

Social Robotics

B. Nebel, F. Lindner, T. Engesser,
B. Kuhnert, L. Wächter
Winter Semester 2017/18

University of Freiburg
Department of Computer Science

Classwork Sheet 3

Exercise 3.1 (Basics of Inference Statistics)

- Describe the difference between a sample and a population in your own words.
- What does a confidence interval of $p\%$ mean?
- Explain the difference between One-Tailed and Two-Tailed tests.

Exercise 3.2 (Type I and II errors)

While testing hypotheses Type-I and Type-II errors can occur.

- What is a Type-I error?
- What is a Type-II error?
- Give one example for each error.

Exercise 3.3 (Drawing samples)

- Imagine you want to evaluate ...
 - ... the educational value of a childcare-robot.
 - ... the effectiveness of an assistance robot for car building.

Specify where/how you would draw a sample that represents the whole relevant population for each case.

- In the last classwork you've designed a research process for your groups' robo including a first hypothesis. What kind of sample would you use in order to represent the population?

Exercise 3.4 (Samples and Populations)

- Two samples are drawn from a population. One sample has $N = 5$ values, the other $N = 30$. For which of the two samples does the sample mean (\bar{X}) most probably lie closer to the population mean (μ)? Explain your answer.
- The following parameter is known for a population: $\sigma = 10$. Calculate the standard error of the mean ($\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$) for the following sample sizes:
 - For a sample with $N = 4$
 - For a sample with $N = 25$
 - For a sample with $N = 100$

What can you see in the results?

- A population with $\mu = 100$ and $\sigma = 20$ is given.
 - Consider a sample of size $N = 25$. Calculate the value limit of the confidence interval which separates the middle 95% of the sample means from the extreme 5% at the edges. Use the following formula: $\Delta_{crit} = \mu \pm z_{2.5\%} * \sigma_{\bar{x}}$

- (b) A sample mean of $\bar{X} = 106$ is calculated. Is this value part of the middle 95% of the sample means of the population?

Exercise 3.5

A robot was deployed at a bus stop to inform people about an important topic and afterwards ask them for a donation. After some weeks of work the population mean of donation amounts can be calculated ($\mu_0 = 6, \sigma_0 = 3$). Afterwards the robot is taken to the waiting area of an airport to compare which place is raising higher donations on average. After 200 interactions the robot has gained $\bar{X} = 7$.

- Formulate a H_1 hypothesis and its corresponding H_0 hypothesis.
- Use the z-Score to test the H_1 hypothesis at significance level $\alpha = 0.05$.