

In the exam you may have your pens and pencils, a ruler and an eraser. On top of that you may have one A4 of notes. The rules for the note are: size A4, text on one side only, it must be hand-written, your name has to be on the top right corner of the note. Other materials, such as formulae books, calculators and tables, you may not have in the exam.

1. (visualization, 6 p.)

Explain how you would visualize the following data sets.

- (a) The heights of the female students attending Introduction to Statistical Inference -course. (2 p.)
- (b) The proportion of faulty products obtained from a manufacturing process. (2 p.)
- (c) The political parties of the politicians elected to the Finnish parliament. (2 p.)

Justify your answers.

2. (testing normality, 6 p.)

You are working as data-analyst in laboratory L. You are analyzing a sample of independent and identically distributed observations x_1, x_2, \dots, x_n . You wish to test the null hypothesis that the observations are normally distributed.

- (a) Explain, step by step, how χ^2 Goodness-of-fit test can be applied in testing the null hypothesis. (4 p.)
- (b) Mention at least two other alternative methods for testing/examining normality of the observations. (2 p.)

3. (one sample sign test, 6 p.)

- (a) Give the general statistical assumptions needed for applying one sample sign test. (2 p.)
- (b) Give the null hypothesis and the two sided alternative hypothesis of the one sample sign test. (4 p.)

4. (multivariate linear regression, 6 p.)

Consider multivariate linear regression model

$$y_i = b_0 + B^T x_i + \varepsilon_i, \quad i \in 1, \dots, n,$$

where the elements of 2×1 vector b_0 and 4×2 regression matrix B are unknown constants and the expected value of the residuals ε_i is $E[\varepsilon_i] = 0$.

- (a) What does variance inflation factor (VIF) measure? (1 p.)
- (b) Give the definition of VIF for the explanatory variable $(x_i)_3$ and explain how it is calculated. (3 p.)
- (c) Explain how VIF can be used in selecting explanatory variables. (2 p.)