IE 303.3 Modeling and Methods in Optimization
Fall 2004
HW # 5, Due: 8.11.2004
The homework should be turned in to Evren Kahramanoğlu or Murat Kalaycılar since Ayşegül Altın will be away during November.

The homework is expected to be strictly personal work. If you happen to find answers to any questions in a book or on the web, please give proper reference. Failure to do so will result in zero credit.

1[50 points] An oil company has identified eight individual oil traps, called *targets*, in an off-shore oil field and wishes to drill wells to extract oil from these traps. To save drilling cost, the company plans to extract oil from any two targets together by drilling a single hole. The amount of oil extracted by drilling any pair of targets as a dual completion depends on the three-dimensional spatial relationships of targets to the drilling platform and to each other. The decision problem is to determine which pairs to drill together as duals so as to maximize the amount of oil extracted. The amount of crude oil (in barrels/day) that can be extracted by drilling a common hole for target i and j is denoted p_{ij}, and given in the following table.

Target	Target							
	1	2	3	4	5	6	7	8
1	-	4	9	11	-M	7	-M	-M
2		-	2	-M	3	-M	6	7
3			-	-M	-M	1	6	-M
4				-	6	-M	12	8
5					-	7	8	6
6						-	-M	7
7							-	5
8								-

The technologically impossible pairings are represented by a "-M" in the table. Formulate this problem as one of the graph optimization problems discussed in class and solve using XPRESS-MP/MOSEL.

2[50 points] Airline company GlideAir needs to assign its fleet of various aircraft to its flight routes. The airline has 10 aircrafts of type A, 8 aircrafts of type B, and 12 aircrafts of type C; it wishes to use this fleet to meet its demand of 1000 passengers on route 1, 1500 passengers on route 2, 800 passengers on route 3, 2000 passengers on route 4, 1000 passengers on route 5, 600 on route 6, 750 on route 7, 900 on route 8. By operating an aircraft of type i on route j, the airline incurs a cost of c_{ij} (in thousands of USD) and can accommodate a_{ij} passengers. These values are given in the table below (the first number in the parenthesis is the cost in thousands of USD, and the second figure is the passenger capacity). The airline would like to assign aircrafts to the routes to satisfy the customer demand at the least possible operating cost.

Aircraft type	Route							
	1	2	3	4	5	6	7	8
A	(100,50)	(75,50)	(95,55)	(110,65)	(65,65)	(75,75)	(45,75)	(75,75)
B	(120,60)	(65,50)	(85,58)	(100,65)	(87,68)	(78,79)	(55,75)	(75,85)
C	(110,80)	(95,50)	(90,55)	(130,69)	(68,60)	(65,85)	(95,85)	(98,79)

Formulate this problem as a network flow problem with gains, and solve using XPRESS-MP/MOSEL. Notice that you may not obtain an integral number of aircraft assigned to a route if you solve the problem as an LP. Try to solve the problem as an LP without using integer variables, and round up the fractional values to the nearest integer. Then try to solve the same problem by specifying integer variables. Compare the objective function values of the integer solution you obtain by rounding, and the integer optimum solution.