Exercises lecture 2, 2.4

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Let $x_{ij} = \begin{cases} 1 & \text{if student } i \text{ is assigned project} \\ 0 & \text{otherwise} \end{cases}$

$y_{jk} = \begin{cases} 1 & \text{if project } j \text{ is assigned to room } k \\ 0 & \text{otherwise} \end{cases}$

d = lowest number assigned by a student to a project he/she has to do

Let M be a "large" constant

$$
\begin{array}{lllr}
\max & d & & \\
\text{s.t} & d + Mx_{ij} \leq c_{ij} + M & i = 1, \dots, n,\ j = 1, \dots, p & (1) \\
& \sum_{i=1}^{n} x_{ij} + My_{jk} \leq m_k + M & j = 1, \dots, p,\ k = 1, \dots, p & (2) \\
& \sum_{j=1}^{p} x_{ij} = 3 & i = 1, \dots, n & (3) \\
& \sum_{k=1}^{p} y_{jk} = 1 & j = 1, \dots, p & (4) \\
& x_{ij} \in \{0,1\} & i = 1, \dots, n,\ j = 1, \dots, p & (5) \\
& y_{jk} \in \{0,1\} & j = 1, \dots, p,\ k = 1, \dots, p & (6)
\end{array}
$$

Here are some explanations:

Constraint (1) ensures that $d \leq c_{ij}$ when $x_{ij} = 1$

(2) ensures that max m_k students can be assigned to project j when $y_{jk} = 1$

(3) ensures that each student gets precisely 3 projects

(4) ensures that each project is assigned to one room.