Inferential Statistics

AQM2101E

Syllabus

Prof. Dr. Thilo Klein

Winter Term 2019 / 2020

Lecture:	AQM2101E – Inferential Statistics
Performance Record:	written exam of 60 minutes
Lecturer:	Prof. Dr. Thilo Klein office: W2.3.04 office hours: Tuesdays, 12:00 – 13:30 email: thilo.klein@hs-pforzheim.de
Time:	Wednesdays, 12:00 – 13:30
Room:	W1.5.05

Course Description:

The ability to take data – to be able to understand it, to process it, to extract value from it, to visualise it, to communicate has become a hugely important skill in a world full of data. However, understanding data is important not only at the professional level but even at the educational level for elementary school kids, for high school kids, for college students. The complimentary scarce factor is the ability to understand that data and extract value from it. Statistical methods provide an important tool for making economic and business decisions. The students will get an overview and many details of methods that are highly relevant in business, economics and the social science. The topics of "Inferential Statistics" cover basic methods for making valid and reliable statements from the drawn sample to the underlying population. The lecture places heavy emphasis on understanding the ideas of statistical testing and its application to real empirical problems. With the latter, the students will be ably to quantify uncertainty in professional data analysis by using tools of mathematical statistics.

Precondition:

- Analysis and Linear Algebra (AQM1041)

- Descriptive Statistics (AQM1021)

Course Objectives:

The students

1. understand what random variables are and how to use them with the corresponding parameters;

2. know the ideas applications in business and economics of selected discrete and continuous distribution models (χ^2-, binomial-, hypergeometric, poisson, student-, Normal and F-distribution);

3. are able to calculate and interpret confidence-, forecast and tolerance intervals for the mean, the variance and shares;

4. are able to do and interpret parametric statistical tests in the one- and two-sample problem;

5. are able to do and interpret basic nonparametric tests in the one- and two-sample problem;

6. are able to do and interpret one-way ANOVAs.

Schedule:

date	content of the lecture
01.10.	Introduction & random variables
09.10.	Distribution parameter
16.10.	Discrete distribution models
23.10.	continuous distribution models
30.10.	Samples & sample functions
06.11.	Sample functions
13.11.	Estimation & confidence intervals
20.11.	Forecast- and tolerance intervals
27.11.	Principles of statistical testing
04.12.	One-sample problem
11.12.	From the one- to the two-sample problem
18.12.	*Mock Exam*
25.12.	*no lecture*
01.01.	*no lecture*
08.01.	Two-sample problem & tests of linear models
15.01.	Independence & homogeneity
22.01.	*open questions*

Learning Strategy:

The lecture is given to students from many different study programs. To prepare for the exam and to get familiar with the provided content, six exercise sheets will be additionally provided during the semester. Details will be provided in the lecture. "Inferential Statistics" is a classical lecture with the idea of the methods, the methods itself and empirical applications of the methods. The content of the lecture is built upon the previous lecture "Descriptive Statistics". Due to the quantity and details of the topics discussed in the lecture, it is strongly recommended to keep track to the lecture by working through the hand-outs / slides and the corresponding chapters in the books during the term. The primary approach to the course will be analytical/logical. It is important to understand why and how the methods are used rather than just being able to get the correct answer. Some mathematics, however, will be necessary to understand course content. Students are expected to attend all classes, arriving on time and staying until dismissed. You are also expected to participate actively in all class discussions and activities. It is very important that students ask and answer questions during the class. This will greatly help to understand the material better. The spoken word of the lecturer prevails.

Course Material:

Slides with all necessary details and applications will be available before each lecture in the Moodle platform. The course is based on the following (german) textbook:

- Handl, A. und Kuhlenkasper, T. (2017): Einführung in die Statistik mit R.

  (free PDF: www.skripten.kuhlenkasper.de)

Additional Material:

- six exercise sheets

Exam / Course Grading:

For the course, the participants have to pass a written exam (60 minutes). For the exam, the following scheme of grades will be applied: 'very good' corresponds to an outstanding performance which is clearly above the average. 'good' corresponds to good performance being above the average. 'satisfactory' corresponds to an average performance with some deficits. 'sufficient' corresponds to a performance below the average with clearly deficits. 'insufficient' corresponds to performance clearly below the average with deficits being not acceptable.

Contribution of the course to the goals of the study program:

Goal	contribution
1.4 1.4 Technical knowledge in quantitative methods	Learning of inferential statistical methods to solve empirical problems and for decision support in companies. The lecture provides details of basic and advanced statistical methods. Heavy emphasis is placed on the application of the methods and the entire process of empirical and therefore quantitative research. The course covers many relevant topics for a broad field of applications. Heavy emphasis is also placed on the idea and the applications of statistical testing.
3. Critical Thinking	Critical judgment concerning the potentials and limitations of statistical methods and empirical data and the interpretation of results.
4. Ethical Awareness	Creation of empirical analyses for the decision support in companies following these rules: (1) The results must be „fair", objective and neutral in their appearance, (2) The results being presented must contain the desired as well as the undesired results, (3) It is not allowed to use inadequate methods to obtain desired results (4) The cleaning and preparation of data must be well documented and reasonable. It is not allowed to manipulate data to obtain desired results.
5.1 Written Skills	Statistical problems are discussed with an exact mathematical notation and the results will be interpreted appropriately in the exercise sheets and in the final exam.
7.1 Skill of data acquisition	Learning of quantitative methods to make valid and reliable statements of the entire population with data coming from a drawn sample.
7.2 Skill of carrying out a data analysis and provide relevant information for decisions	Learning of methods for inferential statistics and their interpretation in the context of empirical problems, especially with statistical testing.