LW11 IP Tutorial Tasks

Task 1: The Excel file for this task contains the (not yet complete) spreadsheet models for the various selection and assignment optimization problems described next. For each problem, do the following:

i) determine the type of problem (selection or assignment)

ii) complete the spreadsheet model to solve the problem

iii) write the algebraic BIP model to solve the problem

COMMITTEE Problem

Considering 10 candidates, a University COMMITTEE is being formed which must include at least one female, one male, one student, one administrator, and one faculty member. The mix of features of each of the candidates is shown in the table. The goal is to form the smallest committee that satisfies the requirements. The following are additional conditions:

- Candidates 5 and 6 are both selected or none of them at all.
- Candidate 6 may be selected only if candidate 8 is selected.
- Only 1 of candidates 1, 2, 3, 4 and 5 may be selected.

Category	Individuals
Females	1,2,3,4,5
Males	6,7,8,9,10
Students	1,2,3,10
Administrators	5,6
Faculty	4,7,8,9

EMERGENCY VEHICLES Problem

Emergency coverage involves deciding the location of EMERGENCY VEHICLES around a city with various districts as potential locations. The city is divided into 9 districts and 7 sites have been identified as potential locations for the emergency vehicles. A vehicle located in a given site can reach some of the districts within the required time limit as indicated in the table. The problem is to provide emergency vehicle coverage to all the 9 districts within the required time while using the minimum number of emergency vehicles.

	S1	S2	S3	S4	S5	S6	S7
D1	0	1	0	1	0	0	1
D2	1	0	0	0	0	1	1
D3	0	1	0	0	0	1	1
D4	0	1	1	0	1	1	0
D5	1	0	1	0	1	0	0
D6	1	0	0	1	0	1	0
D7	1	0	0	0	0	0	1
D8	0	0	1	1	1	0	0
D9	1	0	0	0	1	0	0

SWIMMERS Problem

A group of SWIMMERS must be assigned to a 200m (4 x 50m) medley relay team. Most swimmers are very fast in more than one stroke so it is not clear which swimmer should be assigned to each of the four strokes. The 5 best swimmers and their times are given. The problem is to assign 4 swimmers to the 4 strokes as to minimise the total sum of the times.

Stroke	SW1	SW2	SW3	SW4	SW5
Backstroke	37.7	32.9	33.8	37.0	35.4
Breaststroke	43.4	33.1	42.2	34.7	41.8
Butterfly	33.3	28.5	38.9	30.4	33.6
Freestyle	29.2	26.4	29.6	28.5	31.1

Task 2: The Excel file for this task contains a spreadsheet with the data for a GENERALISED ASSIGNMENT problem with N=30 tasks and M=5 workers. Develop the spreadsheet model to solve this problem.

Task 3: The Excel file for this task contains two spreadsheets for a BIN PACKING problem with N=12 items and M=6 bins each of capacity B=1. The non-linear model is complete. Following the algebraic formulation given in the lecture, complete the linear model to solve this problem.