1A Lent Algorithms

Supervision 7: Amortized Analysis and Advanced Data Structures

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1 Refresher (Flows)

1. (From previous sheet, for those with whom we didn't go through the problem) You would like to assign n people into m activities in such a way that the largest activity group is as small as possible. For each person, you know exactly which activities they can be part of. Describe an algorithm to find the smallest possible size of the largest group.

   Hint: First, find an algorithm that checks whether, for a given integer s, it is possible to make the assignment in such a way that the largest group has at most s people.

2. Given an unweighted, undirected graph G and two vertices in it u and v. Describe an algorithm that finds the number of edge-disjoint paths from u to v and the paths themselves. How can you find the number of *vertex*-disjoint paths from u to v?

3. * Consider a round-robin tournament with n players. In the tournament each pair plays exactly twice (home game and away game) and there are no draws. We will say that a team has lost *mathematically* if it has no chance of winning, no matter what the outcomes of the remaining games is. Given the current table of the tournament (the pairs of teams that have already played and who won each game), determine the team that have lost mathematically.

   Hint: Construct a graph that involves the teams and the games and use flow.

2 Advanced Data Structures and Amortized Analysis

1. Questions 1-11 from the Lecturer's example sheet 7/8 **from last year**[1].

2. Recall the implementation of a queue using two stacks discussed in supervision 3.[2] Analyse it using the potential method.

[1] `http://www.cl.cam.ac.uk/teaching/1718/Algorithms/ex7.pdf`
[2] `http://www.cl.cam.ac.uk/~hs586/files/1a-alg-lent-2019/supervision3.pdf`