IE 303.1 Modeling and Methods in Optimization
Fall 2008
HW1, due date: 25.9.2008

You are expected to work individually on the problems below.

1.[20 points] From the book **Applications of Optimization with Xpress** from Dash Optimization, locate Chapter 10 entitled "Ground Transport". The first model problem of this chapter is called "Car Rental". Download the MOSEL model and data files corresponding to this example on your computer, and solve this model yourself. Attach a printer output. You will need this example in the next problem.

2.[40 points] A company produces a commodity in two shifts (regular working and overtime) to meet known demands for the present and future. Over the next four months the production capacities and demands (in thousands of units producible) are

	January	*February*	*March*	*April*
Regular working	100	150	140	160
Overtime	50	75	70	80
Demand	80	200	300	200

The cost of production of each unit is 1 if done in regular time or 1.5 if done in overtime. Units produced can be stored before delivery at a cost of 0.30 per month per unit. The problem is how much to produce each month to satisfy present and future demand. The unit costs in this problem arise from a combination of production and storage costs, e.g., production in January by overtime working for delivery in March gives a unit cost of 1.5 (production) +0.6 (storage for two months) = 2.1, while production in January in regular working for delivery in January gives a unit cost of 1 only.

1. Complete the unit cost table based on the above example. Remember that it is impossible to produce for demand of an earlier month.
2. Can you formulate the problem as a network optimization problem? What kind of network optimization problem is it?
3. Using help from the previous model "Car Rental", code your model in Xpress MOSEL, and solve your model. Attach a printer output.

Hint: You might have to use inequality constraints in flow conservation equations.

3.[40 points] Turkish Safelines uses the Ankara Esenboğa Airport as a hub to minimize the number of flight connections to other national destinations. Six airplanes of this company from Bingöl, Diyarbakır, Muğla, Nevşehir, Niğde and Trabzon are landing between

11 am and 12:30 pm. These aircraft leave for Istanbul, Kars, Artvin, Adana, Izmir and Edirne between 12:30 pm and 13:30 pm. The numbers of passengers transferring from the incoming flights to one of the outgoing flights are listed below.

Origins	Destinations					
	Bingöl	*Diyarbakır*	*Muğla*	*Nevşehir*	*Niğde*	*Trabzon*
Istanbul	35	12	16	38	5	2
Kars	25	8	9	24	6	8
Artvin	12	8	12	27	3	5
Adana	37	14	15	30	2	10
Izmir	–	9	8	25	10	5
Edirne	–	–	–	14	6	7

For example, if the flight incoming from Istanbul continues on to Bingöl, 35 passengers and their luggage may stay on board during the stop at Ankara. The flight from Izmir arrives too late to be re-used on the connection to to Bingöl. Same is true of the flight arriving from Edirne for connection to Bingöl, Diyarbakır and Muğla. These impossibilities are indicated by a −. How should the arriving planes be re-used for the departing flights to minimize the number of passengers who have to change planes at Ankara airport? Formulate a network optimization model, and solve your model in Xpress MOSEL. What kind of network optimization model is it? Attach a printer output.