

Exercise problems from the textbook, *Applied Linear Regression* (3rd edition) by Weisberg:

- (i) Get yourself familiar with the *Forbes'* data.
- (ii) Problem 1.1.

Review exercise on normal distribution, confidence intervals and hypothesis tests.

1. Wires manufactured for use in a computer system are specified to have resistances between 0.12 and 0.14 ohms. The actual measured resistances of the wires produced by company A have a normal distribution with mean 0.13 ohm and standard deviation 0.005 ohm.
 - (a) What is the probability that a randomly selected wire from company A's production will meet the specifications?
 - (b) If four of these wires are used in each computer system and all are selected from company A, what is the probability that all four in randomly selected system will meet the specifications?
2. Suppose that X_1, \dots, X_m and Y_1, \dots, Y_n are independent random samples, with the variables X_i normally distributed with mean μ_1 and variance σ_1^2 and the variables Y_i normally distributed with mean μ_2 and variance σ_2^2 . Consider the difference between the sample means $\bar{X} - \bar{Y}$.
 - (a) Find $E(\bar{X} - \bar{Y})$.
 - (b) Find $Var(\bar{X} - \bar{Y})$.
 - (c) Suppose that $\sigma_1^2 = 2$ and $\sigma_2^2 = 2.5$, and $m = n$. How large should the sample size be at least so that $(\bar{X} - \bar{Y})$ will be within 1 unit of $(\mu_1 - \mu_2)$ with probability 0.95.
3. Solid copper produced by sintering (heating without melting) a powder under specified environment conditions is then measured for porosity (the volume fraction due to voids) in a laboratory. A sample of $n_1 = 4$ independent porosity measurements are normally distributed, have sample mean $\bar{y}_1 = 0.22$ and sample variance $s_1^2 = 0.001$. A second laboratory repeats the same process on solid copper formed from an identical powder and gets $n_2 = 5$ independent porosity measurements with $\bar{y}_2 = 0.17$ and $s_2^2 = 0.002$. Find the 95% confidence interval for the true difference between the population means $(\mu_1 - \mu_2)$ for these two laboratories.
4. A study was conducted by the Florida Game and Fish Commission to assess the amounts of chemical residues found in the brain tissue of brown pelicans. Assume the chemical residuals are normally distributed. In a test for DDT, random samples of $n_1 = 10$

juveniles and $n_2 = 13$ nestlings produced the following results: the sample means and standard deviation of juveniles are $\bar{y}_1 = 0.041$ and $s_1 = 0.017$, the samples means and standard deviations of nestlings are $\bar{y}_2 = 0.026$ and $s_2 = 0.006$. Suppose the two populations have identical variances.

- (a) Test the hypothesis that mean amounts of DDT found in juveniles and nestlings do not differ versus the alternative that the juveniles have a larger mean. Use $\alpha = 0.05$.
- (b) Use p -value to determine whether there is evidence that the mean for juveniles exceeds that for nestlings by more than 0.01 ppm.