

Assignment 1:
Integer Programming with Xpress^{MP}
A Team Building Problem

620-362 Applied Operations Research
Semester 2, 2008

Due Date: 5pm, 14th October 2008

Assignment prepared by Dr. Heng-Soon Gan

What to submit (hard copy, to the assignment boxes):

A report documenting all assumptions, results generated with Xpress-IVE and interpretation/discussion of results for all parts of the assignment.

What to submit (via email, to h.gan@ms.unimelb.edu.au):

All Xpress-Mosel code(s) and data file(s).

The lecturer for 620-362 Applied Operations Research is required to allocate students to teams for the subject's industrial project. Students were asked if they could program and also to nominate the types of problem they like and to list the degree(s) they are currently enrolled in. For types of problem, students were asked if they were interested in pure (theorems and proofs), applied (industrial problems) or hands-on (involving implementation) problems. A profile of the class by these categories is shown in Table 1.

The lecturer aims to build teams with comparable strengths. A team must consist of at least four and not more than five members. The industrial project requires implementation and testing of solution methodologies. It is therefore required that each team must have programming capability. Also, each member of a team can at most contribute one interest (pure, applied or hands-on) to the team and each team must have all three of these interests represented.

Table 1: Class profile.

Student	Can program ?	Are you interested in...			Degree				
		Pure problems ?	Applied problems ?	Hands-on problems ?	BSc	BE	BCom	BA	BIS
Veki	Y		Y	Y	Y	Y			
Chek	Y	Y			Y	Y			
Kaer	N		Y	Y	Y				
Ruao	N	Y			Y	Y			
Juwi	Y		Y	Y	Y	Y			
Goie	Y			Y	Y		Y		
Mier	Y		Y	Y	Y		Y		
Maes	N		Y	Y	Y		Y		
Jown	Y		Y	Y	Y				
Jals	Y		Y	Y	Y				
Wion	N			Y	Y		Y		
ChHu	Y	Y	Y	Y	Y		Y		
Mard	N		Y	Y	Y				Y
LuhY	N	Y	Y		Y		Y		
Saey	N				Y				
Algo	Y		Y	Y	Y				Y
Muab	N		Y		Y				
Sing	Y			Y	Y		Y		
Huan	N			Y	Y	Y			

Student	Can program ?	Are you interested in...			Degree				
		Pure problems ?	Applied problems ?	Hands-on problems ?	BSc	BE	BCom	BA	BIS
Alng	Y	Y	Y	Y	Y	Y			
Jeen	N	Y	Y		Y			Y	
Rost	N	Y			Y				
Alto	Y		Y	Y	Y		Y		
Rian	N		Y	Y	Y				
Miey	Y			Y	Y	Y			

The lecturer has developed a team scoring metric to gauge the strength of a team. For a team of not more than two members with programming capability, the team will gain a score of 1 point per programmer. The third programmer, and all other additional programmers, appended to the team will contribute a negative score of 0.5 points per programmer to the team. Furthermore, a score of 1.5 points per enrolled degree will awarded to a team, for three degrees or less. A team will be awarded 0.5 point per enrolled degree for any additional degrees beyond three. For example, consider Sample Team 1 in Table 2. The strength of Sample Team 1 = $2(1) + 1(-0.5) + 3(1.5) + 1(0.5) = 6.5$.

Table 2: Sample Team

Sample Team 1	Can program ?	Degree				
		BSc	BE	BCom	BA	BIS
Veki	Y	Y	Y			
Jeen	N	Y			Y	
Rost	N	Y				
Alto	Y	Y		Y		
Miey	Y	Y	Y			

- FORMULATE** a mixed-integer-program (MIP) whose solution minimises the difference between the highest and lowest team strength. The MIP must be written in standard mathematical notations. Xpress-Mosel code will not be accepted as a solution to this part. State all assumptions.
- PROGRAM** and **SOLVE** the MIP formulated in part (a) using Xpress^{MP}. Comment on the solution obtained. Xpress-Mosel code must be attached here.
- Now suppose Goie and Miey must belong to the same team. **REFORMULATE** the problem in part (a) to include this additional requirement and **SOLVE** using Xpress^{MP}. State all assumptions, and comment on the new solution obtained. Compare this new solution to the solution in part (a). Xpress-Mosel code must be attached here.
- Now suppose that each team must have a minimum strength of 7.5. **REFORMULATE** the problem in part (a) to include this additional requirement and **SOLVE** using Xpress^{MP}. Is there a feasible solution to this new problem? If not, **SUGGEST** how you would rectify this in order to find a feasible solution accounting for this additional requirement.