

Assignment 5

Due: Sunday 1 December 2019 @ 11.59pm

Directions:

- Your solutions must be typeset. LaTeX is recommended (but not required).
- You must upload your solutions as a PDF file on Canvas before the deadline.
- You don't have to include your solutions to the programming problems in the PDF file.

Problem 1

Recall the dynamic table from class. We discussed the algorithm for TABLE-INSERT and analyzed its amortized running time. Your task in this assignment is to:

1. Give an algorithm for TABLE-REMOVE which removes an item from the table and contract the table by halving the size when $\alpha < \frac{1}{4}$.
2. Analyze the amortized running time of TABLE-REMOVE.

Problem 2

The **set-partition** problem takes as input a set S of numbers. The question is whether the numbers can be partitioned into two sets A and $A' = S - A$ such that $\sum_{x \in A} x = \sum_{x \in A'} x$. Show that the set-partition problem is NP-complete. (*Hint: Reduce SUBSET-SUM*)

Problem 3

Suppose you're helping to organize a summer sports camp, and the following problem comes up.

The camp is supposed to have at least one counselor who's skilled at each of the n sports covered by the camp (baseball, volleyball, and so on). They have received job applications from m potential counselors. For each of the n sports, there is some subset of the m applicants qualified in that sport.

The question is: For a given number $k < m$, is it possible to hire at most k of the counselors and have at least one counselor qualified in each of the n sports? We'll call this the **EFFICIENT RECRUITING PROBLEM**.

Show that **EFFICIENT RECRUITING** is NP-complete.