Valid from 2024.HS

Module description: Stochastics and Statistics

Module Code	t.BA.XXM5.STS.19HS
ECTS Credits	4
Language of Instruction/Examination	German
Organizational Unit	IAMP
Module Coordinator	Thomas Oskar Weinmann
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 3a 2 lecture lessons per semester week and class+ 2 lab bi-weekly lessons per semester and half-class
Module Description	Introduction to the theory of probability and statistics.
Module Content	**Basic terms:** • probability spaces • independence of events • combinatorics and probability • probability of unions **Conditional probability:** • multiplication rule • rule of total probability • Bayes' theorem **Discrete random variables:** • distribution of a random variable • expected value of a random variable • variance and standard deviation of a random variable • some discrete distributions (binomial, multinomial, poisson, ...) **General random variables:** • expected value and variance of absolutely continuous random variables • Some continuous distributions (uniform distribution, exponential distribution, normal distribution, ...) • transformations of random variables • joint distribution, marginal distribution and conditional distribution • sums of independent random variables • covariance, variance and correlation • multivariate normal distribution **Limit Theorems:** • Laws of large numbers • central limit theorem **Statistics:** • point estimates (method of moments, maximum likelihood method) • interval estimates (expected value of a normal distribution with known / unknown variance, expected value of any distribution for large samples, ...) • testing hypotheses (binary hypotheses, parametrized hypotheses, hypotheses about the distribution function, ...)
Prerequisite Knowledge	Multivariate Calculus

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Learning Objectives (Competences)

Students...	Competencies	Taxonomies
Students are familiar with the most important methods for estimating parameters and testing hypotheses and are capable to apply these methods.	M, F	K3, K4
Students understand the laws of large numbers and the central limit theorem and grasp their impact on statistical applications.	M, F	K3, K5
Students are familiar with the basic terms and concepts of the theory of probability and are able to create and analyze probabilistic models.	F, M	K3, K4, K5, K6
Students are familiar with the most important distributions and understand the concept of the joint distribution, the conditional distribution as well as the concept of covariance and correlation of random variables.	F, M	K3, K5
Students are able to use probabilistic methods for the analytical as well as numerical calculation of probabilities.	F, M	K3, K6
Students understand the concept of random variables and the properties of the probability density function and the distribution function.	M, F	K3, K4

Performance Assessment

End-of-module exam	Assessment	Length (min.)	Weighting	Form
written exam	Grade	90	60	acc. to module agreement

Performance assessment during the semester	Assessment	Length (min.)	Weighting	Form
written exam	Grade	20	10	acc. to module agreement
written exam	Grade	20	10	acc. to module agreement
written exam	Grade	20	10	acc. to module agreement
written exam	Grade	20	10	acc. to module agreement

Classroom Attendance Requirement

None

Learning material

- Depending on the lecturer: script, slides, exercise series

Comments