CO370: Deterministic Operations Research Models, Winter 2022

Homework Assignment #4: Due Wednesday, March 2, 2:30PM.

Papers should be submitted through CrowdMark. Two students may work together and submit a single paper with both students receiving full credit. The only restriction is that the same pair of students may work together on at most two assignments.

1. (5 marks) For a mini-session scheduled between the spring and fall terms, registered students must select four courses (and follow the same schedule each day). Courses are 50 minutes long and start each hour, 8:00AM, 9:00AM, and so on, up until 8:00PM. To accommodate the large number of students, each course is offered several times each day with different instructors. Section i of course j begins at time t_{ij}. Suppose a student, Alice, has made a numerical preference p_{ij} for each section, based on the reputation of the instructor and the time of day. Due to timing conflicts, Alice cannot always select the sections she prefers.

- Part A (2 marks). Formulate an integer-programming model to find a feasible schedule that maximizes the sum of Alice's preferences.
- Part B (2 marks). Modify the formulation so that Alice never has more than two consecutive sections without a 1-hour break.
- Part C (1 mark). Modify the formulation so that instead of maximizing the sum of Alice's preferences, you find a schedule that starts as late in the day as possible.

2. (5 marks) Let $G = (V, E)$ be a graph with rational-valued edge weights $(c_e : e \in E)$. (The edge weights may include negative numbers.) For any $S \subseteq V$ such that $\emptyset \neq S \neq V$, let $\delta(S) = \{e \in E : e \text{ has exactly one end in } S\}$. Formulate an integer-programming model to find $\emptyset \neq S \neq V$ that minimizes $\sum(c_e : e \in \delta(S))$. The number of variables and constraints in your model must be at most $a|V| + b|E| + c$ for some constants a, b, c (the values of a, b, c cannot depend on the values of $|V|$ and $|E|$).