

**(10) Hypothesis testing**

## STUDY QUESTIONS

1. Define the notion of a test hypothesis.
2. Define the notions of simple, composite, and nil hypotheses.
3. Define the notion of a statistical test.
4. Write down the components of a standard test.
5. Write down the definition of a one-sided critical value-based test.
6. Write down the definition of a two-sided critical value-based test.
7. Define the notions of Type I and Type II test errors.
8. Define the size, specificity, and power of a test.
9. Define the significance level of a test.
10. Define the notions of a conservative, exact, and liberal test.
11. Write down the definition of the test quality and power function.
12. State the typical procedure for constructing a hypothesis test.
13. Write down the definition of the test statistic for the likelihood ratio test.
14. Write down the Neyman-Pearson lemma.
15. State how a test of significance level  $\alpha' = 1 - \delta$  can be constructed based on a  $\delta$ -confidence interval.
16. State how a  $1 - \alpha'$ -confidence interval can be constructed based on a test of significance level  $\alpha'$ .
17. Write down the definition of a test statistic-based p-value.

## EXERCISES (THEORY)

1. Introduce the test-quality and power function of the likelihood ratio test for the expectation of a Gaussian distribution with known variance parameter ([Wasserman \(2004, Example 10.2\)](#), [Casella and Berger \(2002, Example 8.3.3\)](#)).
2. Introduce the likelihood ratio test of two-sided hypotheses about the parameter of a Bernoulli distribution ([DeGroot and Schervish, 2012, Example 9.1.18](#)).
3. Introduce the p-value for the one-sided t-test ([Casella and Berger, 2002, Example 8.3.29](#)).

## EXERCISES (PROGRAMMING)

1. By means of simulation, show that a T test of significance level  $\alpha'$  is an exact test.
2. By means of simulation, validate the power function of the T test.
3. By means of simulation, demonstrate that the  $\delta$ -confidence interval-based test for the expectation parameter of univariate Gaussian distribution is of significance level  $\alpha' = 1 - \delta$ .