EEB 581, Problem Set One

Due Thursday, 22 Jan 2004

1: Data was collected on 50 individuals for arm size (x) and brain size (y), with the following results:

$$\overline{x} = 10, \qquad \overline{y} = 50$$

$$\sum_{i=1}^{50} (x_i - \overline{x})^2 = 100, \qquad \sum_{i=1}^{50} (y_i - \overline{y})^2 = 400$$

$$\sum_{i=1}^{50} (x_i - \overline{x})\ (y_i - \overline{y}) = 175$$

(a) Compute the variances of x and y, their covariance, and correlation.

(b) What is the best linear regression of arm size on brain size?

(c) What is the best linear regression of brain size on arm size?

(d) What fraction of the total variance in brain size does the regression account for?

2: Use the properties of covariances to show that

$$E[(x - \mu_x)^2] = E[x^2] - \mu_x^2$$

where $\mu_x = E[x]$.

3: What is the covariance between a particular data point z_i and the sample mean $\overline{z} = (1/n) \sum z_i$? Assume the data points are independent.

4: Assuming the appropriate normality assumptions, compute the 95% confidence intervals for σ_x^2 and σ_y^2 using the data in (1). (Hint: Use R to obtain the appropriate χ^2 values).