ISyE 3104 Fall08
Homework 3-Part 1 (30 points)
Due September 16, 2008

1) (10 points) The recently graduated industrial engineer in homework-2, who joined a paper company, is now responsible for planning its production and workforce levels on 30th of September 2008 for the next 3 months. The company estimates the following demand for its paper products (in cases) over the next four months:

<table>
<thead>
<tr>
<th>Month</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Forecast</td>
<td>1000</td>
<td>800</td>
<td>1000</td>
</tr>
</tbody>
</table>

There are currently 10 workers working at the company and it is estimated that one worker can produce 2 cases per day, where it can be assumed that each month has 20 working days. Hiring cost is $1000 and firing cost is $2000 per worker. Inventory cost is $10 per case per month.

The company will have 200 cases of paper in inventory at the end of September, and would like to have at least 400 cases in inventory at the end of December. Assuming that stock-outs or backorders are not allowed:

a) Determine the minimum constant workforce plan and the cost of that plan.
b) Determine the zero inventory plan (chase strategy) and the cost of that plan.

2) (6 points) Assume that estimates for the following 2 months are also available and the company wants to capture also those months in the plan.

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Forecast</td>
<td>200</td>
<td>600</td>
</tr>
</tbody>
</table>

Now assume that you do not need to have any inventory on hand at the end of December (i.e. take the net demand for December as 1000 not 1400, so no inventory will be left to January) but you still have 200 cases of initial inventory at the beginning of October and no ending inventory is needed at the end of February. Now the company is allowed to hire/fire workers once at the beginning of October and second at the end of December (beginning of January). Suggest the mixed plan possible in this situation where no backorders or stock-outs are allowed (Hint: you may develop two separate constant workforce plans). Determine the total holding and hiring/firing cost in this mixed case.

3) (14 points) The Batu Co. manufactures car engine spare parts. One particular spare part has a known and constant demand rate of 1600 units per year. The fixed cost of the setup for each production run is $200 and the inventory holding cost is $4 per unit per year. There is a lead time of 1 week. Assuming that there is infinite production capacity, compute:

a. The economic order quantity
b. The optimal reorder point (Be careful about the time unit when multiplying, they should be the same)
c. The resulting annual setup cost

Now assume that there was a finite production rate of 8,000 units per year. Compute;
d. The optimal EOQ
e. The maximum inventory level
f. The length of time required to produce a lot (in years)
g. The total annual holding cost
ISyE 3104 Fall08  
Homework 3 – Part 2 (30 points)  
Due September 18, 2008

Note: Please form groups of 5 and turn in a single solution for this part of the homework for each group. It is the responsibility of the group to assure that each group member has contributed approximately equally to the homework.

The following questions are based on the Groundhog’s New Clothes Case. Follow the suggested guidelines about the length of your answers.

a) (5 points) What are the main competitive advantages of the Franklins? (1/4 page or less)

b) (5 points) How does the company attain low lead times without having high WIP? (1/4 page or less)

c) (7 points) Assume that an aggregate production plan is developed and a chase strategy which requires frequent changes (say at least 10 workers is hired or fired at each period) in workforce level is advised. What are the advantages and disadvantages of such a strategy for this particular company? That is, considering the company structure, training required for workers etc. what would the company gain and lose by following such a chase strategy? (Do not develop a chase strategy)

d) (7 points) Assume that the company has 2 possible strategies; one is going with new raw material supplier named Threads of Dignity located in Morgantown, WV and second is to continue with the current supplier. Suppose that if the company goes with the new supplier its production costs will be as low as to compete with the new entrants to the market and it may help the company with its current situation. On the other hand, do not forget that there was an environmental issue regarding that raw material supplier. What are the pros and cons of using this new supplier? Describe the stakeholders and how they will be affected from your decision. (1 page or less)

e) (6 points) Consider modeling the aggregate planning problem of the company as a linear program using the following decision variables:

STt: Number of t-shirts to subcontract in month t  
SPt: Number of golf-shirts to subcontract in month t  
DTt: Forecasted demand for t-shirts in month t  
DGt: Forecasted demand for golf shirts in month t  
PTt: Number of t-shirts to produce (without considering yield 2% loss) in month t  
PGt: Number of golf shirts to produce (without considering yield 2% loss) in month t  
ITt: Inventory of t-shirts left from month t to t+1  
IGt: Inventory of t-shirts left from month t to t+1

Write down the conservation of units constraints for t-shirts and golf shirts (seperate 2 constraints and do not forget to account for 2% yield loss). (2-3 lines)