

Discussion 12 Anova cont. and Regression

1. Consider the experiment where we are interested in determining the dose-response rates between several antibiotics applied at the same concentration. Treatments are randomly applied to cultured bacteria, and the percent reductions in bacterial population are given:

Trt 1: 13.3 13.7 11.6 11.9 12.0 12.9 12.3 12.1 12.3 12.3

Trt 2: 12.5 13.9 12.4 14.0 12.8

Trt 3: 16.8 16.6 17.1 14.6 17.4 16.5

Trt 4: 13.2 14.2 13.5 13.2 14.3 12.7 14.9 13.3 13.5

- (a) Analyze the data graphically. Does it look like ANOVA will be useful?
- (b) Create an Anova table, and decide whether we have sufficient evidence to reject the null. (Work out calculations in R and/or on calculator so you get practice.)
- (c) Conduct multiple comparisons for each treatment using 95% CI based on Tukey-Kramer by hand, then verify with R function. Make a table to summarize your findings.
- (d) Perform a Kruskal - Wallis test with possible Wilcoxon Rank Sum posthoc comparison (with Bonferroni correction). Summarize these findings in a table. Are the conclusions consistent between the two methods? Explain why.

2. We measure the heights and weights of 4 randomly chosen students. The value and some summary measures are given below. You can also use the fact that $\sum_{i=1}^4 (x - \bar{x})(y - \bar{y}) = 680$

Student	x: wts (kg)	y: hts (cm)
1	50	151
2	60	165
3	70	178
4	80	192

Variable	Mean	Standard Deviation
Weight (x)	65	12.91
Height (y)	171.5	17.56

For all of the parts below (except for graphs), please perform the calculations by hand, and show your work. You may use R to check your answers.

- Based on the scatter plot, does a straight-line model seem reasonable? If so, compute the sample correlation and the least square estimates for the y intercept and slope of the regression line relating height (y) to weight (x).
- Compute the 4 residuals and create a plot of the residuals vs fitted values (by hand and R) and a QQ plot of the residuals (just in R). Do the necessary regression assumptions seem met?
- Compute the MSError from the residuals calculated above.
- Perform a test of

$$H_0 : \beta_1 = 1$$

vs.

$$H_1 : \beta_1 \neq 1,$$

using a t -test at $\alpha = 0.05$. Make a conclusion in the context of the problem.

- If a student weight is 75kg, what does the model predict to be the height? Compute the estimated SE of this estimate assuming it is for a single future value and 95% prediction interval.
- What is the estimated height of a student with weight 75kg? Compute the estimated SE of this estimate and find 95% CI.