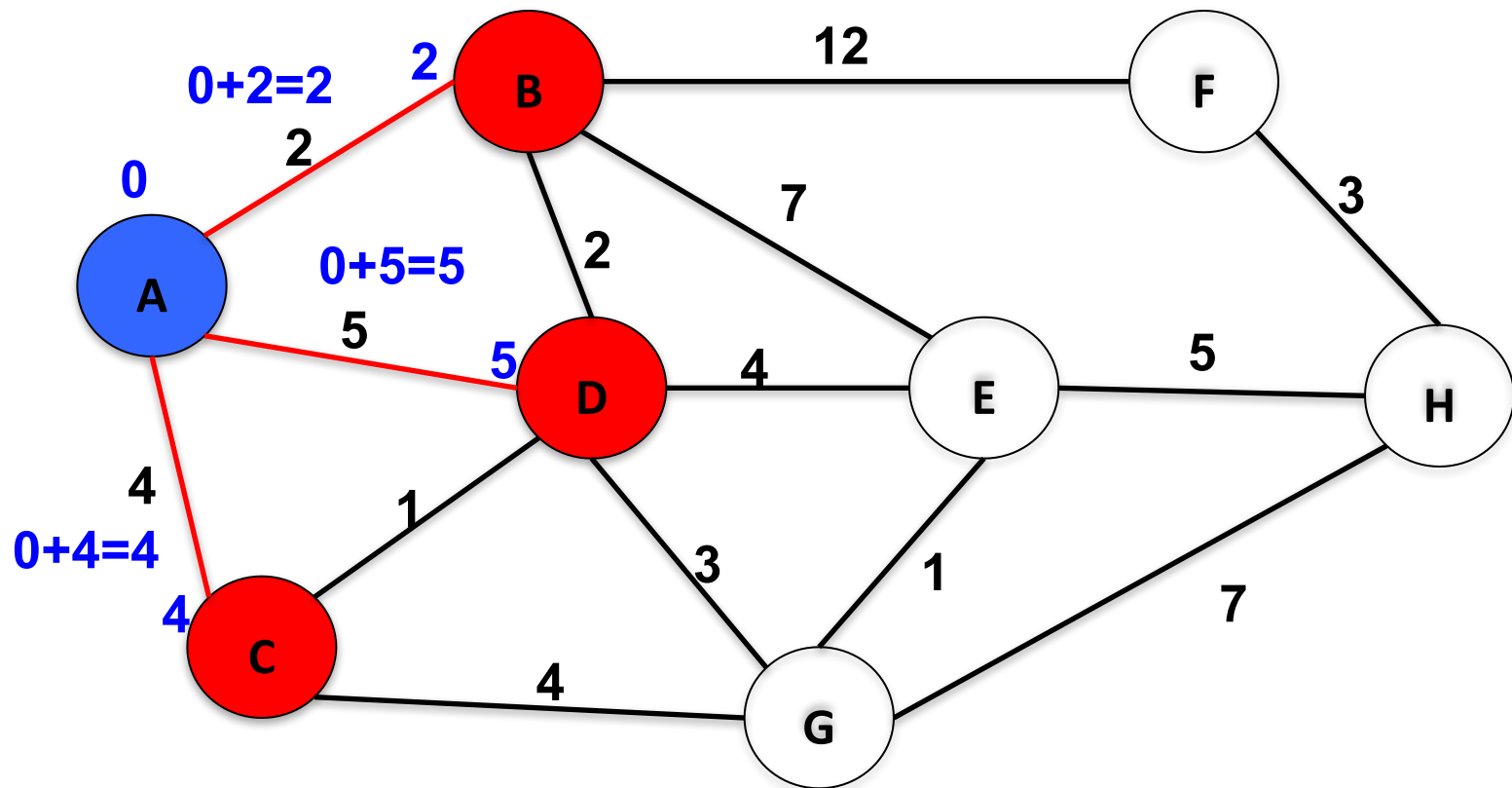

Find shortest path t to v

- Forwarding table entry at t

  (A) (t,x)   (B) (t, s)

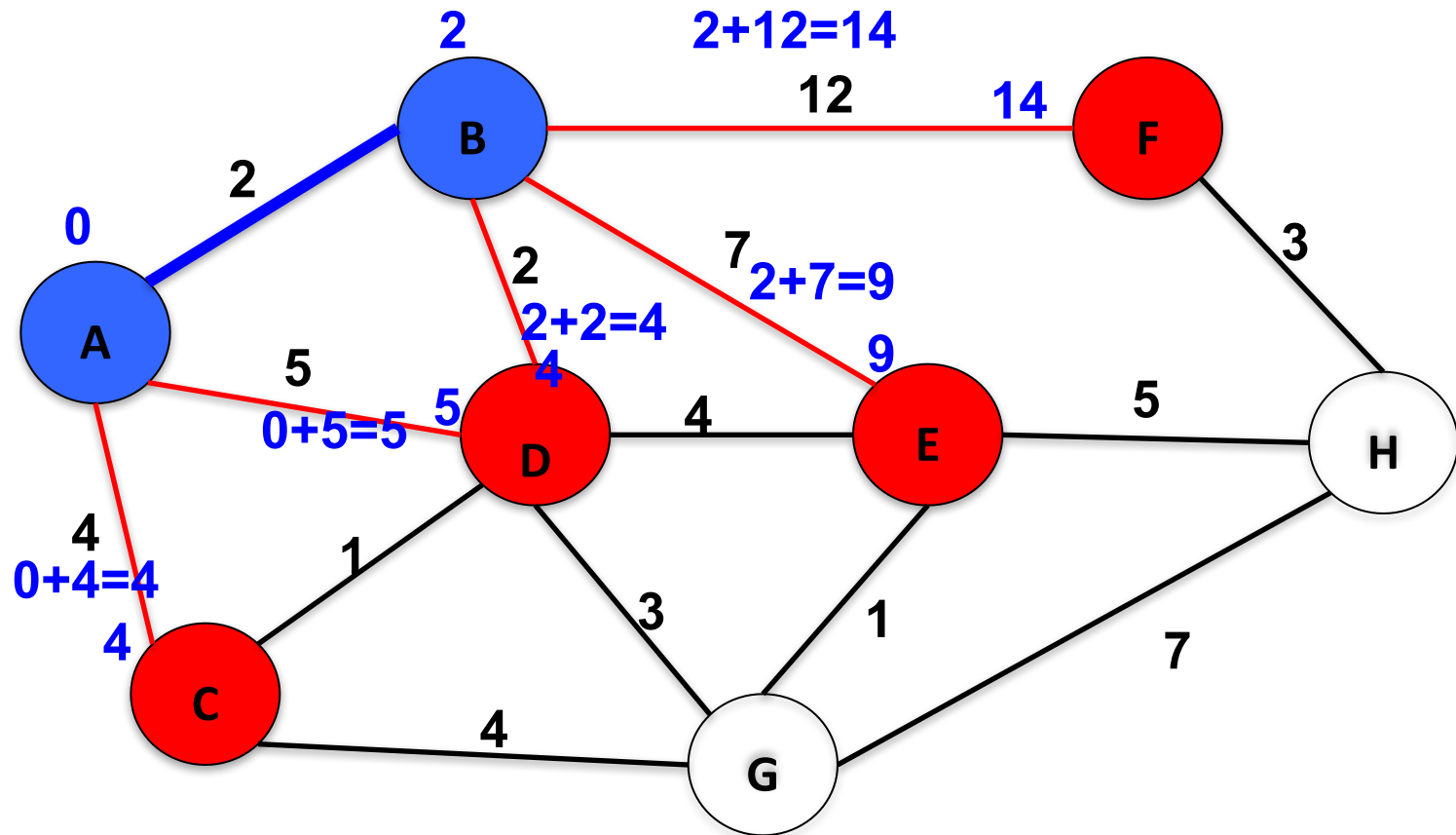- Distance from t to v

  (A) 6   (B) 7   (C) 8   (D) 9

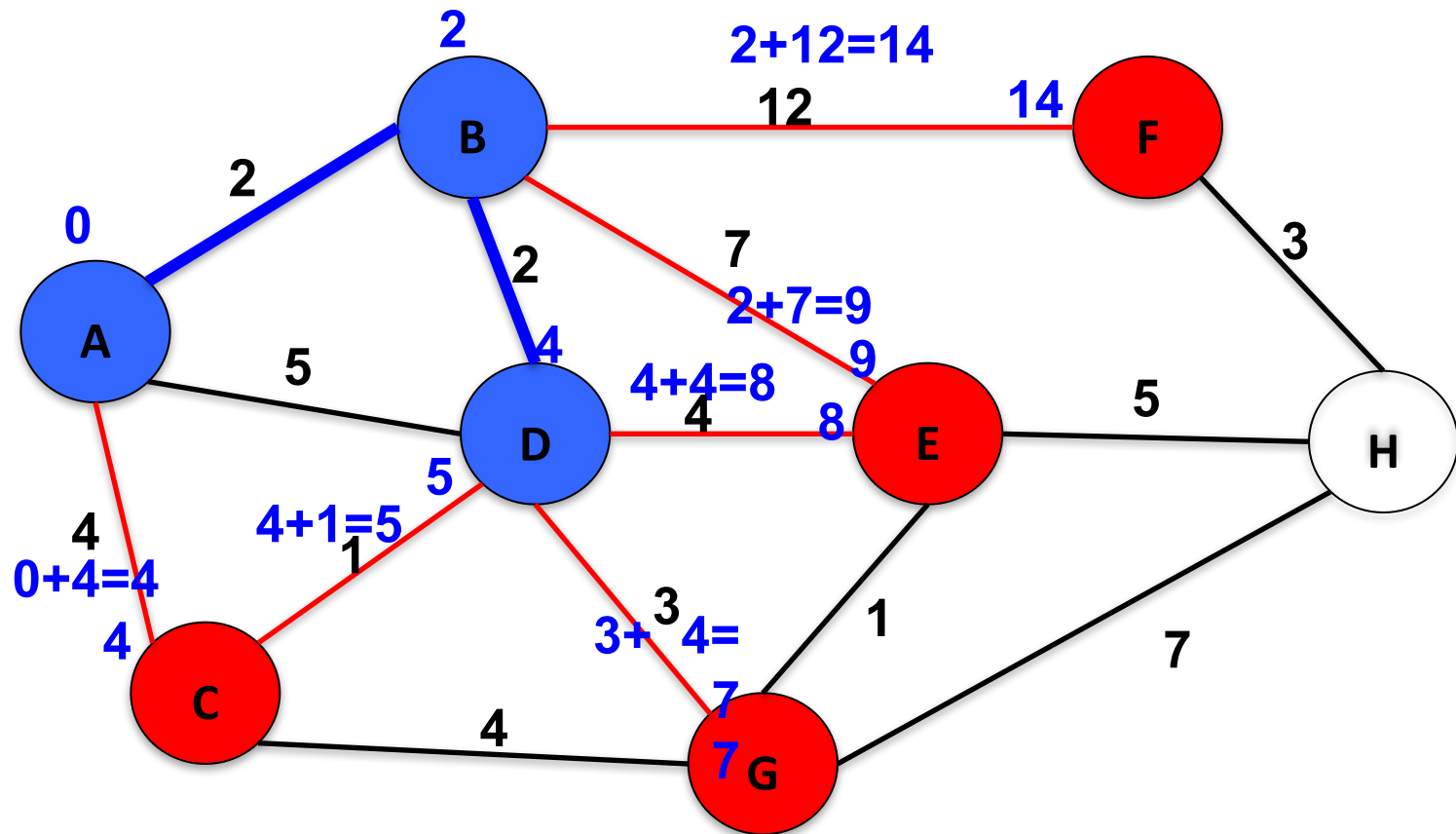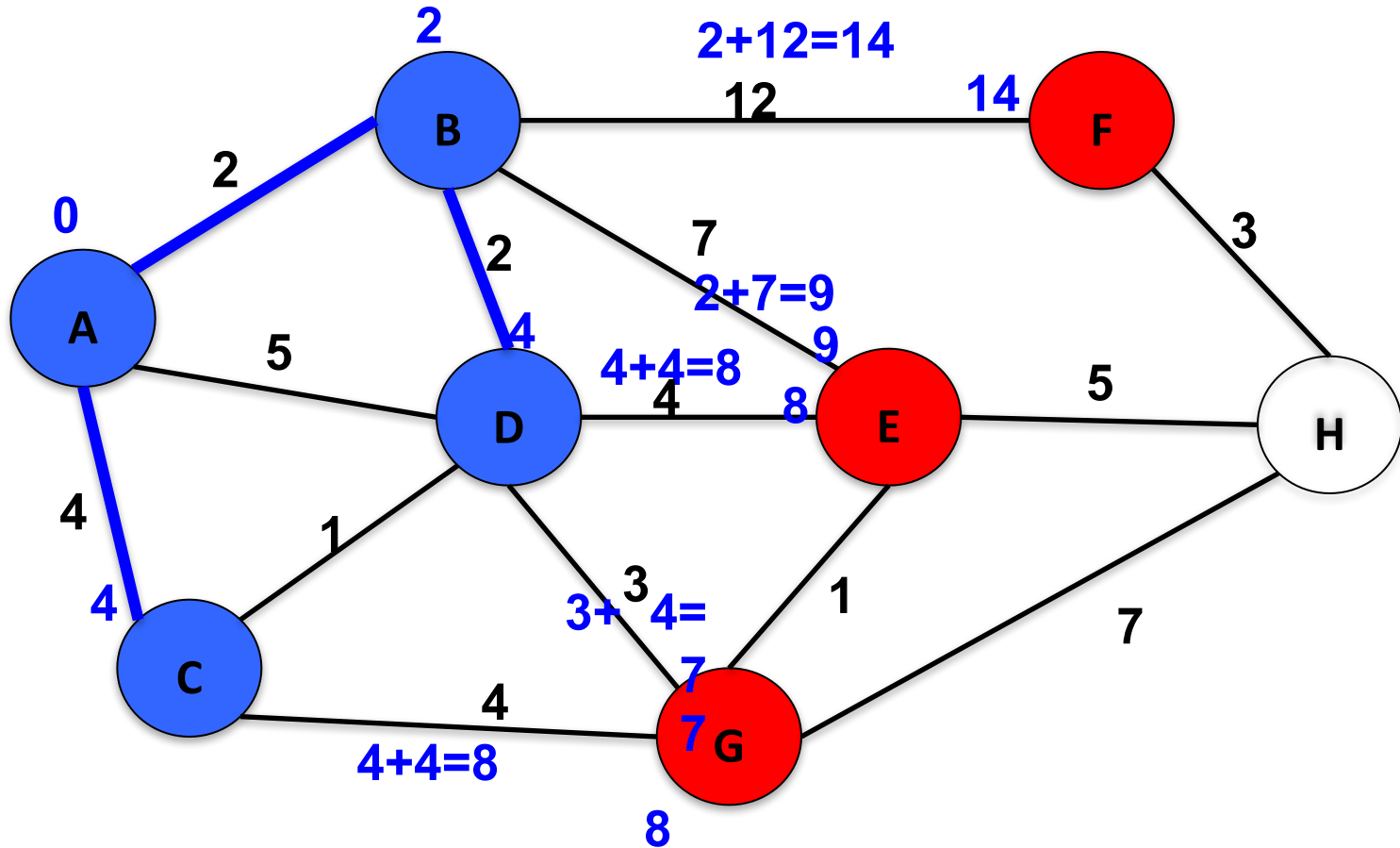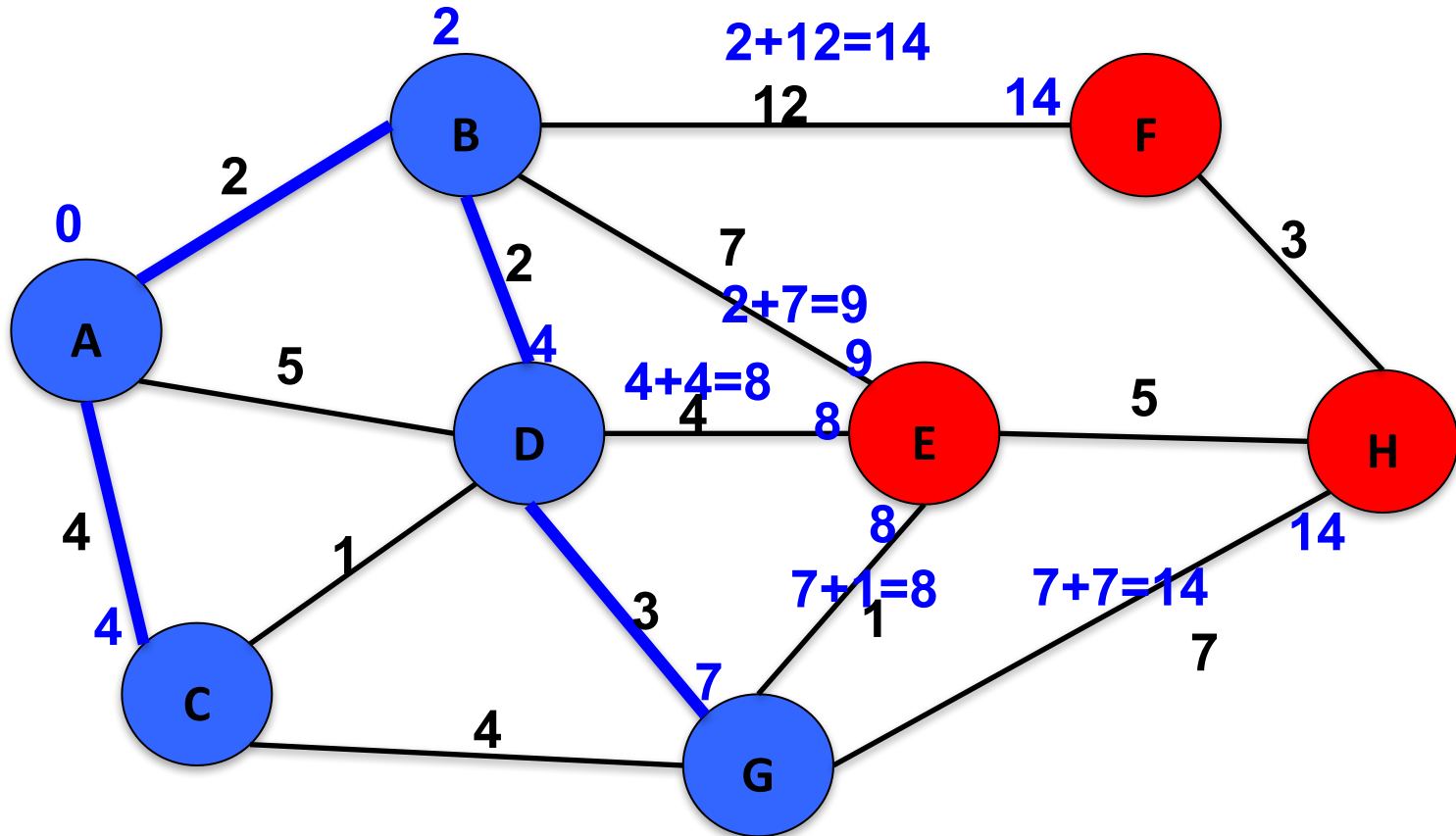# Link-State Algorithm Example 2

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

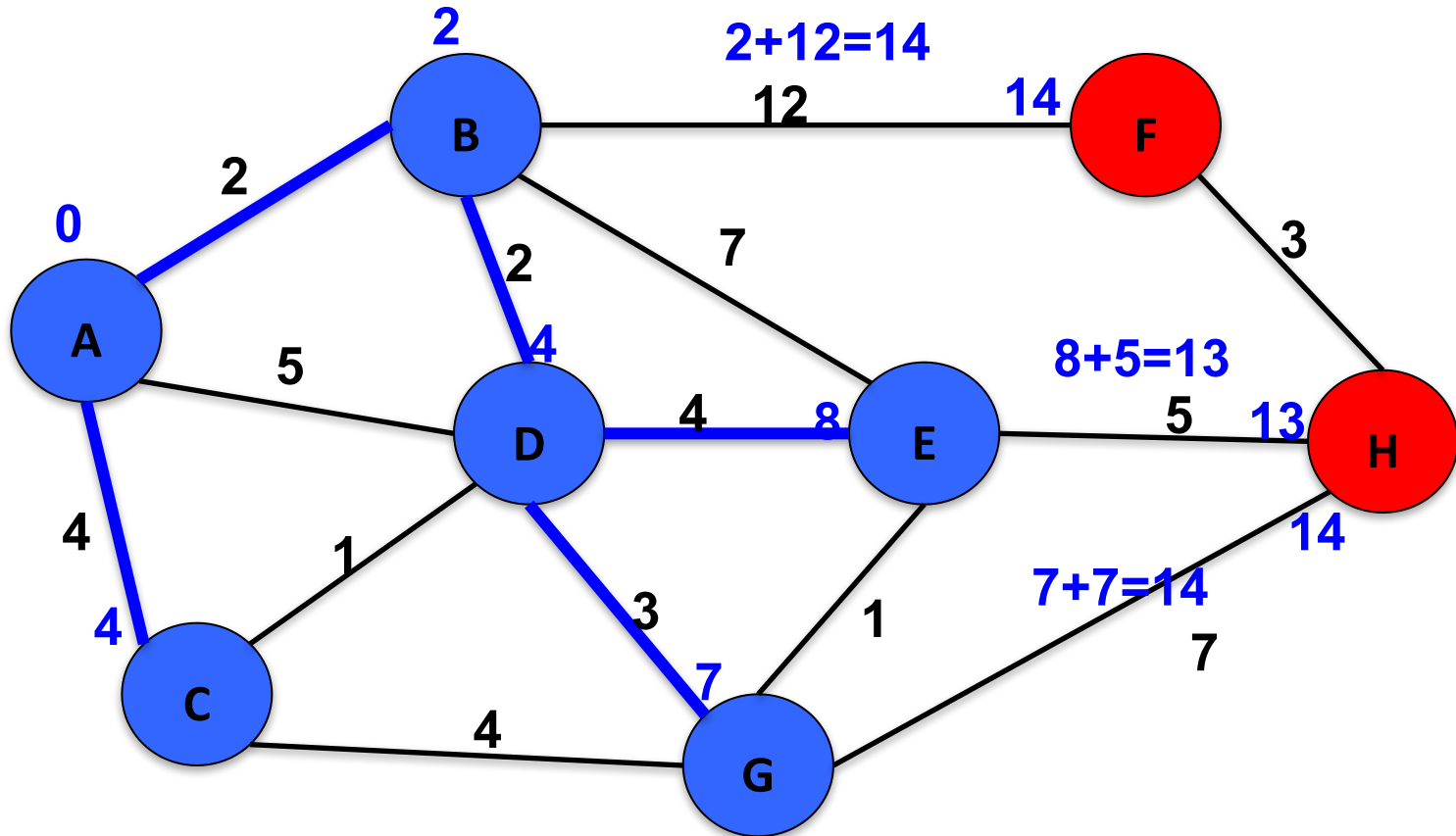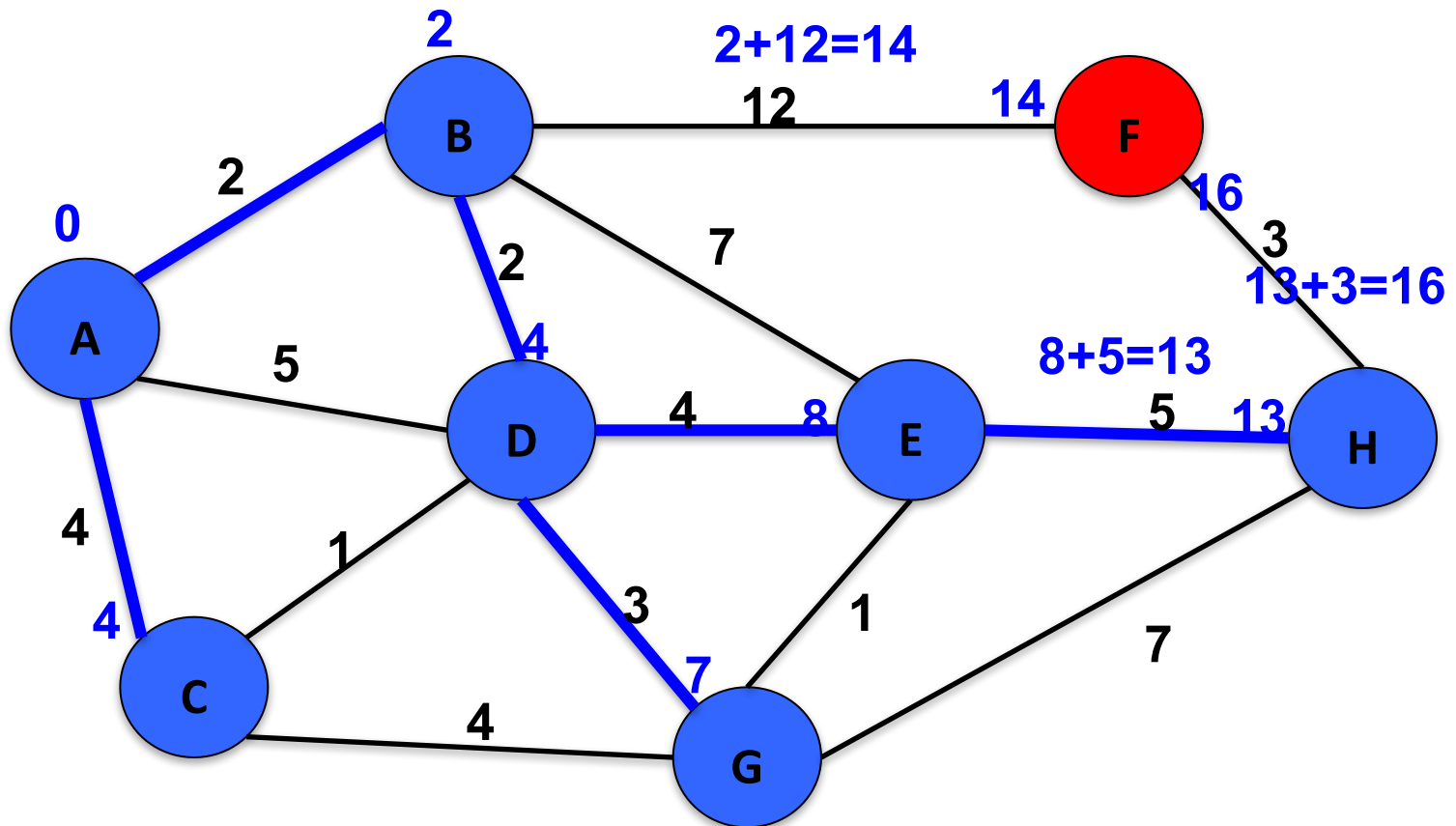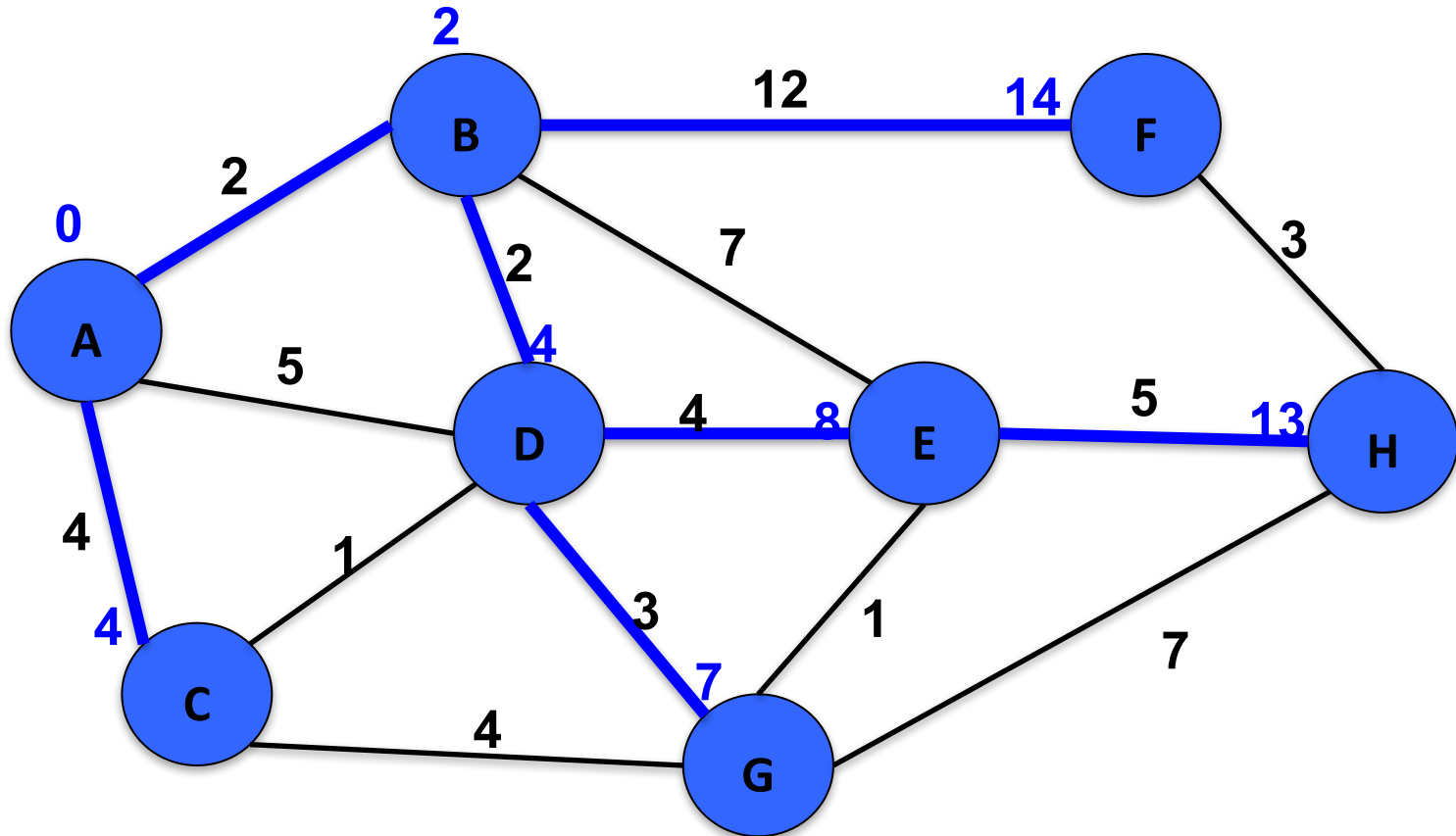# Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)

Link-State Algorithm Example 2 (Cont.)