

STAT 518 – HW 4 – Fall 2017

1) Twelve volunteers were assigned at random to each of three weight-loss plans. It can be assumed that the 36 volunteers resemble a random sample from the population of all people who would try a weight-loss program. Below are the number of pounds lost by each person in the program. Test the null hypothesis that there is no difference in the expected weight loss for the three programs. Give the appropriate hypotheses, your decision rule, test statistic value, an approximate p-value, and conclusion. Use $\alpha = 0.05$.

Plan A: 2,17,12,4,5,25,4,6,26,21,8,6
 Plan B: 17,15,3,19,5,14,5,6,19,4,9,7
 Plan C: 29,5,25,3,25,32,28,24,11,36,7,20

2) A random sample of recent stream flow rates at a watershed is to be compared with a sample of flow rates taken earlier. Has the variability of the flow rates changed from earlier times to recent times? You may use either of the two tests we discussed to test this. Give the appropriate hypotheses, your decision rule, test statistic value, an approximate p-value, and conclusion. Use $\alpha = 0.05$.

Earlier Flow Rates: 39,21,58,46,30,22,17,19
 Recent Flow Rates: 32,36,41,27,35,48,31,28

3) Consider the following paired data:

X: -8.7,-8.3,-8.2,-7.2,-6.1,-6.0,-4.1,-2.0,-1.9,-1.6,-1.3,-0.2,0.7,1.3,1.6,2.1,2.2,4.0,5.6,5.9,6.2,6.6,6.7,8.1
 Y: -0.6,-0.8,-1.3,-1.9,-2.0,-2.1,-4.0,-4.6,-4.7,-5.5,-5.6,-6.0,4.6,4.4,4.2,3.9,3.8,3.5,3.1,2.6,2.0,1.2,0.6,0.4

- a) Make a rough scatterplot. Does there seem to be an association between X and Y?
- b) Compute Kendall's τ . (I recommend using R for this!)
- c) Compute Spearman's ρ . (I recommend using R for this!)
- d) What do the tests based on Kendall's τ and Spearman's ρ tell you about whether X and Y are independent?

4) Consider the following random sample of universities; for each university, the number of students and the number of faculty were obtained.

Univ.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Stud	2546	1355	1019	1858	4500	1141	784	1063	267	753	3164	1189	2755	5602	2697	988
Fac	129	75	87	99	300	109	77	64	40	61	190	90	240	300	170	73

- a) Estimate and write the linear regression equation using least squares (let faculty be the independent variable and students the dependent variable).
- b) Give a scatterplot of the data, along with the graph of the regression line.
- c) Using a nonparametric method test the hypothesis that an increase of one faculty member corresponds to an expected increase of 15 students (i.e., test whether the true slope is 15). Give the appropriate hypotheses, your decision rule, test statistic value, an approximate p-value, and conclusion. Use a significance level of 0.05.
- d) Use a nonparametric method to find a 95% confidence interval for the true slope.

5) A random sample of 12 companies reported their percent increase in advertising expenses (X) and their percent increase in sales (Y) over a one-year period.

Company	1	2	3	4	5	6	7	8	9	10
X (Ad)	4	62	31	-11	47	88	16	-1	74	21
Y (Sales)	10	33	39	-14	37	39	18	-8	45	33

- a) Plot the data on a scatter plot. Does the relationship between Y and X seem linear?
- b) Use kernel regression to estimate the regression function relating Y and X. Explain your choice of bandwidth.
- c) For a company with a 25 percent increase in advertising, use your estimation regression function to predict the percent increase in sales.

- 6) [Required for graduate students, extra credit for undergraduates] In the two-sample case, what are some of the reasons why we might prefer to use the Mann-Whitney test instead of the Kruskal-Wallis test?