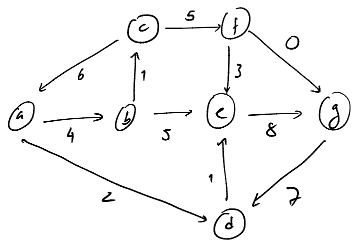
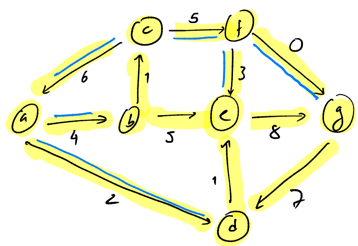
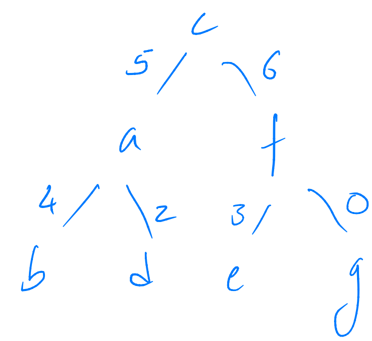
T1 06/07 II.1





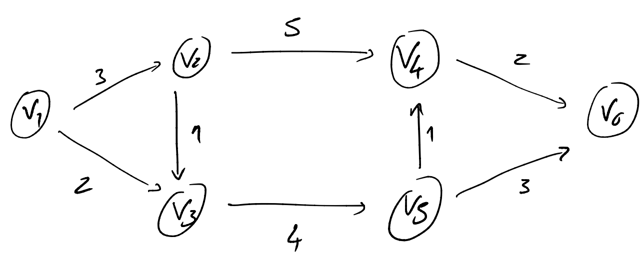
a	∞	6^c	6^c	6^c	—	—	—
b	∞	∞	∞	∞	10^a	10^a	10^a
c	0	—	—	—	—	—	—
d	∞	∞	∞	12^d	8^a	—	—
e	∞	∞	8^f	8^f	8^f	8^f	—
f	∞	5^c	—	—	—	—	—
g	∞	∞	5^f	—	—	—	—

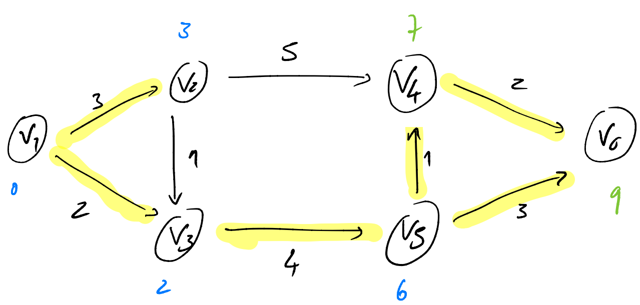


$\downarrow \rightarrow$ valores pedidos pelo Ex.

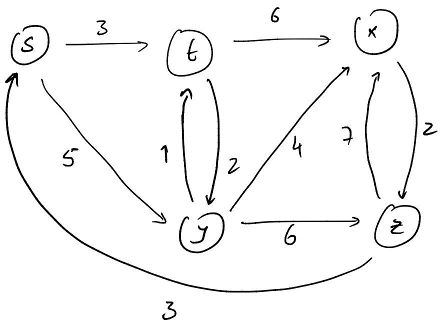
a: 6, c
b: 10, a
c: 0, Nil
d: 8, a
e: 8, f
f: 5, c
g: 5, f

T1 08/09 II.3

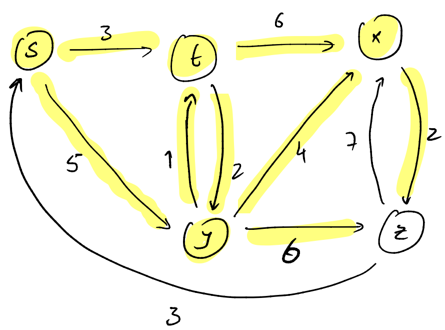




Ex. 24.3-1

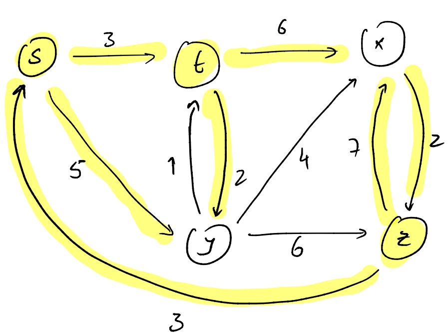


• s as source



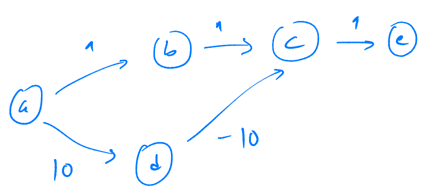
s	0 nil	—	—	—	—
t	∞	3 s	—	—	—
x	∞	∞	9 t	9 t	—
y	∞	5 s	5 s	—	—
z	∞	∞	∞	11 y	11 y

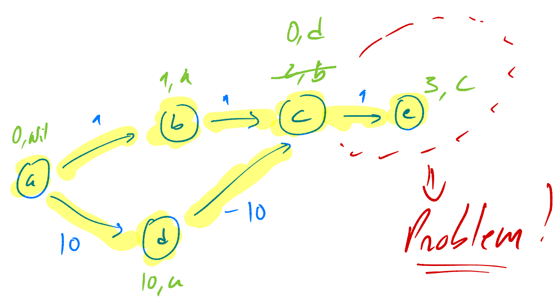
• z as source



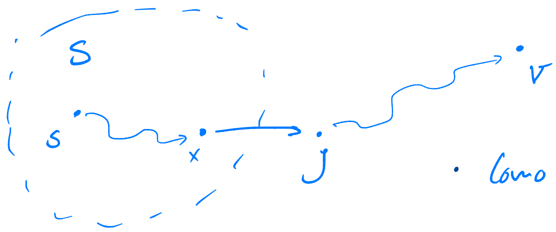
z	0	—	—	—	—
y	∞	∞	8 s	8 s	8 s
x	∞	7 z	7 z	7 z	—
t	∞	∞	6 s	—	—
s	∞	3 z	—	—	—

Ex. 24.3-2





Comentário à prova:



- Como parte da prova de correcção há que mostrar que:
  $\delta(s, v) \geq y.d$

$$\delta(s,v) = \delta(s,x) + w(x,y) + \delta(s,y)$$
$$= x.d + w(x,y) + \delta(s,y)$$ Porque (x,y) já foi relaxado
$$= y.d + \delta(s,y)$$
$$\geq y.d$$

Este passo só funciona se não existirem arcos negativos

Ex 24.3-3

- Sim.
  Depois de $|V|-1$ iterações temos que existe apenas um vértice em Q; seja u esse vértice.
  Temos portanto que: $S = V \setminus \{u\}$ e $Q = [u]$.
  O invariante do algoritmo de Dijkstra garante que: $\forall v \in V \setminus \{u\}.\ v.d = \delta(s, v)$
  pelo que a relaxação dos arcos que partem de u não altera o valor de d para nenhum vértice em $V \setminus \{u\}$.

Ex 24.3-4

① $\forall v \in V.\ \pi[v] \neq Nil \Rightarrow d[v] = d[\pi[v]] + w(\pi[v], v)$ — $O(V)$

② $\forall (u,v) \in E.\ d[v] \leq d[u] + w(u,v)$ — $O(E)$

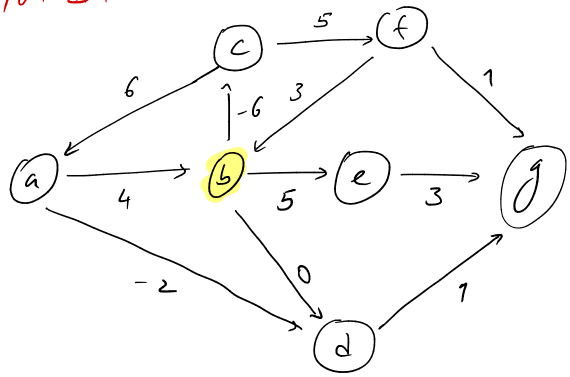
③ $\forall v \in V.\ s \not\leadsto v \Rightarrow d[v] = \infty$ — $O(V+E)$

④ $d[s] = 0 \wedge \pi[s] = s$ — $O(1)$

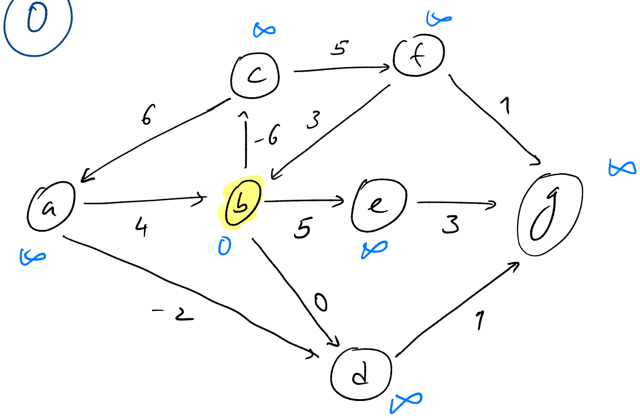
⑤ $\forall v \in V.\ \pi[v] = Nil \Leftrightarrow d[v] = \infty$ — $O(V)$

$O(V+E)$

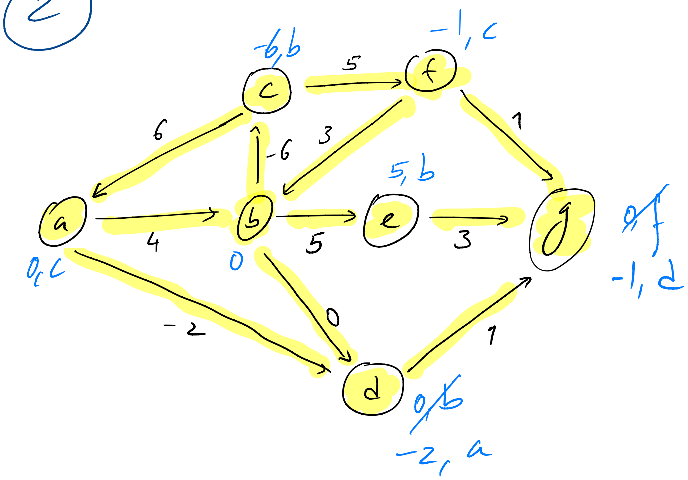
R1 06/07 II.1



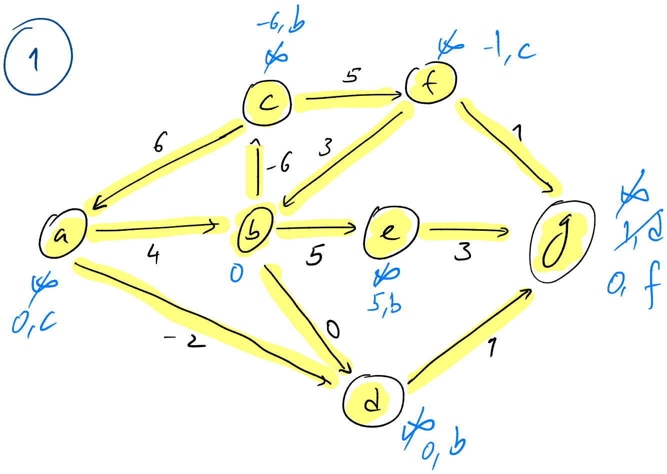
0



2

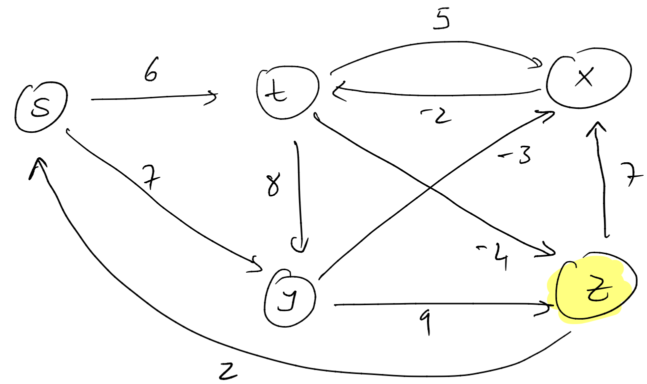


1



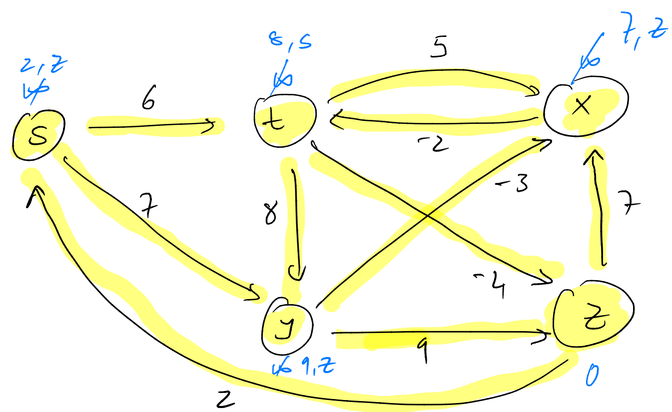
a : 0, c	e : 5, b
b : 0, Nil	f : -1, C
c : -6, b	g : -1, d
d : -2, a	

24.1-1

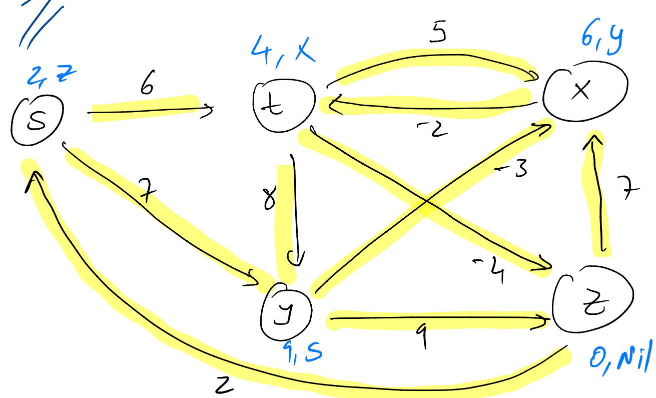


Order of relaxations: t x y z s

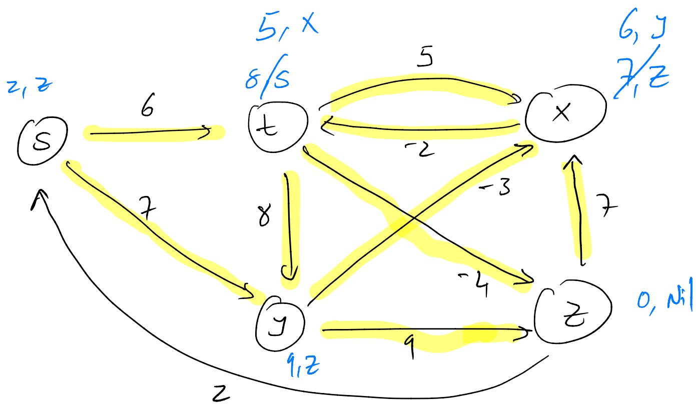
0



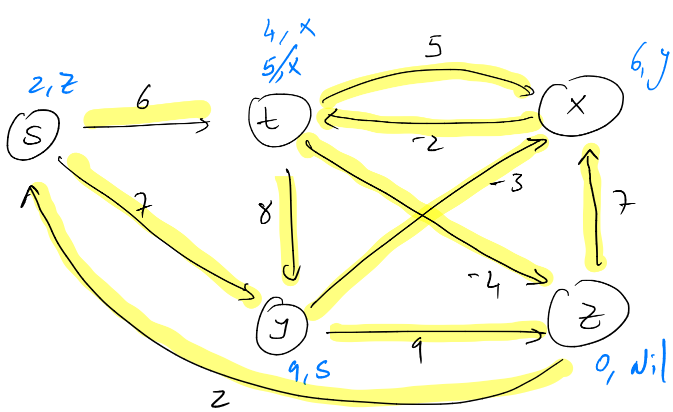
3

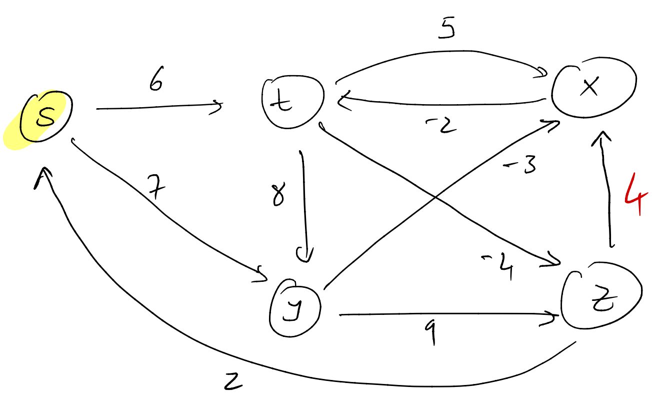


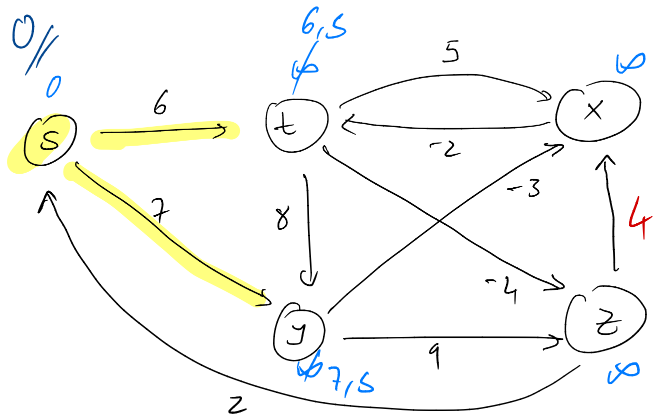
1

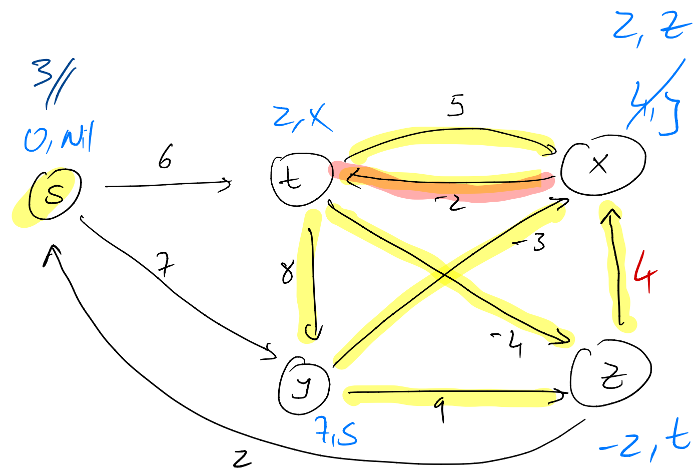


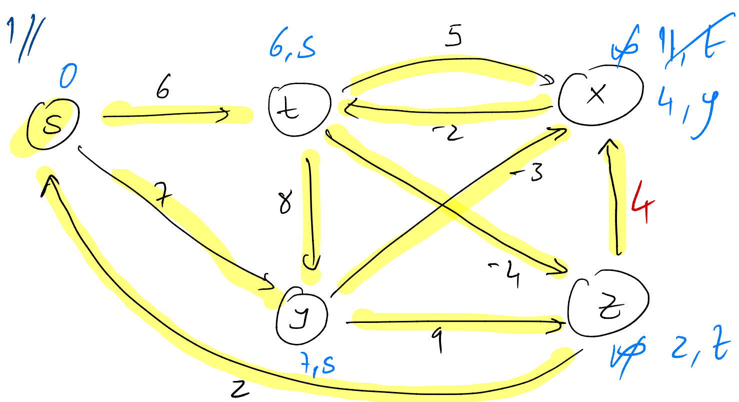
2

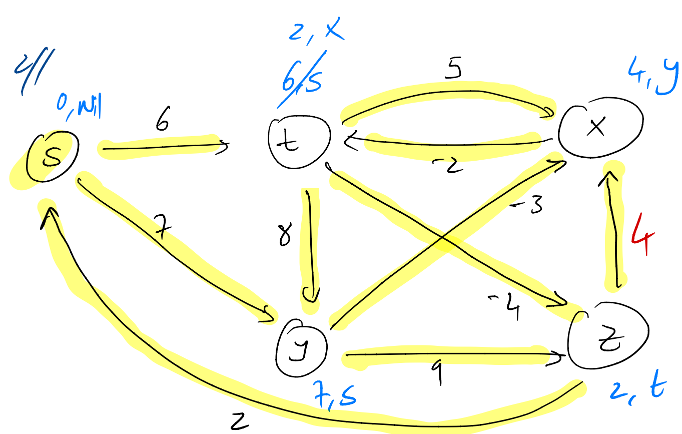












$\forall (u,v) \in E.$

$d[v] \le d[u] + w(u,v)$

$d[t] \le d[x] + w(x,t)$

$\Leftrightarrow 2 \le 2 + (-2)$

$\Leftrightarrow 2 \le 0$

$\Rightarrow$ False

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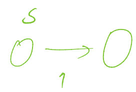
1 - V

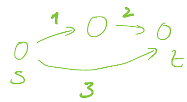
2 - V

3 - F

4 - F  $|V|-2=0$

5 - V

6 - V

7 - F 

8 - F $O(V \cdot E)$

24.1 - 4

```
BellmanFord'(G, s)
  InitializeSingleSource(G, s)
  for i=1 to |G.V|-1
  |  for each (u,v) ∈ G.E
  |  |  Relax(u, v, G.w)
  let marked = ∅
  for each (u,v) ∈ G.E
  |  if v.d > u.d + w(u,v)
  |  |  marked = marked ∪ {v}
  for each v ∈ Marked
    mark all nodes reachable from v with -∞
```

modified DFS