Assignment 2

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Exercise 1

Poland et al. (1970) in an experiment was concerned with the effect of occupational exposure to DDT on human drug and steroid metabolism. The DDT-exposed subjects were employees of the Montrose Chemical Corporation, who had been working in the DDT plant at Torrance, California, for more than 5 years.

All these individuals had received moderate to intense occupational exposure to DDT, and all were in good health. One of the measures used in the study was the 24-h urinary excretion of 68-hydroxycortisol.

However, a median 6β-hydroxycortisol excretion rate greater than 175 is considered occupational hazard and violate the law. The worker's union hires you as the lawyer against the corporation, and you are supposed to present evidence.

Worker i	Z_i
1	254
2	171
3	345
4	134
5	190
6	447
7	106
8	173
9	449
10	198

(1) Specify the hypotheses you, as the lawyer for the workers, are interested to test.

(2) What test is appropriate? Explain the assumptions underlying the chosen test in this context.

(3) Suppose there is only $n = 4$ observations available, derive the null distribution of the test statistics using permutation.

(4) Perform the test chosen above (using all data), using both the exact permutation method and large-sample approximation method, and make conclusions.

(5) Obtain a point estimate of the median 6β-hydroxycortisol excretion rate and find a 95% confidence interval.

(6) Summarize your findings in (4) and (5), as if you were presenting in a real professional setting.

Exercise 2

The data below are a subset of the data obtained by Smith (1969) in an experiment investigating the geomorphology of the Middle Ground sand ridge, which is located in Vineyard Sound, Massachusetts.

Seven samples were obtained from a particular portion of the ridge using a Van Veen grab. One of the objective measurements was the settling velocity of the sediment at 22°C. For sediment from a sand-wave crest section of a sand ridge, the settling velocity has a typical value of 14 cm/s.

The data below gives the settling velocities for the seven sediment samples collected from a particular portion of the Middle Ground sand ridge. We would like to detect whether the seven sediment samples came from a sand-wave crest section of the Middle Ground sand ridge.

i	Z_i
1	12.9
2	13.7
3	14.5
4	13.3
5	12.8
6	13.8
7	13.4

(1) Specify the hypotheses you, as if you were Smith, are interested to test.

(2) What test is appropriate? Explain the assumptions underlying the chosen test in this context.

(3) Perform the test chosen above, using both the exact permutation method and large-sample approximation method, and make conclusions.

(4) Obtain a point estimate of the median the settling velocity of the sediment collected from a particular portion of the Middle Ground sand ridge, and find a 95% confidence interval.

(5) Summarize your findings in (3) and (4), as if you were presenting in a real professional setting.