15-351 / 15-650 / 02-613 Homework #6 Due: Friday, Dec. 4 by 11:59pm

You may discuss these problems with your current classmates, but you must write up your solutions independently, without using common notes or worksheets. You must indicate at the top of your homework who you worked with. Your write up should be clear and concise. You are trying to convince a skeptical reader that your answers are correct. Avoid pseudocode if possible. Your homework should be submitted via GradeScope as a typeset PDF. A LaTeX tutorial and template are available on the class website if you choose to use that system to typeset.

1. "Thom's Problem." On graduate school visit days, professors need to meet with visiting students to explain to them how great CMU is. V various fixed time slots, an temps://eduassistpro.github.io/is to find an assignment of studen and professors have certain visi possible.

More formally, A Signment Project Exam Help
• A set of visiting students $S = \{s_1, \dots, s_m\}$.

- A set of professors $P = \{p_1, \dots, t_n\}.$

- A collection of sets

 s_i is available.

- A collection of sets the sets of the set
- A collection of sets $M_{s_i} \subseteq P$, where M_{s_i} gives the professors that visiting student s_i wants to meet.

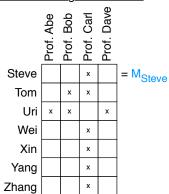
Professor p_i will only meet with students on her list on their list M_{s_i} . (Well the these requirement after Contents as $SISI_{ij}$ meet with professors on their list M_{s_i} . (Well the these requirement after Contents as $SISI_{ij}$ meet with professors on their list M_{s_i} . the student and professor are available. At any time, each student can each professor can meet with at most 1 student.

Example input:

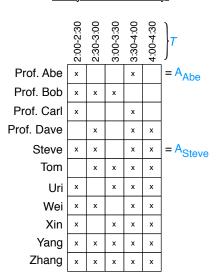
Professor Meeting Preferences:



Student Meeting Preferences:



Everyone's availability:



- (a) Write an integer linear program that finds maximum the number of (prof, student, time) meetings that can happen.
- (b) Explain how to get the actual meeting schedule from your integer linear program.
- (c) Suppose you are now also given, for each professor, a "bigshot score" b_{p_i} that is a positive number that says how important it is to satisfy that professor's demands. For every meeting that professor p_i takes with a student in her preference list M_{p_i} , you get b_{p_i} points. Describe how to modify your integer linear program to find a schedule that maximizes the number of bigshot points your schedule gets.

For the following NP-completeness proof problems, you can only assume that Vertex Cover, Set Cover, Independent Set, 3-SAT, Ha Galesman Problem, which we discussed in class, are NP-co

2. Let Integer Linear Proof theorem as a solution of objective value \geq a given k. Prove Integer Linear Programming is NP-complete.

Assignment Project Exam Help
3. A double-Hamiltonian traversal in an undirected graph G is a closed walk that goes through every vertex in G exactly twice.

Prove that the problem of resting whether a graph has a double-Hamiltonian SSIST_Pro

- 4. Suppose G = (V, E) is an undirected graph. A strongly independent set is a subset S of vertices such that for any two vertices STRONGLY INDEPENDENT SET problem is NP-complete.
- 5. The Subgraph-Isomorphic Professional the Guard assisting a subgraph of G_2 . In other words, we ask whether there is an injective f f to map the vertices of G_1 to the vertices of G_2 such that there is an edge $\{u,v\}$ in G_1 exactly when $\{f(u),f(v)\}$ is in G_2 .

 Prove that Subgraph-Isomorphism Problem is NP-complete.
- 6. The REQUIRED PATHS SUBGRAPH problem takes as input an undirected graph G with nodes v_1, \ldots, v_n , an $n \times n$ symmetric matrix R of natural numbers, and an integer b, and asks "Is there a set S of b edges of G with the following property: between every pair of nodes v_i and v_j , $i \neq j$, there are at least R_{ij} disjoint paths (that is, paths sharing no other node except for the endpoints) using edges in S." Prove that this problem is NP-complete.