QERM 598 - HW 5
Due February 21, 2007
Eli Gurarie

Linear Regression

1 Theory

1. Derive the estimate for the intercept parameter $\hat{\beta} = \bar{Y} - \hat{\alpha}\bar{X}$ (equation 4 in the notes).
2. What is the distribution of this estimate?
3. Suggest a test statistic and its null distribution to test the hypothesis that $\beta = 0$.
4. (a) Identify the parameters for each of the five models presented at the end of the notes.
   (b) What are the best estimates for the parameters in the first three models (this is review!)
   (c) Can you guess what the best parameter estimates would be for the last two models?

   Note: feel free to use whatever resources you can find. The answers to most of these questions can be found in any linear regression text. The ability to find an answer without having to reinvent the wheel is a most important skill! However, you will ultimately want to be pretty familiar with this theory.

2 Application to sealion inter-parturition period

Steller sea lions (*Eumatopias jubatus*) aggregate in the summer in specific breeding locations called rookeries to give birth and reproduce. After giving birth, the females nurse their pups for a certain number of days, usually about a week, before beginning to take short foraging trips to sea. This period is referred to as the Inter-Parturition Period (IPP). Longer inter-parturition periods are associated with greater fitness of the female, as they reflect a greater amount of fat reserves which can be converted to lactation. The datafile "SealionIPP.dat" contains data obtained on 105 branded sealions from five rookeries (21 females per rookery) in Russia. Because of the branding, we also know the age of the females.

Analyze this data. Are there differences in IPP between islands? Does IPP depend on the age of female? Be explicit about the models you explore, the parameter values you decide upon, and the statistical tests you use. There is not necessarily a single right answer.

Note: The Island codes are: Br - Brat Chirpoev, P - Raykoke, Lr - Lovushki, Y - Antsiferov and M - Medny.

Figure 1: Suckling pup on Raykoke island