

Math 441
Hiring/Firing

Consider a manufacturing concern that produces a product (refrigerators?) and wishes to meet the following monthly demands predicted for next year:

JAN: 5300 FEB: 5100 MAR: 4400 APR: 2800 MAY: 4100 JUN : 4800

JUL: 6000 AUG: 7100 SEP: 7300 OCT: 7800 NOV: 7600 DEC: 6400

Our problem is to manage the workforce and the inventory so as to meet the demand each month. Each worker in the factory can produce 20 units/month. We begin on December 31 with 290 workers, We can pay \$20 per unit to have extra units produced on overtime where each worker could produce up to 6 units/month on overtime. We can change the workforce size by hiring and firing on the first of every month. We can hire up to 40 workers per month at a cost of \$300/hiring and we can fire up to 40 workers per month at a cost of \$420/firing. We start with no inventory on December 31 and must produce at least 5300 units in January etc. We can store any excess production as inventory at a cost of \$8/month per unit. We should end the year with no inventory.

You may find the following variables useful:

Let x_i = regular workers in month i , $1 \leq i \leq 12$. (Regular production is $20x_i$ in month i).

Let y_i = overtime production in month i , $1 \leq i \leq 12$.

Let z_i = inventory stored from month i to month $i + 1$.

Let t_i = hiring /firing costs in month i , $1 \leq i \leq 12$.

- a) Determine an optimal (or near optimal) strategy minimizing the extra costs required to meet the demands. You might comment on why we need not assign costs to workers and regular production.
- b) Repeat a) when the firing costs are increased to \$6000.
- c) Repeat a) with the additional flexibility that you can select the initial staffing level on December 31 but you must return to that staffing level by the next December 31.
- d) What might you do to handle the possibility of unmet demand?