ISyE 4031 Regression and Forecasting
Homework 2
Due January 29, 2016

1. Solve Exercise 3.3 from the text book, page 125.

2. A large mail−order house believes that there is an association between the weight of the mail it receives and the number of orders to be filled. It would like to investigate the relationship in order to predict the number of orders based on the weight of the mail. A sample of 25 mail shipments is selected, and the data (weight of mail in pounds, orders in thousands) were studied. By using a software, R or Minitab or R:

a) By using a software draw a scatter diagram of the data. Submit the plot. Does a simple linear regression model seem appropriate here?

b) Fit the simple linear regression model using the method of least squares. Submit your solution (output).

c) Report the values of *SSE*, s^2, and *s*.

Note: Please print and attach the scatter plot and the relevant part of the R or Minitab output (include ANOVA).

3. Show that $\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n} x_i y_i - \dfrac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}$.

4. A regression model was used to analyze the data from a study investigating the relationship between roadway surface temperature (x) and pavement deflection (y). Assume that x and y are related according to the simple linear regression model: $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$. The following summary quantities were obtained:

$n = 20$, $\sum_{i=1}^{n} y_i = 12.75$, $\sum_{i=1}^{n} y_i^2 = 8.86$, $\sum_{i=1}^{n} x_i = 1478$, $\sum_{i=1}^{n} x_i^2 = 143{,}215.8$, and $\sum_{i=1}^{n} x_i y_i = 1083.67$.

   a) Calculate the least square estimates of the slope and the intercept.
   b) Estimate σ^2.
   c) Use the equation of the fitted line to predict what pavement deflection would be observed when the surface temperature is 85°F.
   d) What is the mean pavement deflection when the surface temperature is 90°F?
   e) Suppose that the observed value of $y = 0.6$ when $x = 90$°F. Calculate the corresponding residual.
   f) What change in mean pavement deflection would be expected for a 1°F change in surface temperature?