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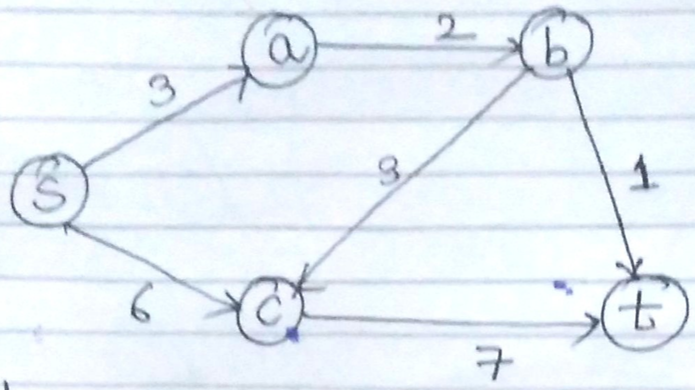
(2)



Find maxflow using push relabel algorithm.

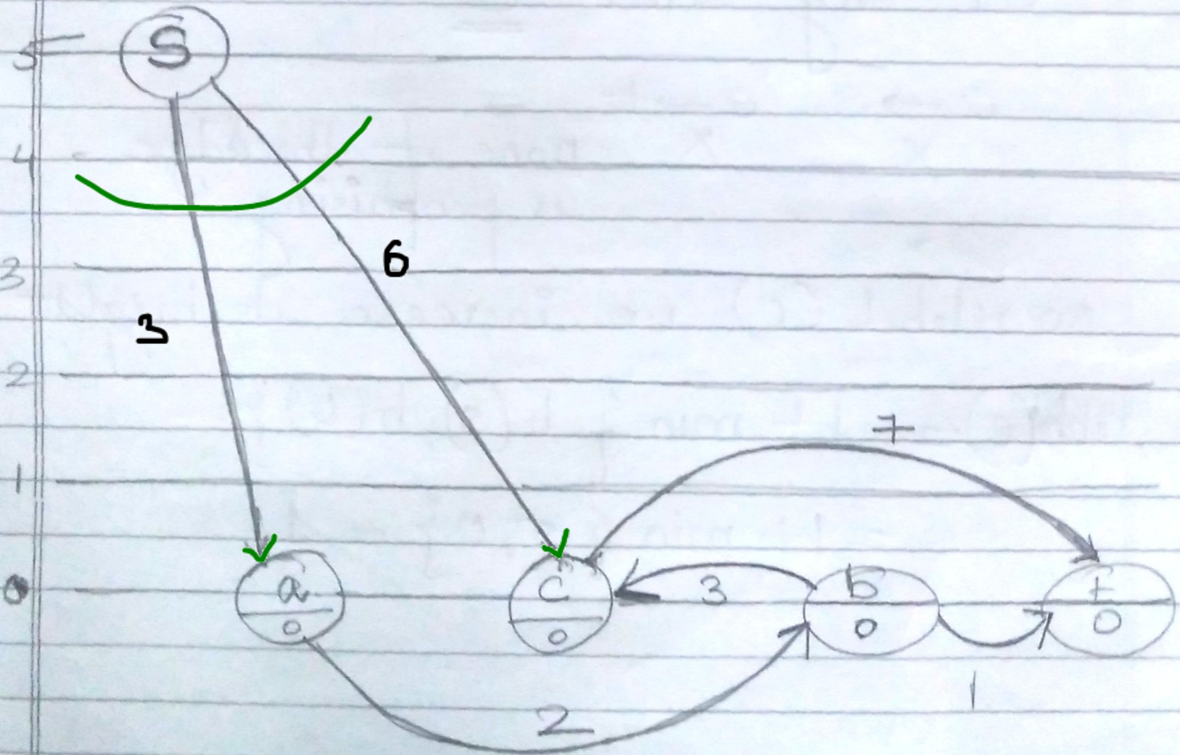
Sol^n

- Initially flow is 0

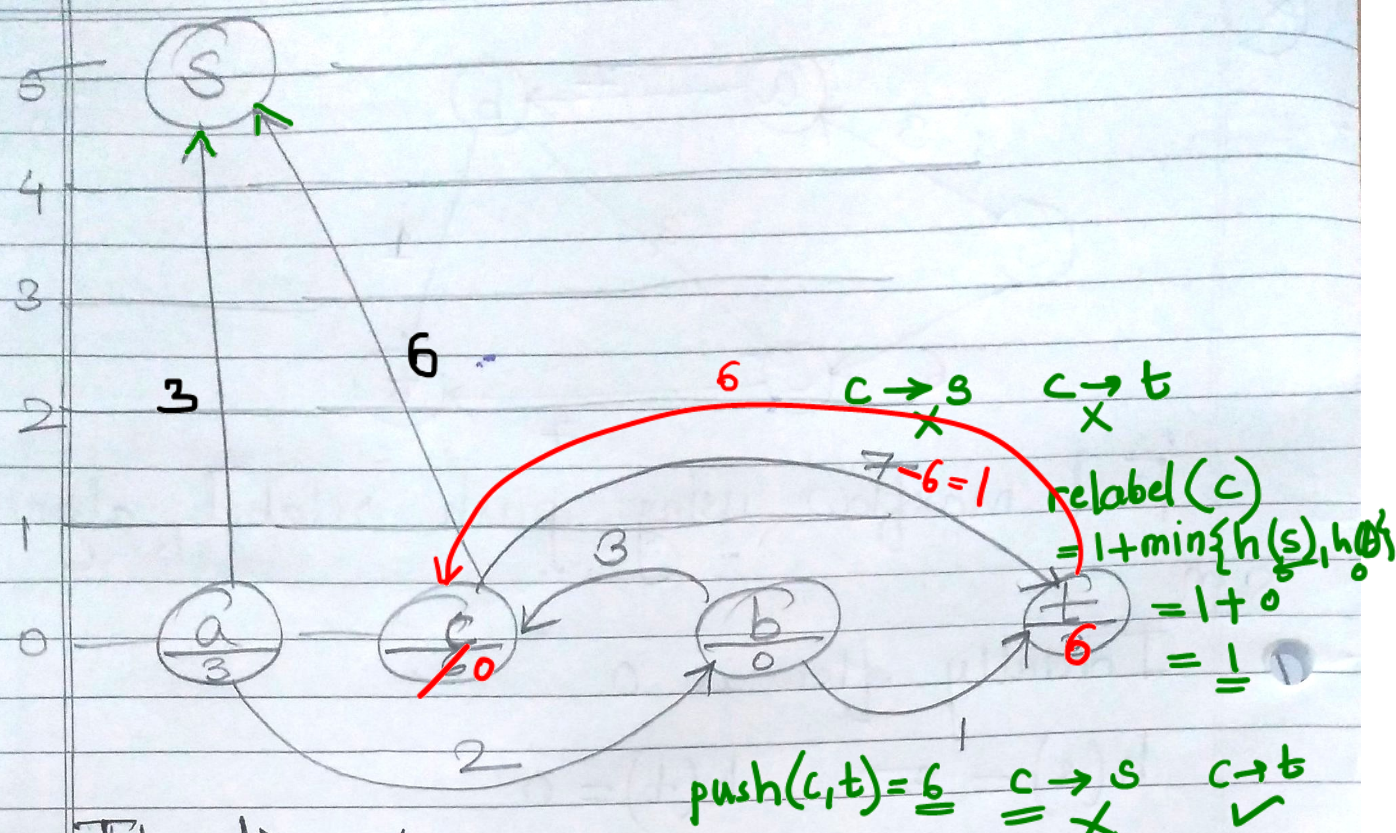
  $h(s) = 5 \qquad h(t) = 0$

  $h(a) = h(b) = h(c) = 0$ ∵ height of all internal nodes is 0

  $e(a) = e(b) = e(c) = 0$ ∵ excess flow at internal node is 0



Saturate edges leaving from S.



Iteration 1

Select any active node.

(Internal node which is overflowing ie $e(\text{node}) > 0$)

Let say select $\underline{c}$

$c \rightarrow s$ X $\quad c \rightarrow t$ X $\quad$ none of the edge is promising

so relabel (c) i.e increase its hight

$$\text{relabel}(c) = 1 + \min\{h(s), h(t)\}$$

$$= 1 + \min\{5, 0\} = 1$$

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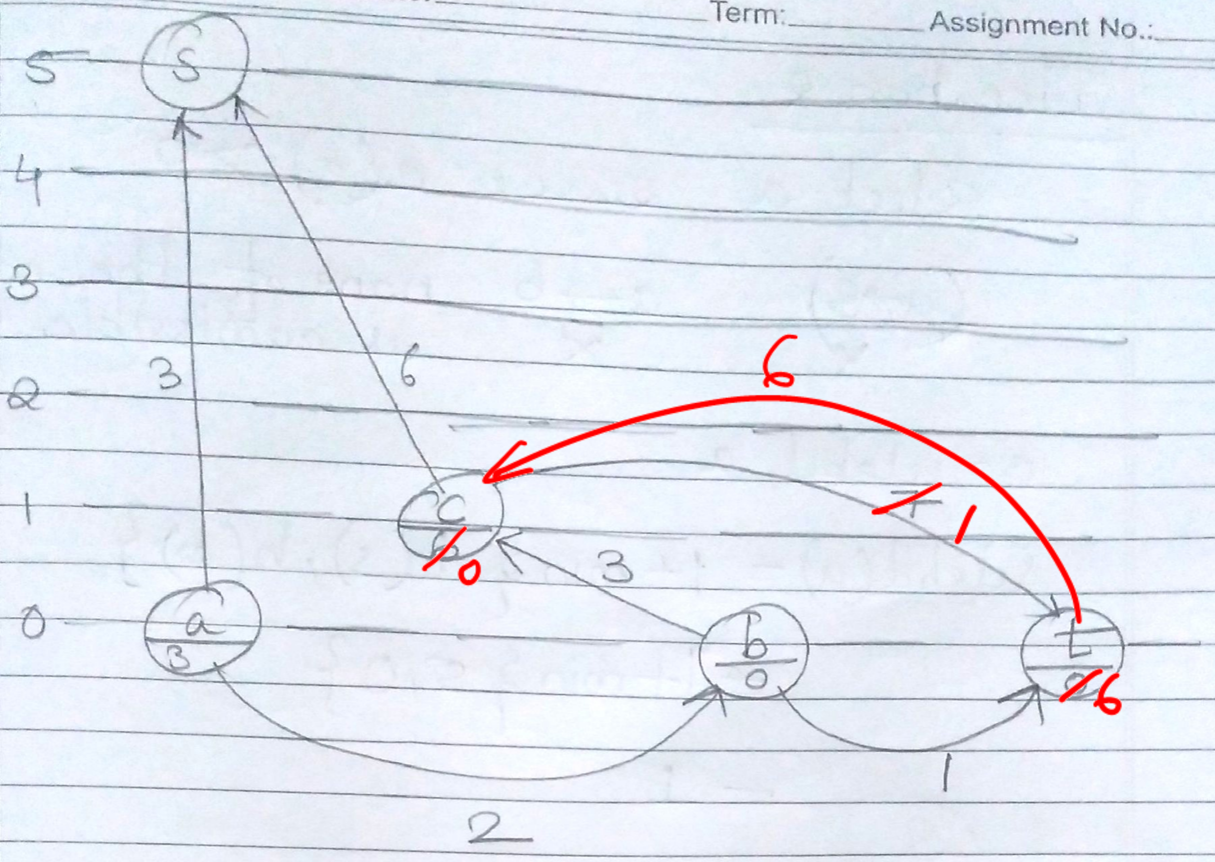


Select c

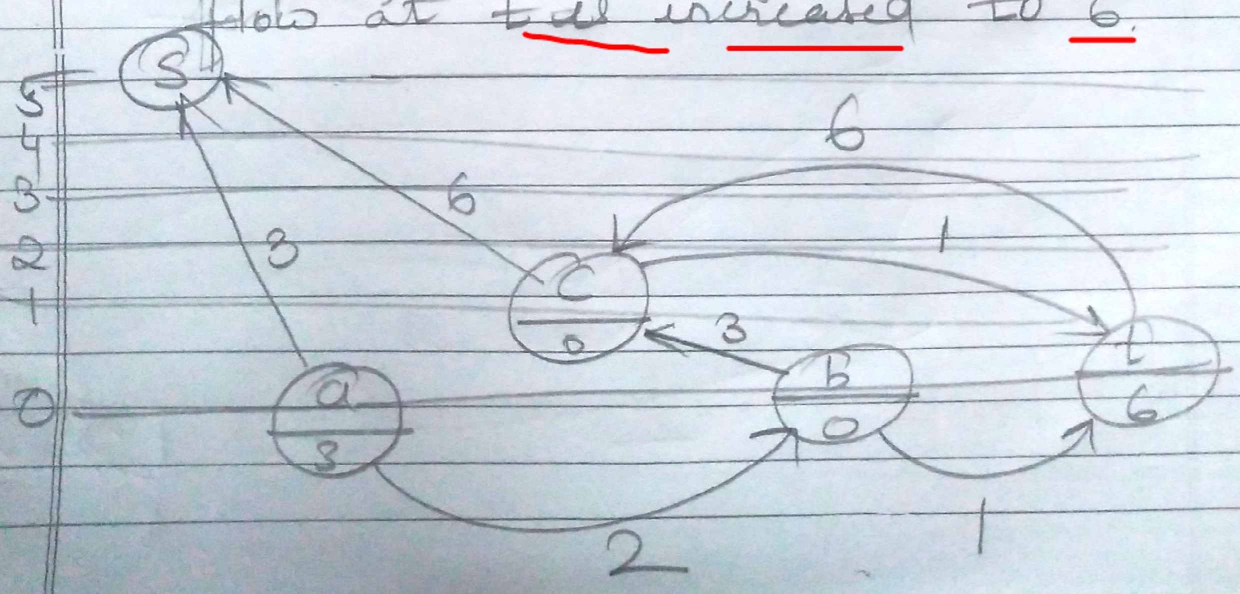
$c \rightarrow t$ is admissible edge

So

$$push(c,t) = d_f(c,t) = \min\{e(c), c_f(c,t)\}$$
$$= \min\{6, 7\}$$
$$= \underline{6}$$

So $e(c) = e(c) - d_f(c,t) = 6-6 = 0.$

Flow at t is increased to 6.



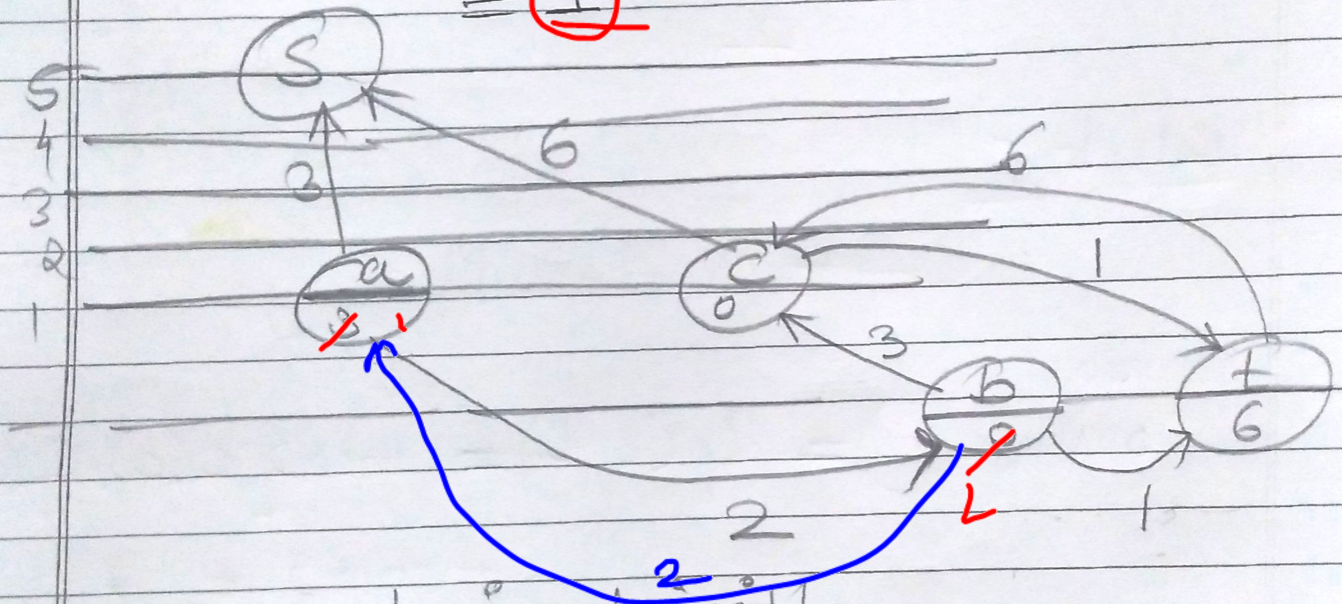
Iteration 2:

Select a since $e(a) > 0$.

$\cancel{a \to s}$ $\quad$ $\cancel{a \to b}$ $\quad$ none of the edge is admissible

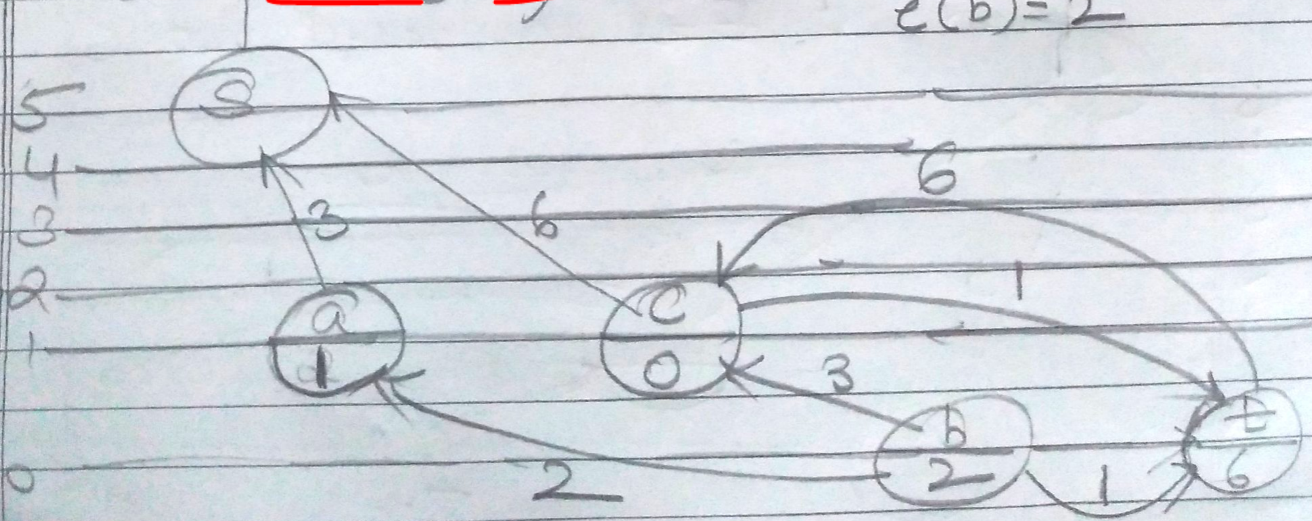
So relabel a

$$relabel(a) = 1 + \min\{h(s), h(b)\}$$
$$= 1 + \min\{5, 0\}$$
$$= 1$$



$a \to b$ is admissible

So push$(a,b) = 2$ $\quad$ $e(a) = 1$, $e(b) = 2$



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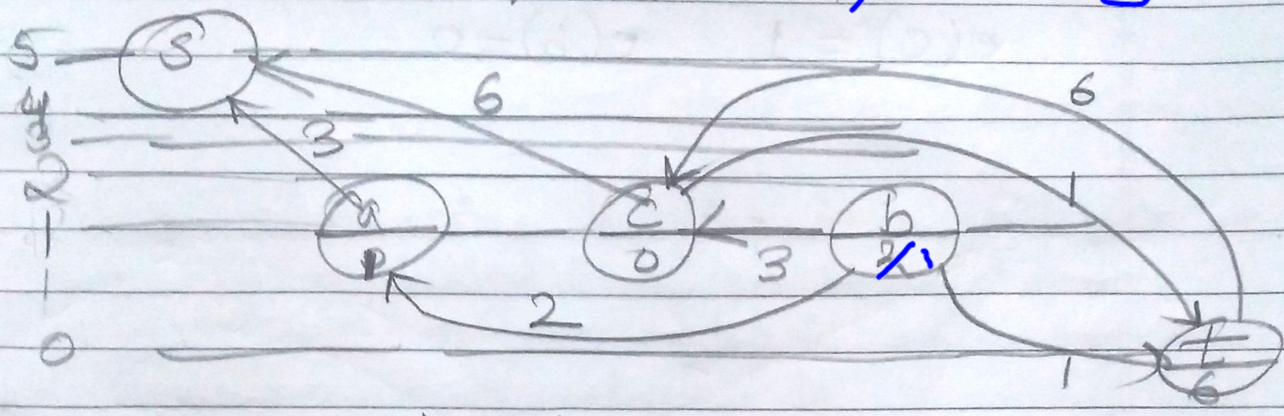
Iteration 3

Select any internal node having $e(\text{node}) > 0$

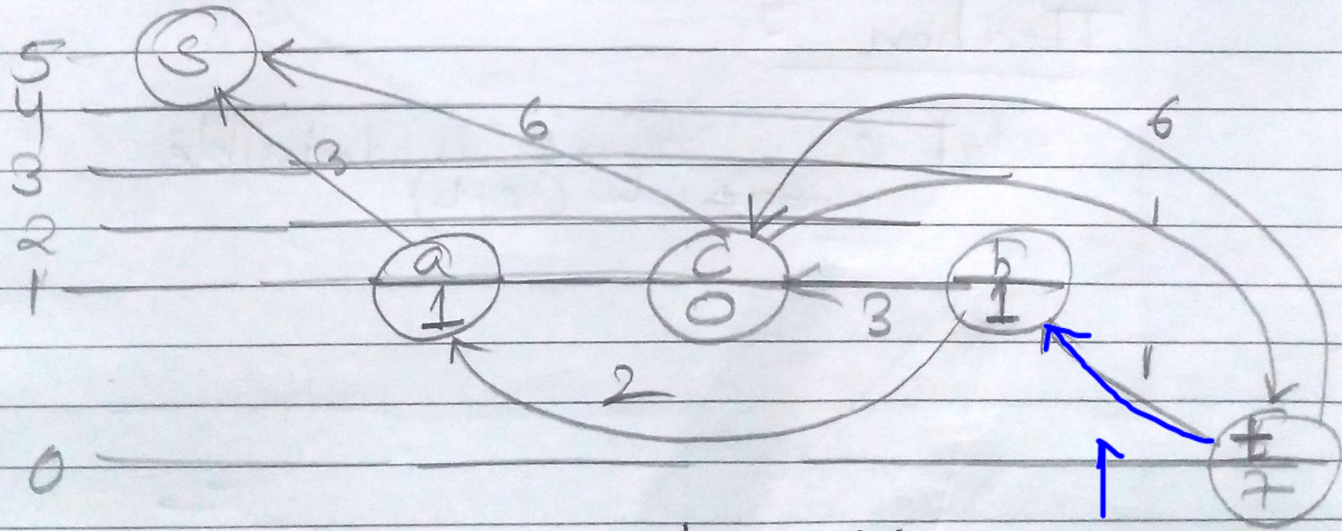
so select b $b \to a$ $b \to c$, $b \to \text{t}$ relabel(b) = 1



so now $b \to t$ is admissible

push(b, t) = 1. so e(b) = 1

flow at t = 6+1 = 7



Iteration 4.

select b.

$b \to a$ X

$b \to c$ X

relabel (b) = 1 + min{ h(a), h(c) }

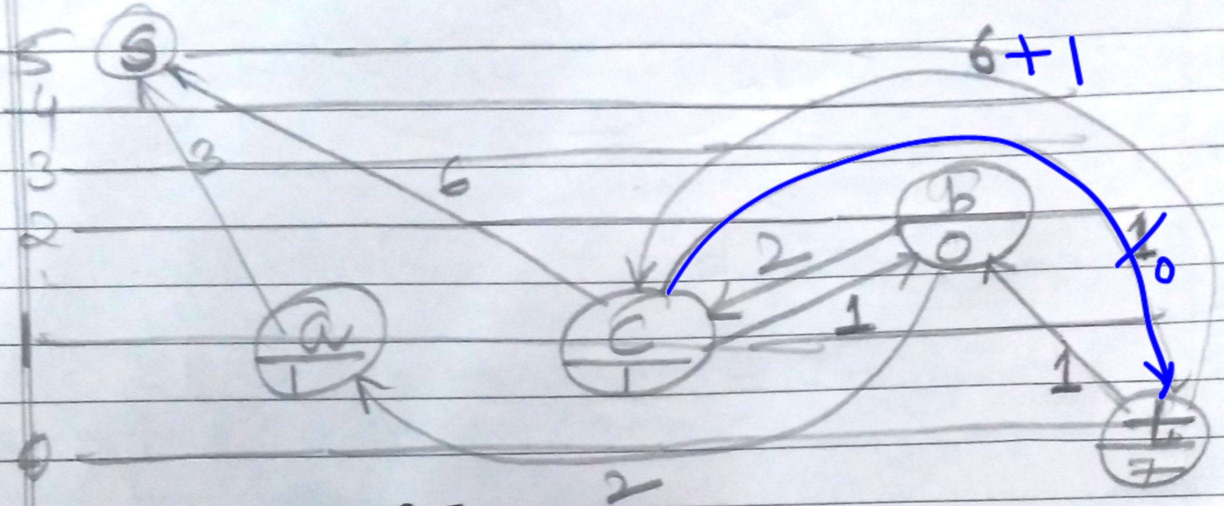
= 1 + min{1,1} = 2.

after relabeling b, b → c edge is admissible

so push(b, c) = min{ e(b), $c_f(b,c)$ }

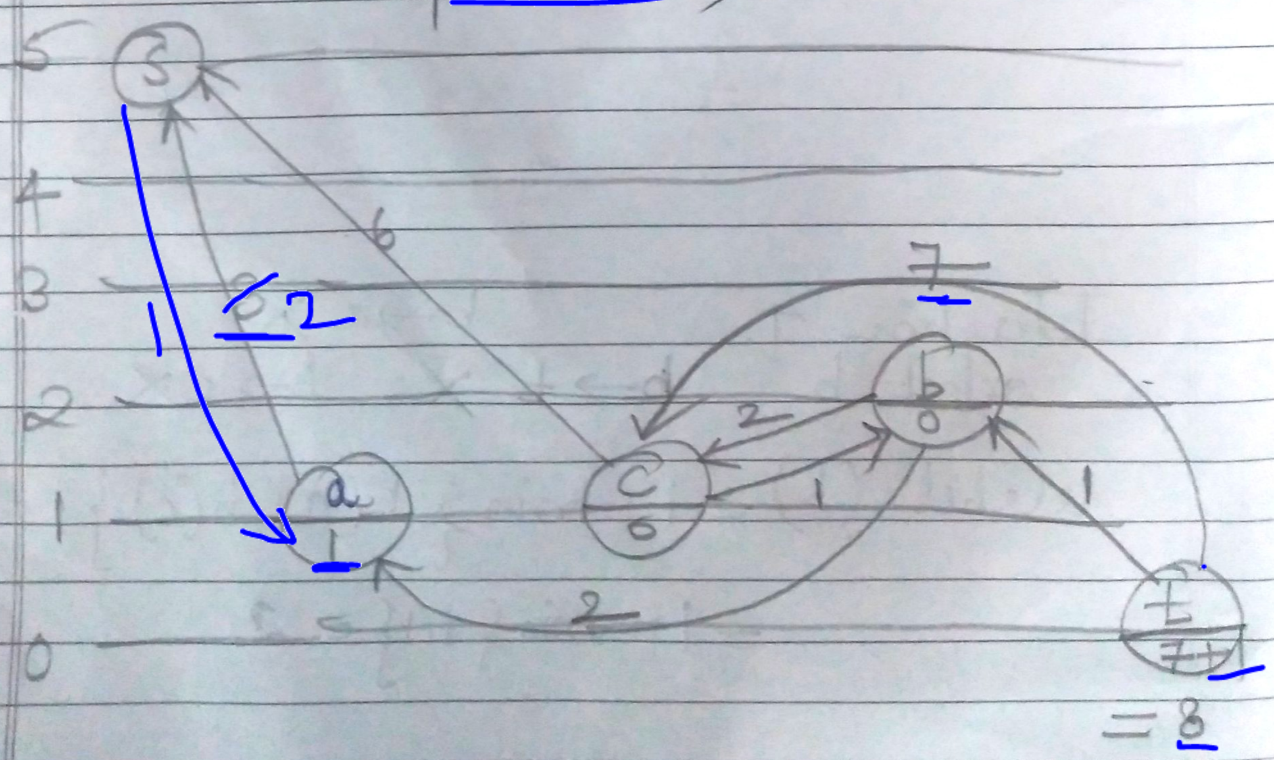
= min{ 1, 3 } = 1

e(c) = 1   e(b) = 0



Iteration 5

Select c, c → t is admissible so push(c, t)



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Iteration 6

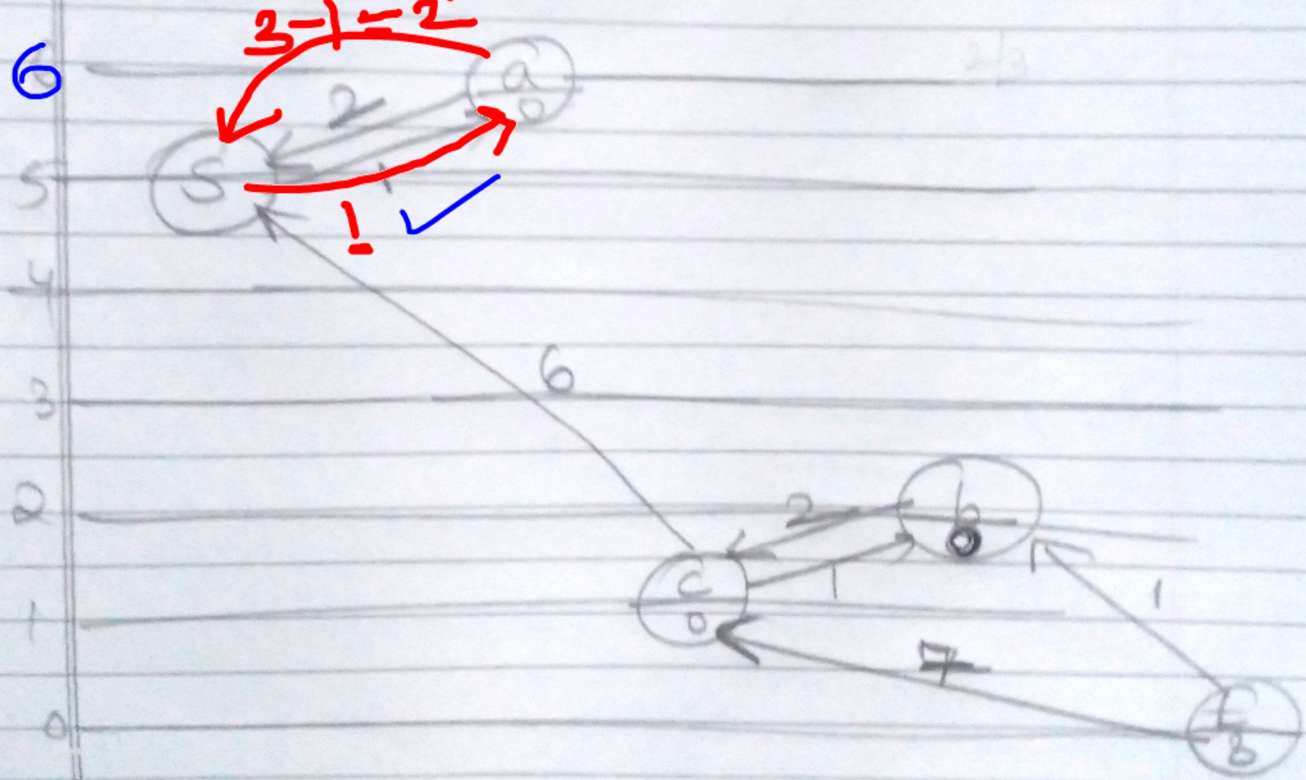
Select a since $e(a) > 0$

$a \rightarrow s$ ✗

So relable $(a) = 1 + h(s)$

$= 1 + 5 = 6$

After increasing height of a, which is more than height of s node, the excess flow is given back to s, since it can not reach to t.



all internal node excess flow is 0, so stop, & flow into t is maxflow.