

E0 225: Homework 3

Deadline: September 26th, 2pm

Instructions

- You need to attempt the homework problems on your own (no peer discussions are allowed). You are also forbidden from consulting the internet and other external sources.
- Academic dishonesty/plagiarism will be dealt with severe punishment.
- Late submissions are accepted only with prior approval or medical certificate.

1 (5 points) Let $G = (V, E)$ be a flow network with source s , sink t , and integer capacities. Suppose that you are given a maximum flow in G . Suppose that the capacity of a single edge $(u, v) \in E$ decreases by one. Give an $O(|V| + |E|)$ time algorithm to update the maximum flow.

(Hint: You might want to use the fact which we proved in the class. f is a maximum flow if and only if there is no $s - t$ path in the residual graph.)

2 (5 points) Among all the minimum cuts in a flow network G with integer capacities, we wish to find one that contains the *smallest* number of edges. Show how to modify the capacities of G to create a new flow network G' such that any minimum cut in G' is a minimum cut with the smallest number of edges in G .

3 (15 points) Solve Problem 3 from Problem Set in <http://timroughgarden.org/w16/ps/ps1.pdf>

Practice Exercises (not for grading)

Solve the problems in this link for practice <http://timroughgarden.org/w16/e/e1.pdf>