Discrete Optimization-II COMP 567
Homework 1 Due: Mon, January 21

1. Japan recently published the results of its global COE competition, which can be found at

http://www.jsps.go.jp/english/e-globalcoe/04_selection.html

63 applications from a total of 28 different universities were accepted, in 5 different categories. McGill would like to sign agreements with the smallest number k of universities that together:

(a) Were awarded at least 60% of the selected applications in Information Sciences, at least 60% of the selected applications in Chemistry, and at least 50% of the selected applications in Life Sciences.
(b) Among all sets of k universities satisfying (a), the selected set of universities should have been awarded the maximum total number of selected applications.

Formulate and solve this problem using CPLEX.

2. Wolsey, Ch 1, Ex. 2, P. 19.

3. Wolsey, Ch 1, Ex. 5, P. 19.

4. Let A be an m by n 0/1 matrix, b be an integer vector of length m, and c be an integer vector of length n. Consider problems:

$$\max c^T x \quad s.t. \;\; Ax \le b, \quad x_j = 0 \text{ or } 1 \quad j = 1, 2, \ldots, n \tag{IP1}$$

$$\min b^T y \quad s.t. \;\; A^T y \ge c, \quad y_i = 0 \text{ or } 1 \quad i = 1, 2, \ldots, m \tag{IP2}$$

(a) Give an interpretation of IP1 as a project selection problem, explaining the meaning of A, b, c.

(b) Give an interpretation of IP2 as a facilities location problem, explaining the meaning of A, b, c.

(c) Suppose A is the vertex/edge adjacency matrix of a graph G with m vertices and n edges. What graph theory problems are solved by IP1 and IP2? Start by first considering the case where $b_i = c_j = 1$, for all i and j.