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Week 9 Discussion

ECS 122A
Spring 2020

Single-Source Shortest Path

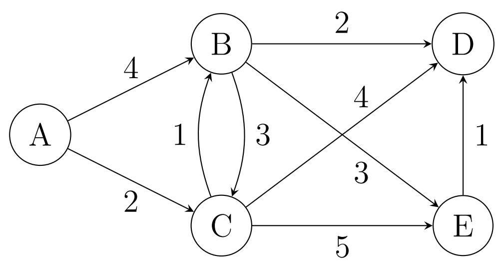

Figure 1: A weighted directed graph G_2

1. The Bellman-Ford algorithm

Bellman-Ford(G, w, s)

// initialization
for each vertex $v \in V$
  $v.d = +$Infty
  $v.pi =$ Nil
$s.d = 0$
for $i = 1$ **to** $|V| - 1$
  for each edge $(u, v) \in E$
    // relax if needed
    if $v.d > u.d + w(u, v)$
      $v.d = u.d + w(u, v)$
      $v.pi = u$
// check whether there is negative-weight cycle
for each edge $(u, v) \in E$
  if $v.d > u.d + w(u, v)$
    return False
return True, $\{v.d : v \in V\}$, $\{v.pi : v \in V\}$

	d					pi				
	A	B	C	D	E	A	B	C	D	E
Init	0	∞	∞	∞	∞	Nil	Nil	Nil	Nil	Nil
1										
2										
3										
4										
Check										

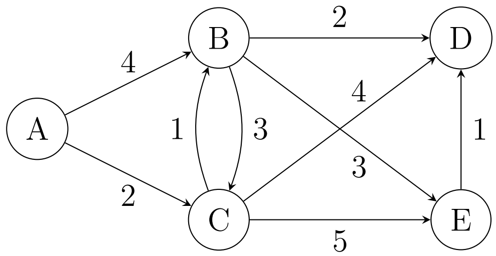

Figure 2: A weighted directed graph G_2

2. Dijkstra's algorithm

```
DIJKSTRA(G, w, s)
// initialization
for each vertex v ∈ V
    v.d = +INFTY
    v.pi = NIL
s.d = 0
// priority queue keyed by d
Q = V
while Q not EMPTY
    u = EXTRACT-MIN(Q)
    for each edge (u, v) ∈ E
        // relax if needed
        if v.d > u.d + w(u, v)
            v.d = u.d + w(u, v)
            v.pi = u
return {v.d : v ∈ V}, {v.pi : v ∈ V}
```