Seminar V 216

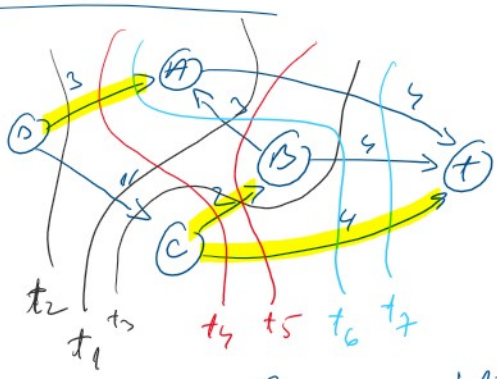
Thursday, April 29, 2021 4:02 PM

$G=(V,E)$ $w: E \to \mathbb{R}^+$

$\{s,t\}$

FORD_FULKERSON

POMPARE



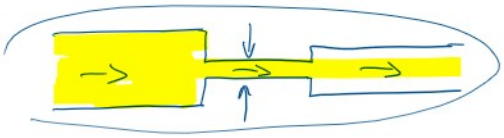
$c_{t_1} = 11+4 = 15$ $c_{t_5} = 10$

$c_{t_2} = 14$ $c_{t_6} = 14$

$c_{t_3} = 13$ $c_{t_7} = 12$

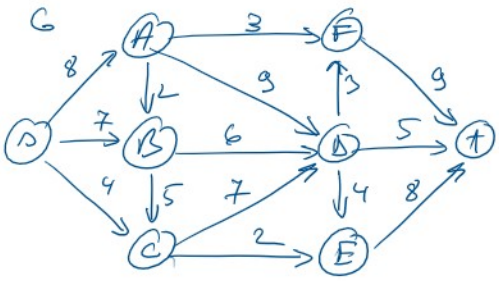
$c_{t_4} = 9$

$|f^*| = 9$

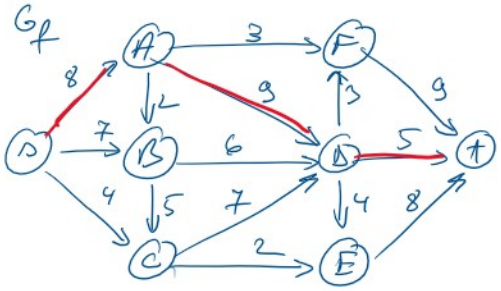


$f \uparrow f_p$ p $c_f(p) = \min\{c_f(u,v) \mid (u,v) \in p\}$

G



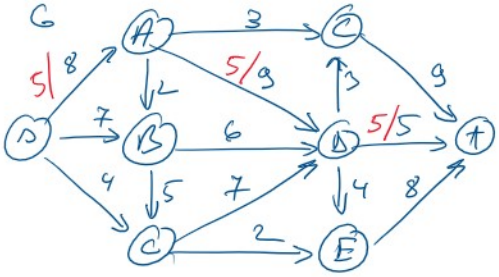
G_f



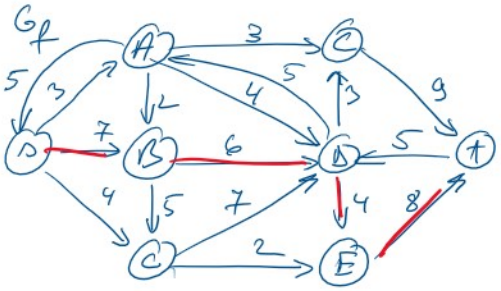
f/c

$p = \langle s, A, D, t \rangle$ $c_f(p) = 5$

G

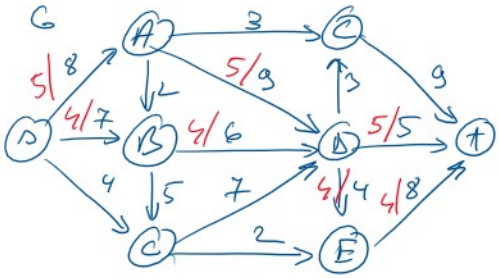


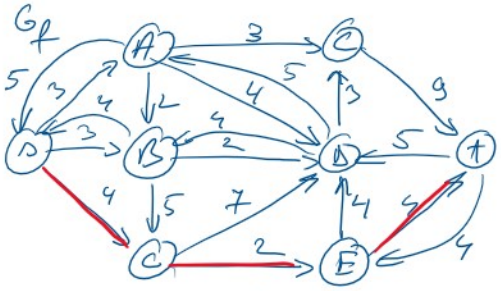
G_f



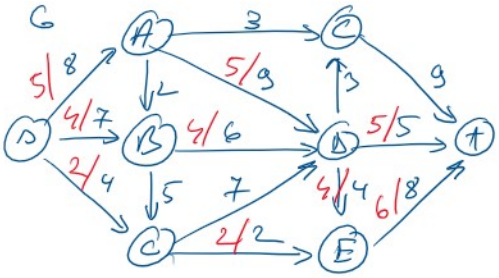
$p = \langle s, B, D, E, t \rangle$ $c_f(p) = 4$

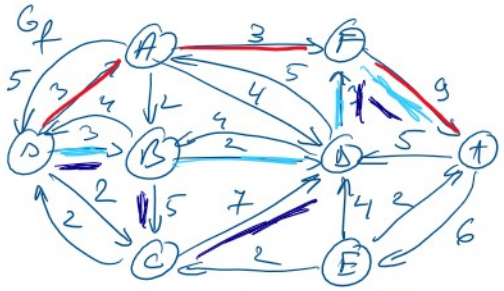
$p = \langle s, B, D, E, t \rangle \quad c_f(p) = 4$





$p = \langle s, C, E, t \rangle \quad c_f(p) = 2$

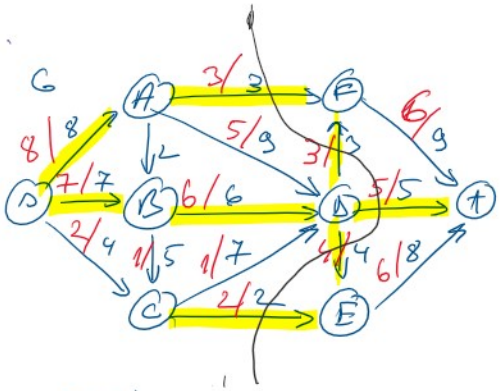


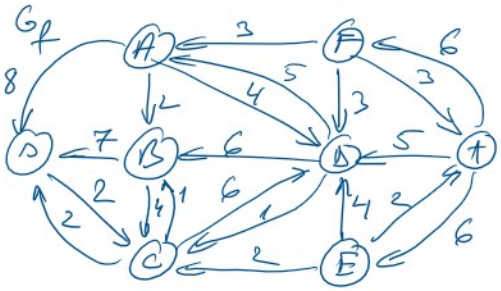


$p = \langle s, A, F, t \rangle \quad c_f(p) = 3$

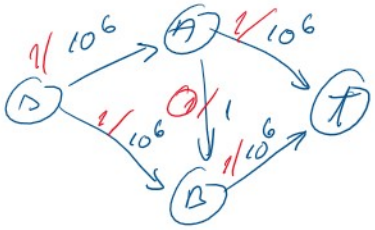
$p = \langle s, B, D, F, t \rangle \quad c_f(p) = 2$

$p = \langle s, B, C, D, F, t \rangle \quad c_f(p) = 1$



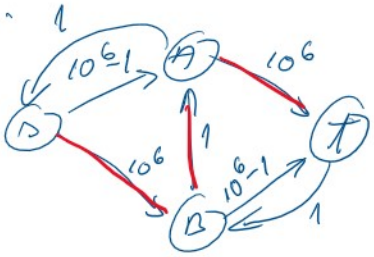


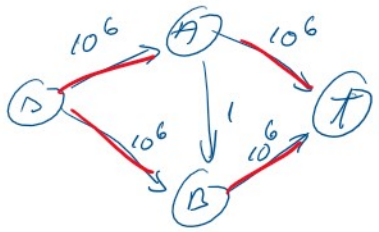
$|f^*| = 17$



$|f^*| = 2 \cdot 10^6$

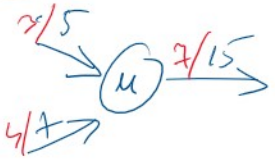
$\begin{cases} s \to A \to B \to t & c_f = 1 \\ s \to B \to A \to t & c_f = 1 \end{cases}$





BFS
greedy

BFS $O(VE^2)$



$$u.e = \sum_{v \in V} (v,u).f - \sum_{v \in V} (u,v).f = 0$$

Poppare $u.e > 0$

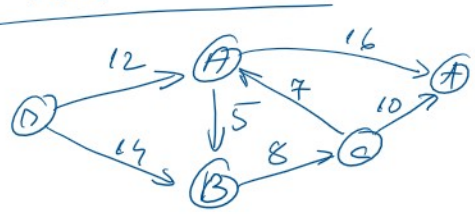
$u.h = v.h + 1$, $c_f(u,v) > 0$

```
INITIALIZARE_PREFLUX(G, s, t)
for v ∈ V do
    v.h = 0
    v.e = 0
for (u,v) ∈ E do
    (u,v).f = 0
s.h = |V|
for v ∈ Adj[s] do
    (s,v).f = c(s,v)
    v.e = c(s,v)
    s.e = s.e - c(s,v)
```

```
POMPARE (u, v)
Δ_f(u,v) = min{u.e, c_f(u,v)}
if (u,v) ∈ E then
    (u,v).f = (u,v).f + Δ_f(u,v)
else
    (v,u).f = (v,u).f - Δ_f(u,v)
u.e = u.e - Δ_f(u,v)
v.e = v.e + Δ_f(u,v)
```

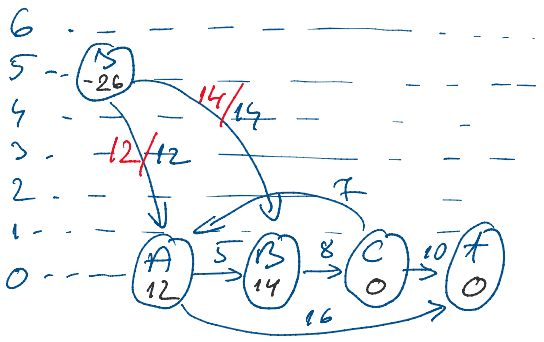
```
INALTARE (u)
u.h = 1 + min{v.h | (u,v) ∈ E_f}
```

```
POMPARE_PREFLUX(G, s, t)                    O(V^2 E)
INITIALIZARE_PREFLUX(G, s, t)
while TRUE
    if ∃ u ∉ {s,t} ∧ u.e > 0 ∧ c_f(u,v) > 0 ∧ u.h = v.h + 1 then
        POMPARE (u, v)
        continue
    if ∃ u ∉ {s,t} ∧ u.e > 0 ∧ [u.h ≤ v.h | ∀ v ∈ V, (u,v) ∈ E_f] then
        INALTARE (u)
        continue
    break
```



6 . . . . . INALTARE(A) → A.h = 1

5 -- (S) -26 . . . . .

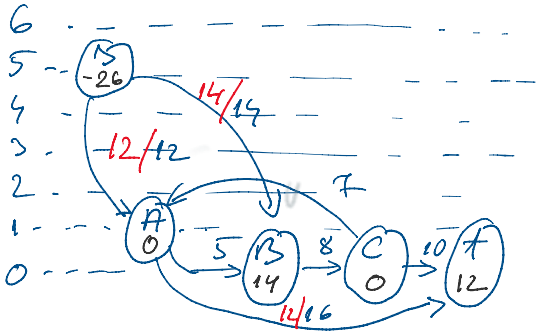


INALTARE(A) → A.h = 1

POMPARE(A,t) → A.e = 0, t.e = 12

POMPARE(A,B) → B.e = 13, A.e = 7

POMPARE(A,t) → t.e = 7, A.e = 0



INALTARE(B) → B.h = 1

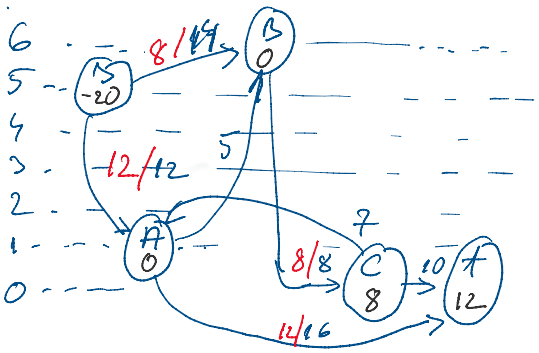
POMPARE(B,C) → B.e = 6, C.e = 8

INALTARE(B) → B.h = 6

POMPARE(B,S) → B.e = 0, S.e = -20

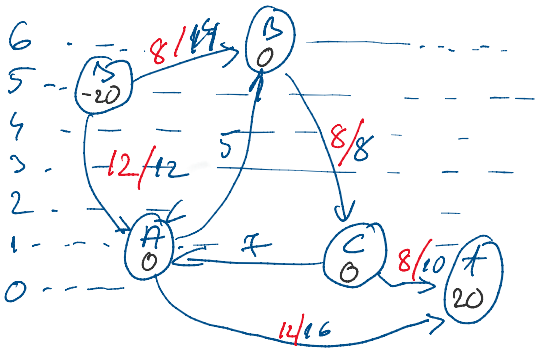
POMPARE(B,A) → B.e = 6, A.e = 5

POMPARE(A,t) → A.e = 0, t.e = 12



INALTARE(C) → C.h = 1

POMPARE(C,t) → C.e = 0, t.e = 20



If* | = 20

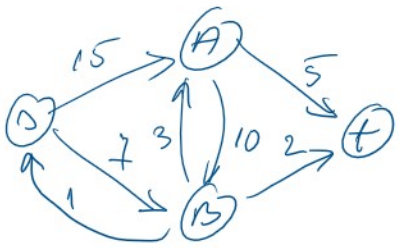
```
POMPARE_TOPOLOGICA (G,n,t)
INITIALIZARE_PREFLUX (G,n,t)
L = V \ {n,t}
for u ∈ V \ {n,t} do
    u.curent = u.N.head
u = L.head
while u ≠ NIL do
    înălțime_veche = u.h
    DESCARCARE(u)
    if u.h > înălțime_veche then
        pune u în coada listei L
```

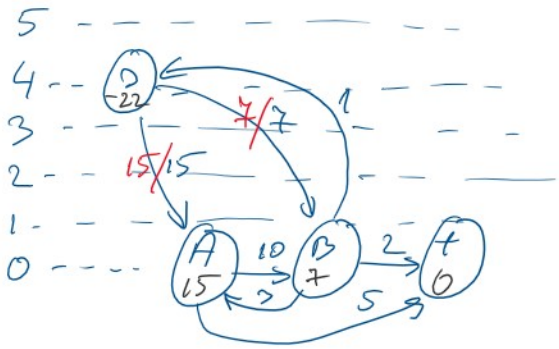
O(V³)

```
DESCARCARE (u)
while u.e > 0 do
    v = u.curent
    if v = NIL then
        INALTARE(u)
        u.curent = u.N.head
    else if c_f(u,v) > 0 ∧ u.h = v.h + 1 then
        POMPARE (u,v)
    else
```

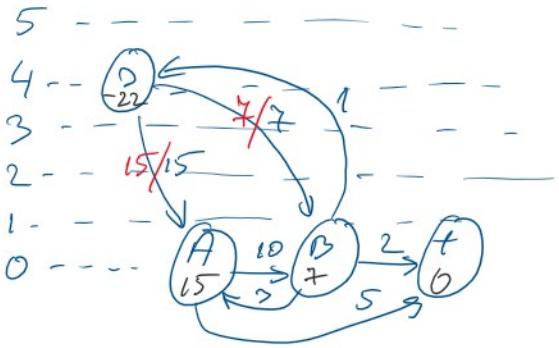
if u.h ≥ înălțime_veche then
    pune u în coada listei L
u.next

POMPARE (u, v)
else
    u.curent = u.următorul_vecin



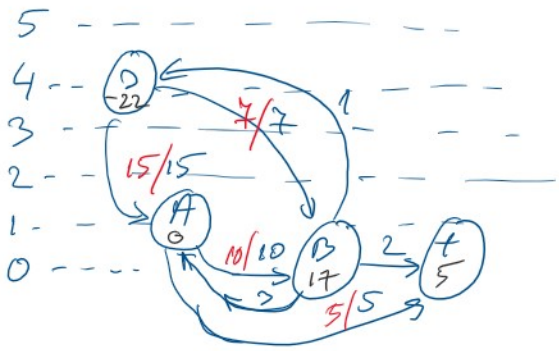


L(v)	A	B
	s	s
	B	A
	t	t



L(v)	A	B
	s	s
	B	A
	t	t

INALTARE (A) → A.h = 1



L(v)	A	B
	s	s
	B	A
	t	t

If* | = 7