E-402-STFO Problems for Module 5

Created by Arnar Bjarni Arnarson

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There are 160 points total in the assignment, getting 100 gives full marks. Kattis does not have the package we use installed so these will be manually graded. Each problem gives 40 points. Some of these problems can be solved using other methods, but any submissions that do not use linear programming to solve the task will be manually set to a 0.

On canvas you can find a python file solving an example problem using pulp so you can see the syntax the package uses.

m4p1 Write code that given a graph G uses integer linear programming to find the size of the maximum clique. A clique is a subset of vertices where every vertex is connected to every other vertex. The graph is given as follows. The first line contains two integers V, E, the number of vertices and edges. Then E lines follow, each containing two integers a, b, meaning that there is an edge between vertices a and b. These values are 0-indexed and the graph will be simple. The input will satisfy $1 \leq V \leq 25$.

m4p2 Write code that given a graph G uses integer linear programming to find the size of the largest independent set. The graph is given as a dictionary of adjacency sets. An independent set is a subset of vertices where no vertex is connected to any other vertex. G has at most 25 vertices. G is given in the same way as in m4p1.

m4p3 Write code that given a set U and a list S of subsets of U uses integer linear programming to find lowest number of subsets from S that can be used to cover U. U has at most 20 elements. The first line of input contains a single integer n, the size of U. We will consider U to contain the elements $1, 2, \ldots, n$. The next line contains a single integer $s \leq 50$, the number of subsets. The next $2s$ lines describe the subsets, each 2 lines giving one subset. The first line contains a single integer x, the number of elements in the subset. The second line has x integers, the elements of the subset.

m4p4 You are given a set of points in the plane. Your code should choose a radius r for each point such that no two circles with centres in the given

points and the chosen radii intersect. The program should output the maximum possible sum of all radii? There will be at most 50 points. The answer will be considered correct its absolute or relative error from the true answer is at most 10^{-4}. The input will be given with the number of points $n \geq 2$ on the first line, and the next n lines each contain two integers x, y separated by a space, giving one of the points. The points will be unique and all coordinates will be in $[0, 1000]$.

m4p5b Solve Mobilization on Kattis.