

Stochastic Math Models (550.252)
Homework 9 (Due Thursday, November 29, 2007)

General Directions: You must show all work and document any assumptions to receive full credit. Feel free to use Excel (but follow the software usage rules discussed in the syllabus.)

1. Lawrence & Pasternack: Problem 6.5
2. Lawrence & Pasternack: Problem 6.7
3. Lawrence & Pasternack: Problem 6.12
4. Use calculus to show that the normal equations for the multiple linear regression model $z = a + bx + cy$ are

$$\begin{aligned} \sum_j z_j &= na + b \sum_j x_j + c \sum_j y_j \\ \sum_j x_j z_j &= a \sum_j x_j + b \sum_j x_j^2 + c \sum_j x_j y_j \\ \sum_j y_j z_j &= a \sum_j y_j + b \sum_j x_j y_j + c \sum_j y_j^2 \end{aligned}$$

(Recall the objective of linear regression is to minimize the squared deviations between the predicted and true values.)

5. The table below shows the weights z to the nearest pound, heights x to the nearest inch, and ages y to the nearest year for 12 boys.

Weight (z)	64	71	53	67	55	58	77	57	56	51	76	68
Height (x)	57	59	49	62	51	50	55	48	52	42	61	57
Age (y)	8	10	6	11	8	7	10	9	10	6	12	9

- a. Using these data create a table with the following columns: z , x , y , z^2 , x^2 , y^2 , xz , yz , xy . At the bottom of your table, include the column sums.
- b. Using the normal equations, set up the system of equations that you would need to solve to determine a , b , and c if $z = a + bx + cy$.
- c. Use Excel to solve the system as an LP. (Any objective function will work.)
- d. Compute the predicted values \hat{z} using the regression equation.
- e. Estimate the weight of a boy who is 9 years old and 54 inches tall.

6. A government contractor who is removing earth from a large excavation can route trucks over either of two roads. There are 10,000 cubic yards of earth to move. Each truck holds 10 cubic yards. The cost per truckload is dependent on the number of trucks using the road. On road A, the cost per truckload is $1 + 2x^2$ cents when x trucks are using the road; on road B, the cost per truckload is $2 + y^2$ cents when y trucks are using the road.
- (a) Formulate a model to minimize the total cost of moving all the earth. Make sure to clearly define your variables and label your constraints.
 - (b) Use Excel to solve the model you formulated in part (a).