

# Chapter 9: Hypothesis Testing

## Exercises

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### Exercise 1

Write the null hypotheses for the following alternative hypotheses (from Chapter 6's exercises):

- a. Individuals who live near an ocean are expected to have a higher belief that climate change is caused by human activity compared to individuals who do not live near an ocean.
- b. Companies with diverse workforces are expected to have higher profits than companies without diverse workforces.
- c. Cities with high pollution are expected to have higher violent crime compared to cities with low pollution.
- d. Countries with free health care are expected to have lower economic growth than countries without free health care.
- e. Cities that offer bounties for rats are expected to have more rats than cities that do not offer bounties.

### Exercise 2

Write a statement signifying a statistically significant relationship for each of the previous alternative hypotheses (in Exercise 1).

### Exercise 3

Using `crime_rate` as the outcome variable and `urban` as the grouping variable from the 2020 Scottish Index of Multiple Deprivation dataset (`simd2020.csv`), carry out the following tests for **independent samples**.

- a. Perform a non-directional  $t$ -test. Are the groups statistically significantly different?
- b. Based on your findings from the previous question, perform an appropriate directional  $t$ -test. Is there a statistically significant difference?
- c. Perform a non-directional Wilcoxon Rank-Sum Test. How are the statistical significance results different from the  $t$ -test (from 'a.') using this non-parametric test?
- d. Based on your findings from the previous question, perform an appropriate directional Wilcoxon Rank-Sum Test. How are the statistical significance results different from the directional  $t$ -test (from 'b.') using this non-parametric test?

## Exercise 4

Using **SMR** as the outcome variable and **DRUG** as the grouping variable from the 2020 Scottish Index of Multiple Deprivation dataset (`simd2020.csv`), carry out the following tests for **dependent samples**.

- a. Perform a non-directional  $t$ -test. Are the groups statistically significantly different?
- b. Based on your findings from the previous question, perform an appropriate directional  $t$ -test. Is there a statistically significant difference?
- c. Perform a non-directional Wilcoxon Signed-Rank Test. How are the statistical significance results different from the  $t$ -test (from 'a.') using this non-parametric test?
- d. Based on your findings from the previous question, perform an appropriate directional Wilcoxon Signed-Rank Test. How are the statistical significance results different from the directional  $t$ -test (from 'b.') using this non-parametric test?

For the answers see **Chapter 9 - Answers to Exercises**.