Deterministic Math Models (550.251)
Homework 6 (Due Thursday, April 03, 2008)

General Directions: You must show all work and document any assumptions to receive full credit. Solve by hand unless otherwise stated. Please include a mathematical formulation of your model. When formulating models, make sure you define your variables and label all constraints.

1. Winston & Albright: Problem 7.9.49 (a), (b). (Assume fractional values are ok.) For each part, specify the total cost, total revenue, and total profit as well as the number to produce. Next, if your answers are fractional, explain whether the the rounded up or rounded down answer would give a better result if the problem were also integer value constrained.

2. Winston & Albright: Problem 7.9.52. (Make sure you read this problem carefully!)

3. Caramel Heads is an up-and-coming rock group that is scheduled to play a concert in the University of Missouri football stadium. The concert promoter, a graduate of the University of Missouri business school, has developed a regression model predicting that ticket demand, X, is related to ticket price (in dollars), P, by $X = 60,000 - 3000P$

   (a) Develop a total sales revenue function.

   (b) Show that the total sales revenue function is concave (i.e., that the second derivative is nonpositive everywhere).

   (c) Using this fact, determine which ticket price will maximize total sales revenues for the concert.

   (d) What attendance is expected, given this ticket price?

   (e) What is the expected sales revenue from ticket prices?

4. A more sophisticated regression model for relating ticket sales and price for the Caramel Heads concert (previous problem) gives the following relationship between sales and ticket prices: $X = 64,000 - 3200P - 10P^3$.

   (a) Develop a total sales revenue function.

   (b) Determine the ticket price that will maximize total sales revenues for the concert.

   (c) What attendance is expected, given this ticket price?

   (d) What is the expected revenue from ticket sales given this ticket price?

5. Demand for the LaGuilotine food processor at Allen Appliance for the past 12 weeks has been as follows (week 12 is the most recent week):

Week	*Demand*	*Week*	*Demand*
1	74	7	98
2	86	8	82
3	79	9	68
4	92	10	90
5	86	11	82
6	85	12	78

The food processors cost Allen $45 each, and Allen uses a 14% annual holding cost rate. The reorder cost is an estimated $18. Lead time for delivery is three weeks.

(a) Determine the average weekly demand based upon all 12 weeks of data. Then use this to compute the average annual demand.

(b) Determine the optimal order quantity.

(c) Determine the number of calendar days between orders (cycle time).

(d) Determine the total annual inventory cost (holding, ordering, procurement) for this policy.

(e) Suppose Allen uses a 10-week moving average to estimate weekly demand. Using the most recent 10 weeks of demand, estimate weekly demand, the optimal order quantity, and the total annual inventory cost. How different is this cost from that obtained in part (d)?