Exercise 8 (for grade) ~ Monday, November 28, 2022 ~ CPSC 535.01 Fall 2022

Write one submission for your entire group, and write all group members' names on that submission. Turn in your submission before the end of class. The X symbol marks where you should write answers.

Recall that our recommended problem-solving process is:

1. **Understand** the problem definition. What is the input? What is the output?
2. **Baseline** algorithm for comparison
3. **Goal** setting: improve on the baseline how?
4. **Design** a more sophisticated algorithm
5. **Inspiration** (if necessary) from patterns, bottleneck in the baseline algorithm, other algorithms
6. **Analyze** your solution; goal met? Trade-offs?

Follow this process for each of the following computational problems. For each problem, your submission should include:

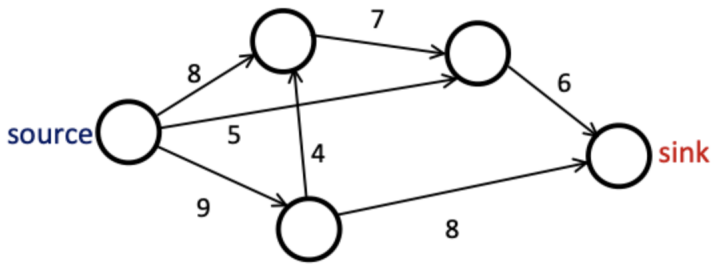
a. State are the input variables and what are the output variables
b. Pseudocode for your baseline algorithm, that needs to include the data type and an explanation for any variable other than input and output variables
a. The Θ-notation time complexity of your baseline algorithm, with justification.

and if you manage to create an improved algorithm:

c. Answer the question: how is your improved algorithm different from your baseline; what did you change to make it faster?
d. Pseudocode for your improved algorithm, that needs to include the data type and an explanation for any variable other than input and output variables
a. The Θ-notation time complexity of your improved algorithm, with justification.

Today's problems are:

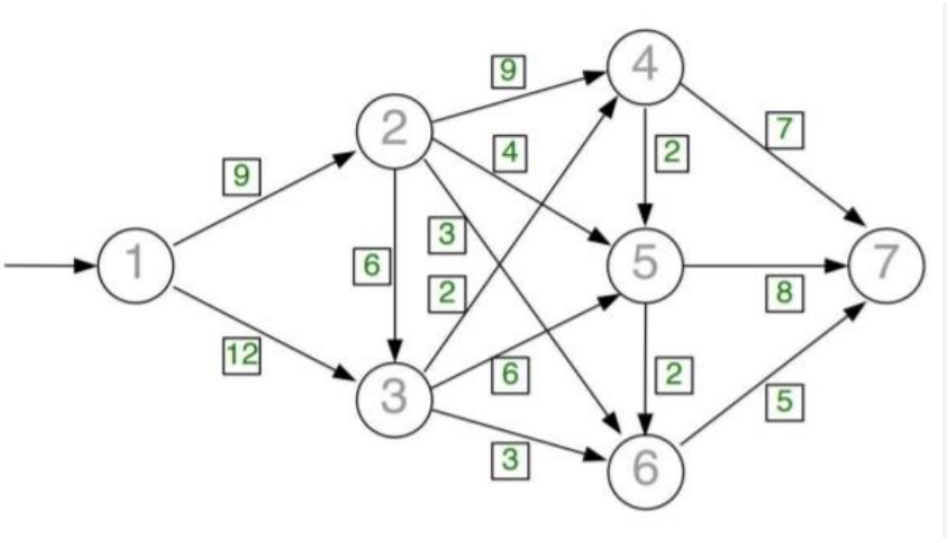
1. *(Max-flow, Ford-Fulkerson method*
   Show the execution of the Ford-Fulkerson on the flow network below:



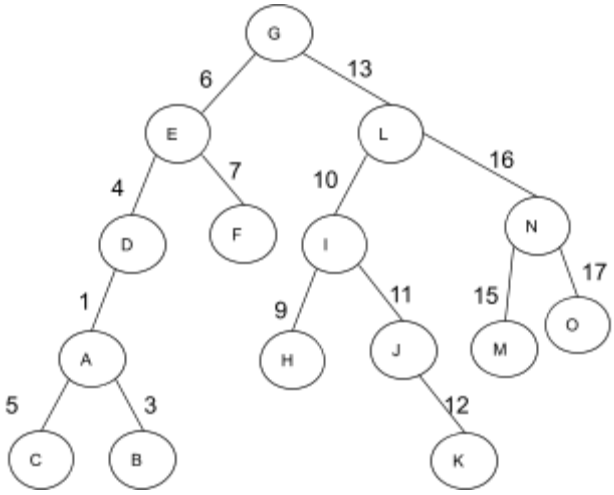
Flow Network(Graph)

   Show each augmenting path and the residual graph after each augmenting path.

2. *(Max-flow, Edmond-Karp algorithm*
   Show the execution of the Edmonds-Karp algorithm on the flow network below, with the source s=1 and the sink t=7:



3. *(Maximum matching in a tree)*
   Compute the maximum matching in the tree below:



Names

Write the names of all group members below.

X Hetal Patel

Tejaas Mukunda Reddy

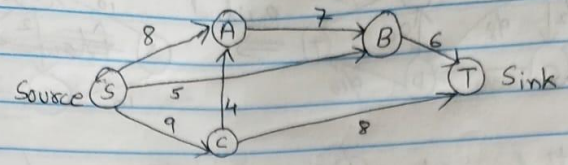
Himasri kanumuri

Exercise 1: Solve and provide answer

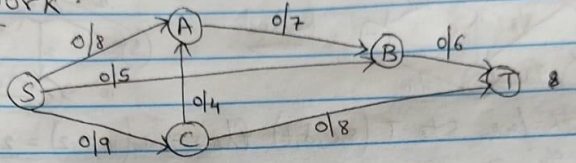
X

Ford Fulkerson :-

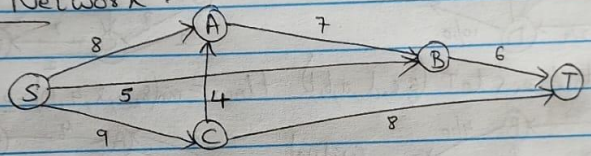
1)



Flow Network :-



Residual Network :-

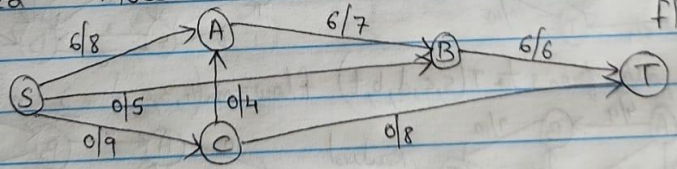


Augmenting Path from S to T

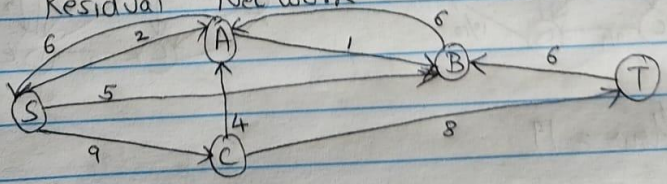
S, A, B, T flow = min(8, 7, 6) = 6

Increase flow by 6

Updated flow Network :-



Updated Residual Network :-

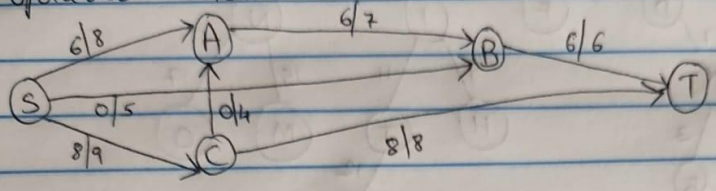


Augmenting Path from S to T

S, C, T flow = 8

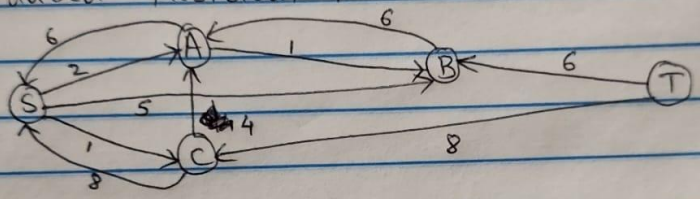
Increase flow by 8

Updated flow Network :-



flow = 0 + 6 + 8
= 14

Updated Residual Network :-

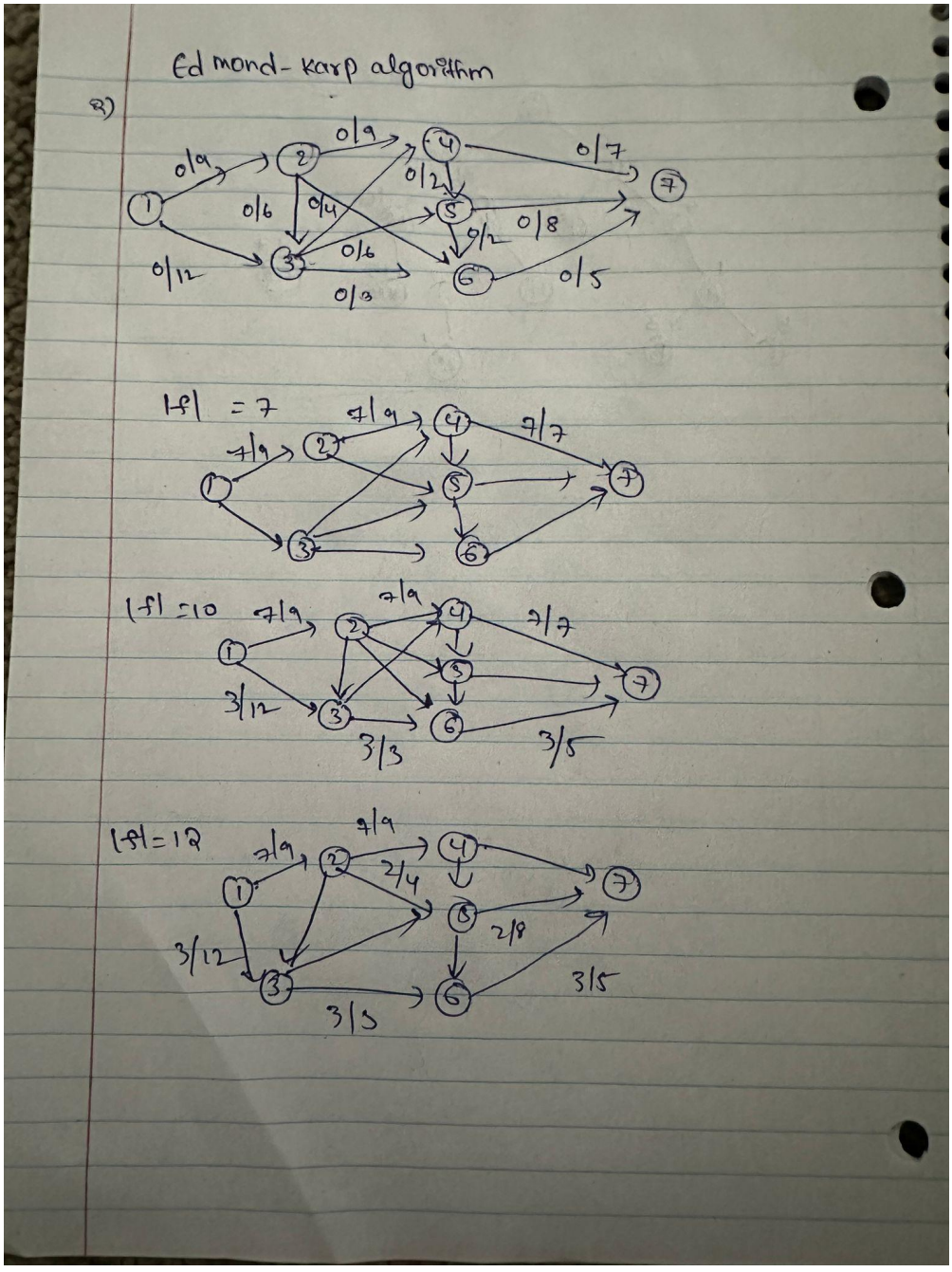


Augmenting Path from S to T

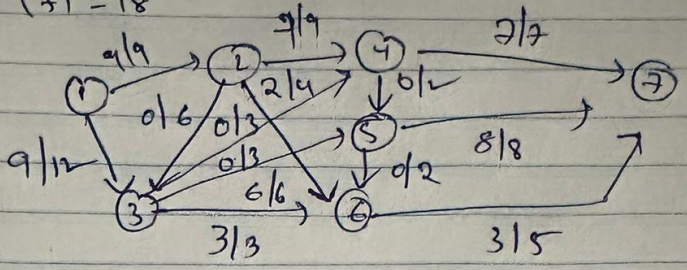
None

Maximum Flow = 14

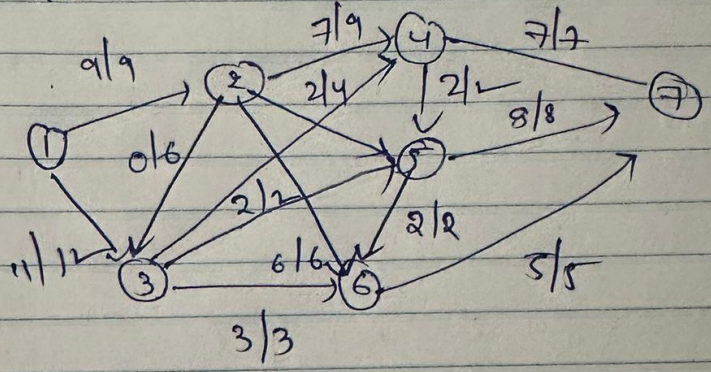
Exercise 2: Solve and provide answer



$|f| = 18$

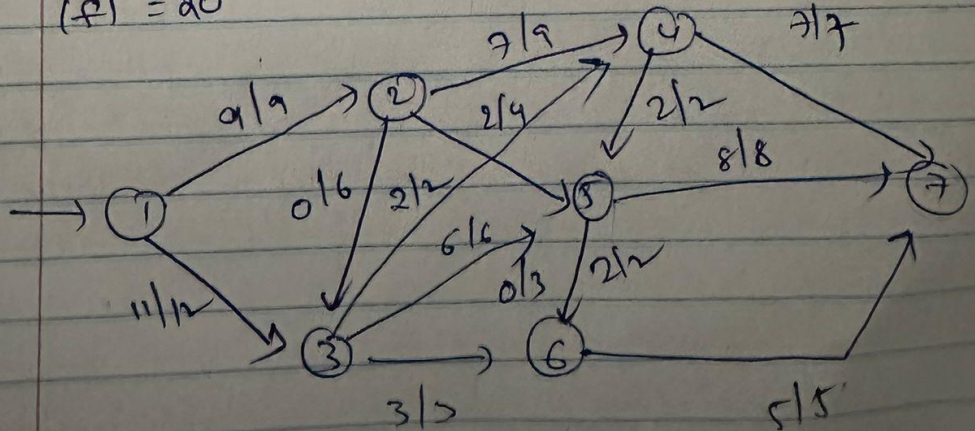


$|f| = 20$

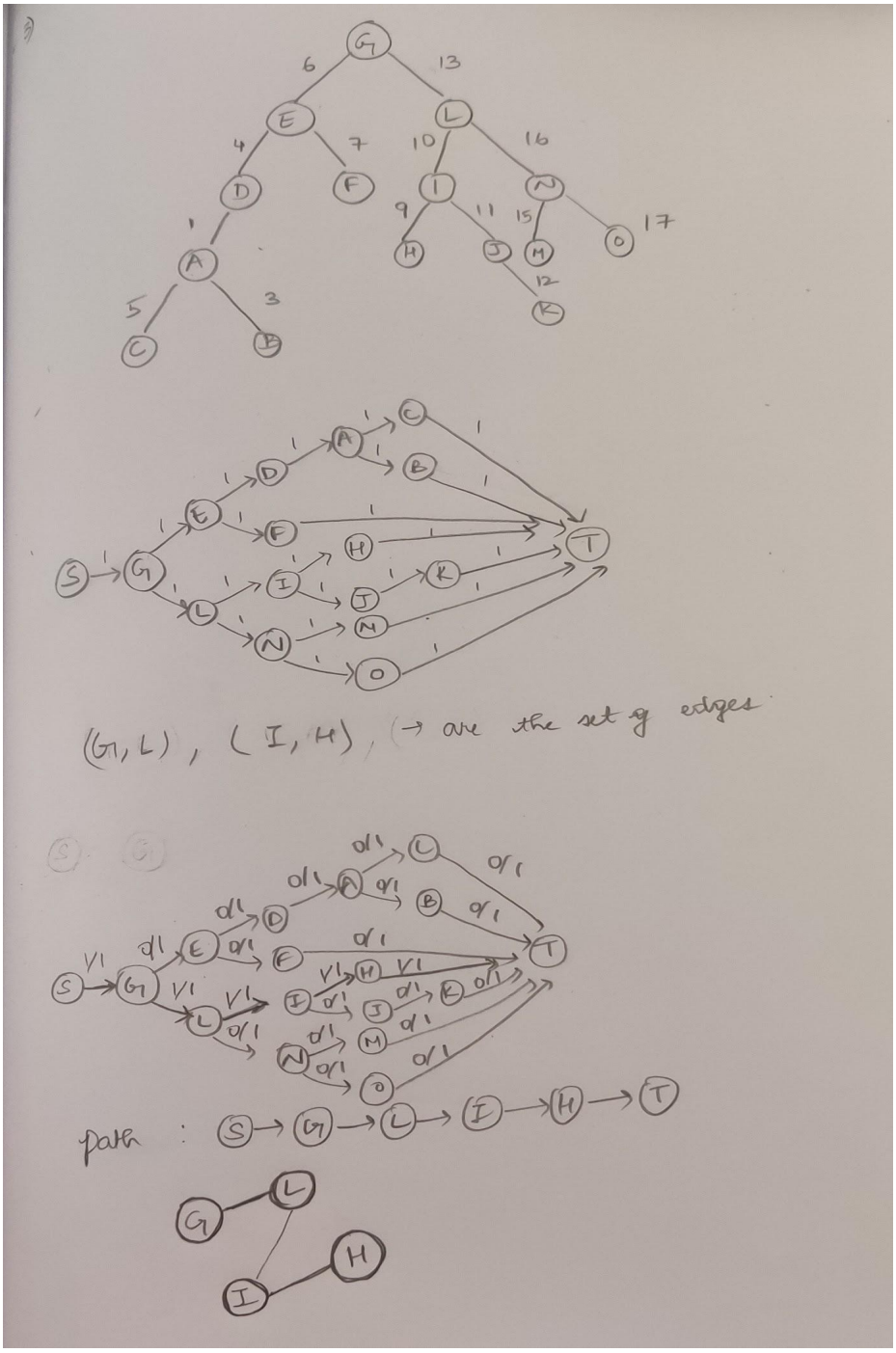


~~Final Answer~~

$|f| = 20$

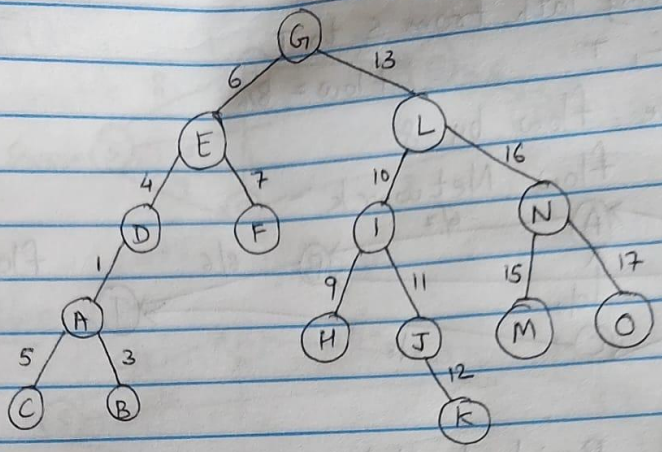


Exercise 3: Solve and provide answer



X

3)



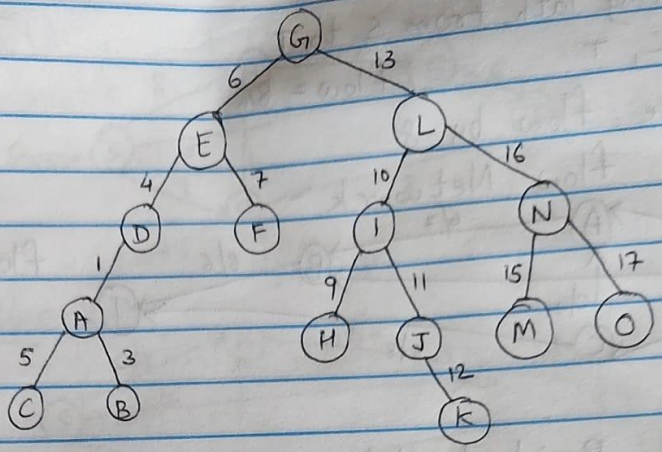
Matched :-

$\{A, C\} = 5$
$\{E, F\} = 7$
$\{G, L\} = 13$
$\{I, H\} = 9$
$\{J, K\} = 12$
$\{N, O\} = 17$

63

Sum of Matching Edges = 63
Total No. of Maximum Matching = 6

3)



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