BioSys PhD | Earthsystems PhD - Non-Parametric Inference

EXERCISES

1. The following data reports readings from 12 home radon detectors exposed to 105 picocuries per liter of radon:

   91.9 97.8 111.4 122.3 105.4 95.0 103.8 99.6 96.6 119.3 104.8 101.7

   We would like to test hypotheses about the median reading from home radon detectors:

   H_0: median=105 *vs* H_1: median$\neq$105

   To do this, apply the Wilcoxon signed-rank statistic to the differences between the observations and 105. What do you conclude?

2. The weight of 5 grains was measured from two experimental varieties designated *premier* and *super*. Each grain was measured in mg to one decimal place. It is intended to determine whether there are significant differences between the two weights varieties.

premier	24.5	23.4	25.3	23.4	22.1
super	26.4	27.0	25.2	25.8	27.1

   Given that the number of observations is very small, use a non-parametric test to answer the question.

3. Nurses in an inner-city hospital were unknowingly observed on their use of latex gloves during procedures for which glove use is recommended. The nurses then attended a presentation on the importance of glove use. One month after the presentation, the same nurses were observed again. Here are the proportions of procedures for which each nurse wore gloves:

Nurse	Before	After	Nurse	Before	After
1	0.857	0.500	8	0.000	1.000
2	0.500	0.833	9	0.000	0.667
3	1.000	1.000	10	0.167	1.000
4	0.000	1.000	11	0.000	0.750
5	0.000	1.000	12	0.000	1.000
6	0.000	1.000	13	0.000	1.000
7	1.000	1.000	14	1.000	1.000

   (a) Why is a one-sided alternative proper here? Why must matched pairs methods be used?

   (b) Does the test indicate that the presentation was helpful? Use an adequate hypothesis testing verifying the assumptions.

4. A chicken pathologist wanted to determine if testosterone in three strains of mature roosters differs.

Strain 1:	339	468	134	497	229	329
Strain 2:	103	115	198	126	115	120
Strain 3:	107	199	102	105	89	110

   (a) Construct side-by-side boxplots of these data. Based on these plots, do means differ by strain? Do variances differ by strains? Would you perform a standard ANOVA for these data? Explain.

   (b) It appears that variances differ by strain. In addition, the sample sizes are small and data do not appear Normal. Use a Kruskal-Wallis test to determine if there are differences among strains.

5. The number of birds observed before finding one with yellow feathers is believed to follow a Geometric distribution with unknown probability of success θ.

Number of birds	0	1	2	3	4	5	6	≥ 7
Number of observations	12	27	49	66	67	32	11	5

   (a) What is the estimate for parameter θ?

   (b) Does the following data provide sufficient evidence for this belief?

6. Hair color and eye color are categorized for a sample of 1000 people.

	Hair color			
Eye color	Brunette	Red	Blonde	Total
Blue	100	20	180	300
Brown	450	30	120	600
Green	50	20	30	100
Total	600	70	330	1000

   (a) Was this study performed in order to test independence or homogeneity? Justify your answer.

   (b) Test the hypothesis established above.