

Tutorial 10

1. An operations manager in a company that manufactures electronic audio equipment is inspecting a new type of battery. A batch of 20 batteries is randomly assigned to four groups (so that there are 5 batteries per group). Each group of batteries is then subjected to a particular pressure level (low, normal high, or very high). The batteries are simultaneously tested under these levels and the times to failure (in hours) are recorded in the data file `batfail.txt`. The operations manager, by experience, knows that such data come from populations that are not normally distributed. He wants to use a non parametric procedure for purposes of data analysis.
 - (a) At the 5% level of significance, analyze the data to determine whether there is evidence of a significant difference in the four pressure levels with respect to median batteries life. Use SAS. (Computation of exact p-value is not required.)
 - (b) Repeat (a) using R.
 - (c) Repeat (a) using Python.
2. Consider the horseshoe female crab data given in the csv file `crab.csv`. We would want to form a model for the weight of the female crabs (kg), which depends on its width (cm) and its spine condition (1 = both good, 2 = one worn or broken, 3 = both worn or broken).
Use R, Python and SAS to solve questions below.
 - (a) Set up a scatter plot of variable width and weight for different condition of spine.
 - (b) Fit a linear regression model for weight which has two regressors width and spine. In this model, variable spine should be represented by two indicator variables, where spine = 3 is chosen to be the reference category.
 - (c) At the 0.05 level of significance, test if variable width is significant in the fitted model.
 - (d) Find a 95% confidence interval for β_1 of variable width.
 - (e) Determine the coefficient of determination R^2 .
 - (f) Find an estimate of the variance σ^2 of the error term.
 - (g) Derive the residual plots (qq plot of standardized residuals (SR) and the plot of SR vs fitted values).
 - (h) What assumptions did you make? Check these assumptions.
 - (i) Predict the weight of a female crab that has width of 27 cm and both spine are in good condition. Provide a 95% CI for the mean weight of this crab.