COMP4130: Linear and Discrete Optimization
Workshop 6: Selection, Assignment and Location Problems

School of Computer Science
University of Nottingham Ningbo China

November 4, 2025

Purpose: Write and solve optimization models for selection, assignment and location optimization problems including modeling constraints using binary decision variables.

Step 1

The Excel file for this workshop contains two spreadsheet models for the INTERNETCONNECTION problem of Lecture 6 notes, non-linear and linear versions. Make sure you understand well these two models and compare the optimal solutions produced. Then, make the following modification to the problem. The connection fee for company C changes from 25 to 50. Compare the optimal solutions produced by the two models for this modified problem.

Step 2

Write the optimization models in LP-Solve for the CHOOSING THE CREW, SWIMMERS and BUILD BRIDGES optimization problems of Lecture 6 notes. You might also want to develop the spreadsheet optimization models in Excel for these three problems. The Excel file for this workshop includes a spreadsheet with the data for the BUILD BRIDGES problem. Make sure you also write the algebraic model in compact notation for these optimization problems.

Step 3

Consider the following constraints. Y1, Y2, Y3 are binary decision variables, each meaning to select an item or not. X is an integer decision variable. Reflect on what would be the meaning in words for the constraints in each case.

e=d

a. $Y1 + Y2 + Y3 \geq 2$ 三种至少两中

b. $Y3 \geq Y1 + Y2$ 3不能跟1和2同时选

c. $Y3 \leq Y1$ and $Y3 \leq Y2$ 选3必须要选1和2

d. $Y3 \leq (Y1 + Y2)/2$ ~~选了3，1和2至少1个~~

c等于d

e. $Y1 = Y3$ and $Y2 = Y3$ 1，2，3必须同时选或者不选

f. $2Y3 = Y1 + Y2$ ~~选3同时1和2同时选或者不选一个~~

g. $X = 5Y1 + 10Y2$

h. $X = 5Y1 + 8(1 - Y1)$ if y1选择了,5,else=5

It might be useful (although not needed for you) to consider all the possible combinations of values for the binary decision variables like in the example below.

Y1	Y2	Y3	Y3 ≤ Y1+Y2 satisfied?
0	0	0	Yes
0	0	1	No
0	1	0	Yes
0	1	1	Yes
1	0	0	Yes
1	0	1	Yes
1	1	0	Yes
1	1	1	Yes

Meaning: Item 3 can be selected only if at least one of items 1 and 2 are selected.

Step 4

Develop the optimization model in Excel and LP-Solve to solve the following optimization problem. Make sure that you also write the algebraic model in compact notation for this optimization problem.

SALESMEN Problem

The manager of a company wants to distribute 18 SALESMEN over the 4 branches of the company. For each salesman, the company has estimated the sales that the person would generate in each of the branches when the salesman is assigned to that branch. The table gives the estimated sales per branch for each salesman. For example, if salesman 1 is assigned to branch B, the expected individual sales for that salesman are 16. Salesmen 1 to 5 are bilingual.

a. Each salesman must be assigned to exactly 1 of the branches, that is, a salesman cannot work simultaneously in more than 1 branch.

b. Each of the branches should get at least 2 salesmen assigned.

c. Salesmen 10 and 11 do not like each other so they should be assigned to different branches.

d. Branches B and C should each have at most 3 salesmen assigned and 2 of them should be bilingual.

e. Salesman 18 should be assigned to either branch A or branch D.

f. Salesmen 15 and 16 are a good team so they should be assigned to the same branch.

g. Finally, it is desirable that branch A is assigned either 4 salesmen or 8 salesmen in total.

The manager wants to know exactly to which branch each salesman should be assigned to maximize the overall expected sales.