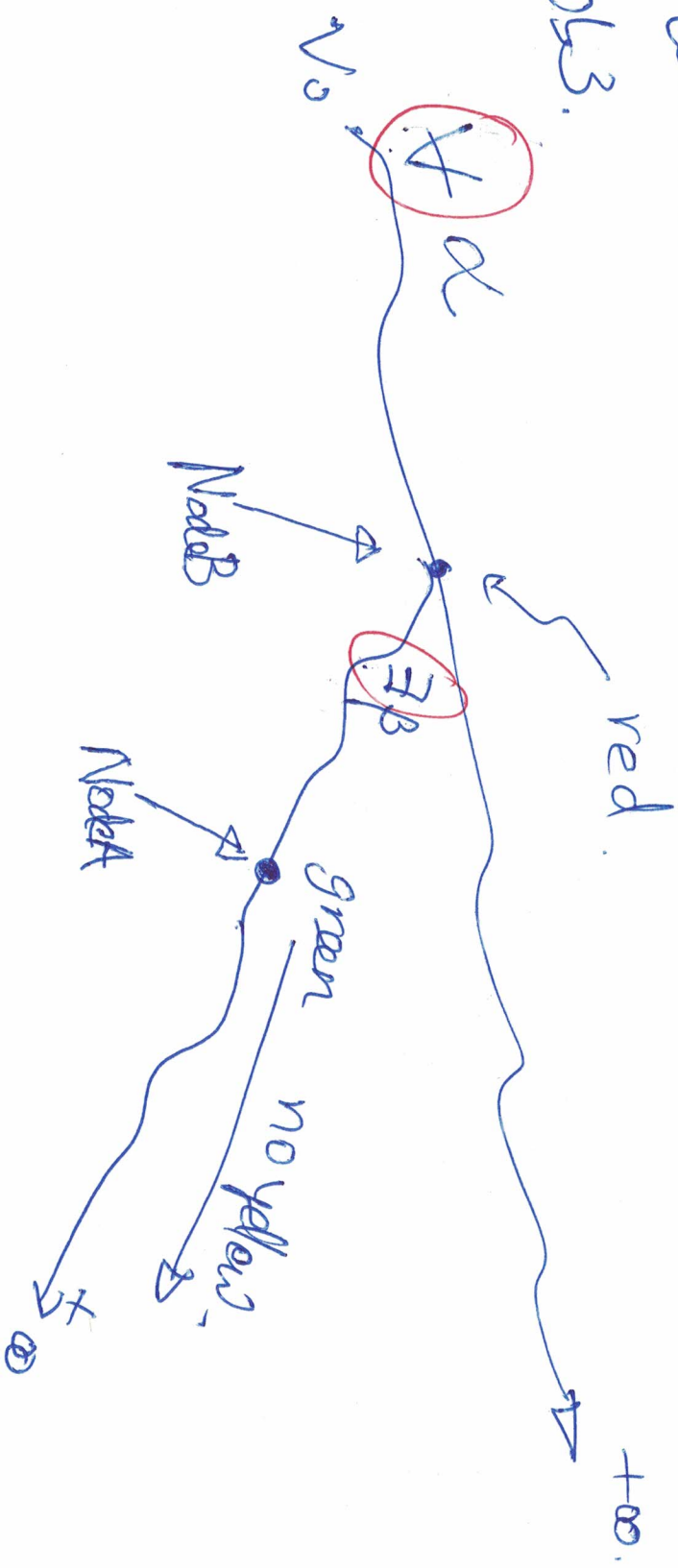


Cpts 515. 10/5/2020

# Symbolic Graph Search.

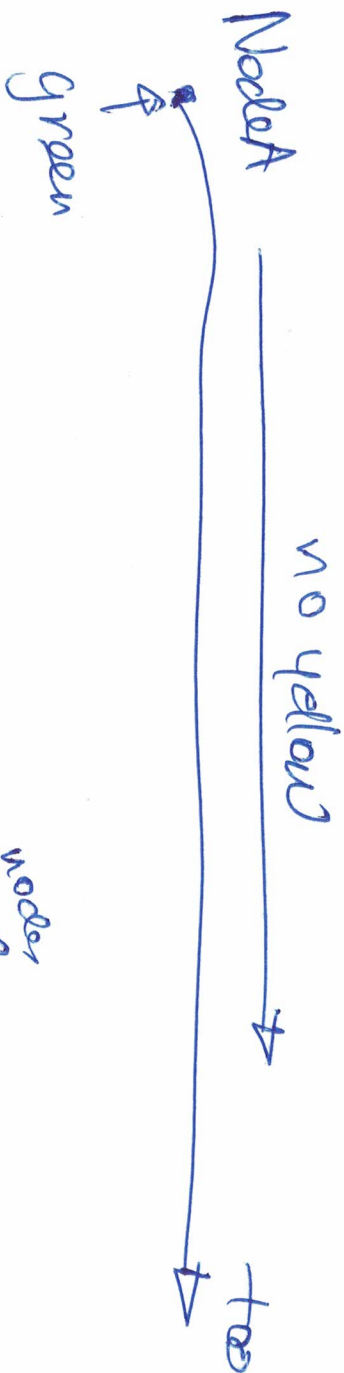
HW Questions.  
Prob3.



Solutions.

(1) Figure out what are the NodeA's? <sup>in G.</sup>

Tell me, using SCC, the NodeA's =



Alg: ① Drop all yellow <sup>nodes</sup> from G and obtain  $G'$ .

② Run SCC on  $G'$ .

③ Find all green nodes that can reach a looping SCC in  $G'$ .

(2). Figure out all NodeB's that sat;

NodeB is red and NodeB can reach

a NodeA.  $\longleftarrow$  easy.

(3). Now, the original question is equivalent to:

"For every  $w$  walk from  $v_0$ ,  $\alpha$  passes  
a NodeB. "  $\dots \dots \dots (*)$

It suffices to decide whether  $G$  sat the negation  
of  $(*)$  :

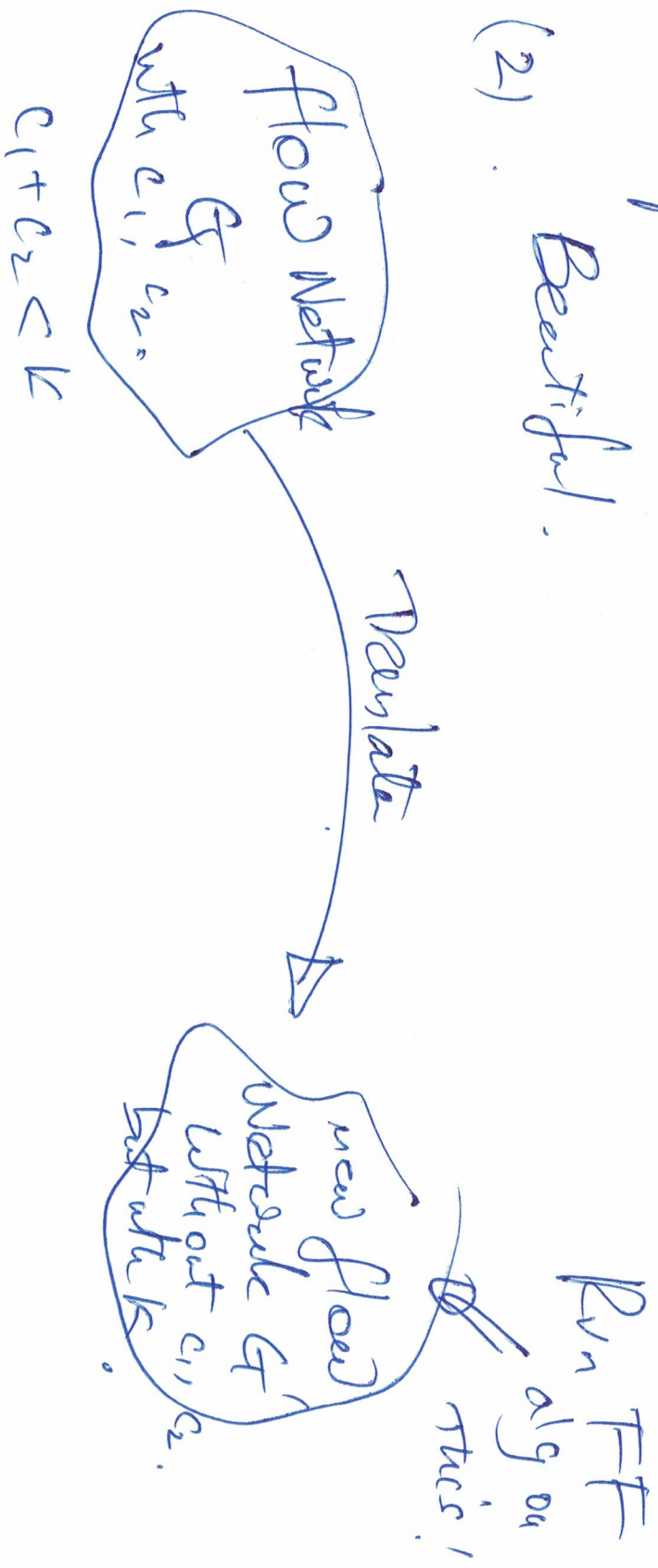
"There is an  $w$  walk  $\alpha$  from  $v_0$ ,  $\alpha$   
doesn't pass any NodeB."  $\dots \dots \dots (**)$

(41). Can you use SCC to decide (\*\*) ?  
Yes. You work on it,

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Prob 2. (1). Not so beautiful. Max flow can be solved using LP. Adding  $c_1 + c_2 < k$  can also be formulated into LP.

(2). Beautiful.



Prob2. Wrong Solution.

Recall: I want efficient solutions! So,

you can't do:

Since  $C_1 + C_2 < K$ , & we assume  
<sup>negative</sup>

$C_1, C_2$  are integers, so we enumerate  
all possible integers  $C_1, C_2$  with  $C_1 + C_2 < K$   
and for each  $C_1, C_2$ . Enumerated, we

Run FF on the  $G$ ;

Return the max of all the max flow results  
for each run.



Time complexity ?

$\infty$   $\infty$

Estimate all  $< C_1, C_2 >$  where  $C_1 + C_2 < K$ .

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exp-time !!

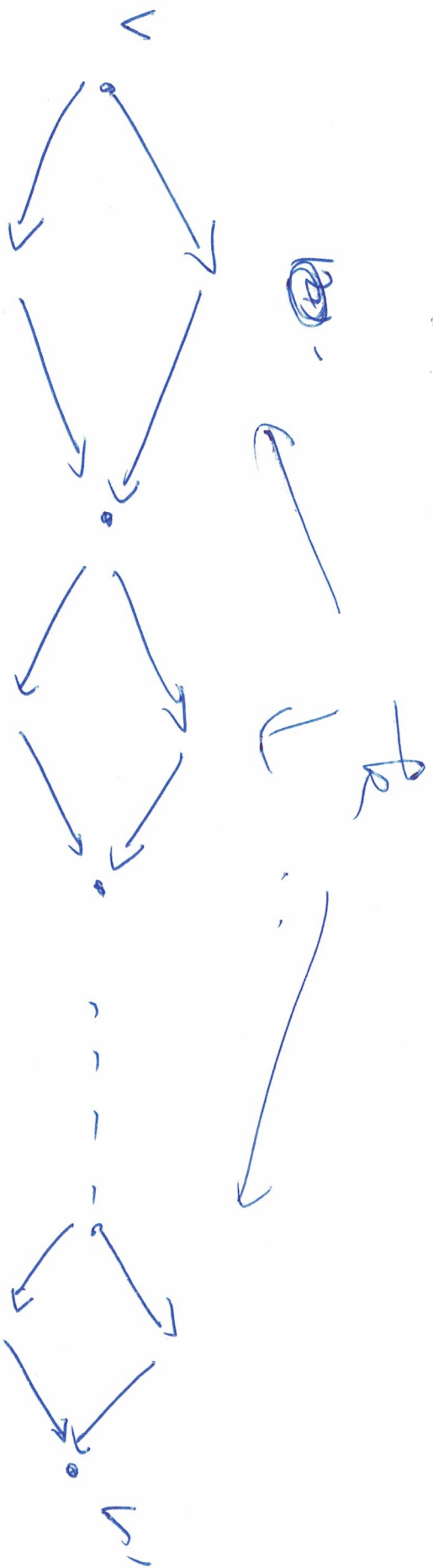
at least  $O(K^2)$  FF).

↳

What is input size ?

$|G| + \log_2 K$ .

Prob 4. (11). efficient alg.



# of nodes from  $v$  to  $v' = 2k$

Since it's a DAG,

- ① Topological sort,
- ② Forward propagation of counts.

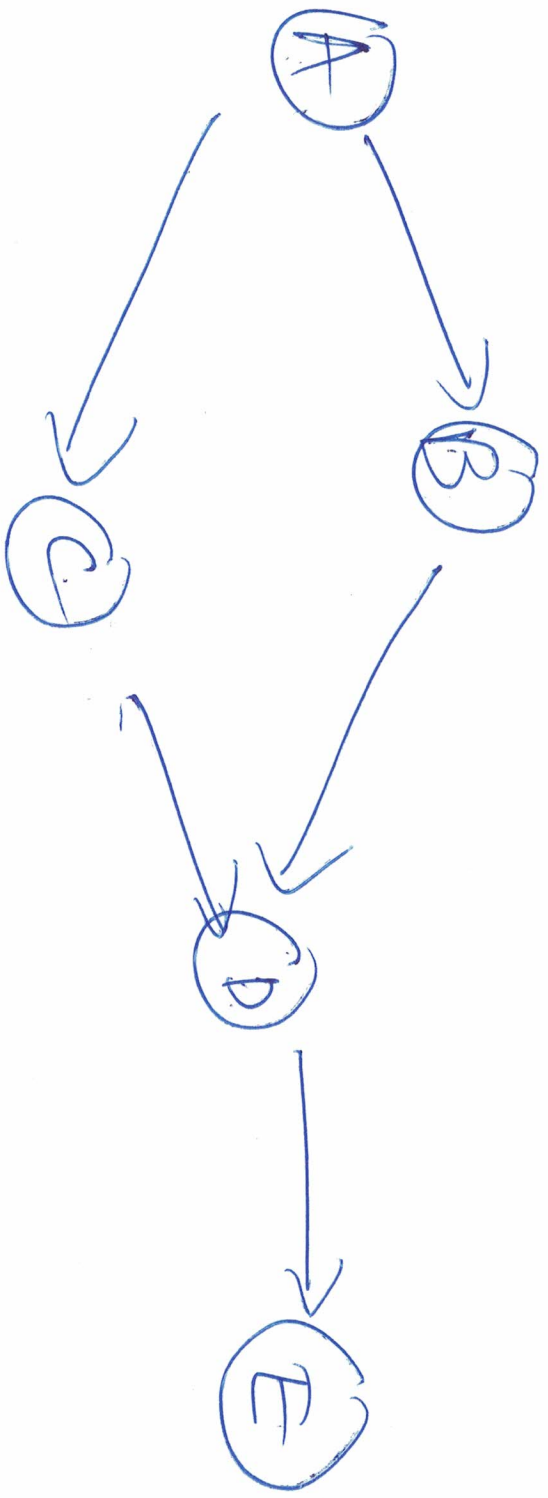
① why it is so hard.  
Prob 4. (2).

② efficient alg.

Hint: You need modify alg in (1).  
by adding an aux. Data structure ~~to~~ each node  
in the topological sort.



DAG:



A B C D E.

A C B D E.