Homework #2  
Supply Chain Models: Manufacturing & Warehousing (ISyE 3104) - Fall 2001  
Due September 11, 2001

Show all your steps to get full credit.  
**Reading assignment**: Read Chapter 3.

**Question 1** (45 points)

An office furniture producer estimates the following demand for its office chairs over the next four months:

<table>
<thead>
<tr>
<th>Month</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Forecast</td>
<td>760</td>
<td>1260</td>
<td>440</td>
<td>320</td>
</tr>
</tbody>
</table>

There are currently 40 workers with the company and it is estimated that one worker can produce 20 chairs per month. Hiring cost is $1500 and firing cost is $2500 per worker. Inventory cost is $15 per chair per month.

The company has 45 chairs in inventory at the end of June, and would like to have at least 20 chairs in inventory at the end of October. In parts (a)-(e) assume that stock-outs or backlogs are not allowed.

(a) Determine the constant workforce plan and the cost of that plan. (In parts (a)-(f) consider only hiring, firing and inventory holding costs.)

(b) Determine the zero inventory plan and the cost of that plan.

(c) Write the linear programming (LP) formulation for this problem. Define your variables, and use the data given for this problem when you write the objective function and the constraints. (You may want to use AMPL or another modeling language to do this.)

(d) Solve this LP using a solver. Attach printouts of the data/model and output files.

(e) Comment on the pros and cons of each of the three solutions you found.

Suppose backlogging is allowed at $30 per item per month.

(f) Considering the option of backlogging, can you find a plan that has a lower cost than the plans you found above?

In parts (a)-(f), we ignored the cost of labor. The company pays a worker $1200 per month to work during regular hours (160 hours per month) and the cost of overtime is $12 per hour. In addition to overtime, the firm also considers the option of subcontracting as a way to better meet demand at $100 per unit.

(g) Write the linear programming (LP) formulation for the general problem considering all the data and options presented.
(h) Solve the LP of part (g) using a solver. Attach printouts of the data/model and output files.

(i) Update the costs of the models you found in parts (a), (b), (d) and (f) including the cost of labor. Compare the four different plans with this updated cost computation.