Assignment ON4

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Due at 3:55 PM on Monday 23 March 2020

Instructions

You must attempt all questions. All answers must be submitted on ICE. The *ONLY* submission format accepted is an RMD file.

Data

The objective of a study by Witteman et al. [1] was to investigate skin reactivity with purified major allergens and to assess the relation with serum levels of immunoglobulin E (IgE) antibodies and to determine which additional factors contribute to the skin test result. Subjects consisted of patients with allergic rhinitis, allergic asthma, or both, who were seen in a European medical center. As part of their study, the researchers collected, from 23 subjects, the following measurements on specific IgE (IU/ml) and skin test (ng/ml) in the presence of Lol p 5, a purified allergen from grass pollen. We wish to characterise the relationship between the IgE (the dependent variable) and skin test levels (the independent variable). (Note: The authors converted the measurements to natural logarithms before investigating this relationship.)

Table. Immunoglobulin E (IgE) and skin test levels folloiwng exposure to Lol p 5. (Values are in natural log units).

IgE	Skin Test
24.87	0.055
12.90	0.041034
9.87	0.050909
8.74	0.046
6.88	0.039032
5.90	0.050909
4.85	0.042142
3.53	0.055
2.25	4.333333
2.14	0.55
1.94	0.050909
1.29	0.446153
0.94	0.4
0.91	0.475
0.55	4.461538
0.30	4.103448
0.14	7.428571
0.11	4.461538
0.10	6.625
0.10	49.13043
0.10	36.47058

IgE	Skin Test
0.10	52.85714
0.10	47.5

Questions

1. (10 marks) Construct a properly-formatted scatterplot of the data.
2. (10 marks) Conduct the simple linear regression and interpret the intercept and slope estimates.
3. (10 marks) Test the null hypotheses that the intercept and slope estimates are zero at $\alpha = 0.10$. Interpret the p-values without recourse to statistical significance.
4. (10 marks) Construct 90% confidence intervals for the intercept and slope estimates and interpret them.
5. (40 marks) Test the assumptions of linearity, independence, normality and equal variance.
6. (10 marks) Predict the IgE level on an individual in natural log units if the skin test level in natural log units is 0.1. Construct 90% intervals.
7. (10 marks) Predict the mean IgE level in natural log units if the skin test level in natural log units is 0.1. Construct 90% intervals.

References

1. Witteman AM, Stapel SO, Perdok GJ, Sjamsoedin DHS, Jansen HM, Aalberse RC, Van der Zee JS. The relationship between RAST and skin test results in patients with asthma or rhinitis: A quantitative study with purified major allergens. *Journal of Allergy and Clinical Immunology.* 1996;9:16-25.

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