Exchange programme Vrije Universiteit Amsterdam

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit Amsterdam - 2024-2025

Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please visit the exchange programmes webpages.

Probability and Statistics

Course Code	XB_0115
Credits	6
Period	P4
Course Level	200
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	dr. R. Hindriks
Examiner	dr. R. Hindriks
Teaching Staff	dr. R. Hindriks
Teaching method(s)	Seminar, Lecture, Practical

Course Objective

After this course the student should be able to

- understand the setup of a probability space, events, probability and conditional probability (knowledge and insight);
- use the basic rules of probability theory (sum rule, product rule, law of total probability, Bayes' rule) (applying knowledge and insight);
- understand what a random variable is, what its distribution is, both for discrete and continuous random variables (this includes the concept of probability mass function, probability density function, and cumulative distribution function)

(knowledge and insight);

- compute the expectation and variance of a random variable (applying knowledge and insight);
- compute the expectation and variance of a sum of independent random variables (applying knowledge and insight);
- derive discrete probability distributions for probabilistic experiments associated to the Bernoulli, Binomial, Negative Binomial and Poisson distribution (applying knowledge and insight);
- compute probabilities for continuous random variables, specifically the uniform, exponential, and normal distribution (applying knowledge and insight);
- perform calculations based on the law of large numbers and central limit theorem (applying knowledge and insight);
- reproduce the definition of an estimator, carry out elementary computations involving point estimators (applying knowledge and insight);
- understand what confidence intervals are and be able to derive them in simple settings using a pivot (applying knowledge and insight);
- understand the setup of classical hypothesis testing (critical region, p-value, type of errors) and apply this to simple hypothesis testing problems (knowledge and insight);
- derive likelihood ratio tests in simple settings (applying knowledge and insight);
- perform basic computations with the statistical software package R (judgement, learning skills);
- carry out statistical analyses using the software package R (judgement, learning skills);.

Course Content

From the book by From Pishro-Nik:

Chapter 1: Basic concepts
Chapter 3: Discrete random variables, Bernoulli, Binomial, Negative Binomial, Poisson
Chapter 4: Continuous random variables; sections 4.0, 4.1 and from 4.2 uniform, exponential and normal random variables
Chapter 7: Law of large numbers and central limit theorem; sections 7.0 and 7.1
Chapter 8: Classical statistics (point estimation, interval estimation, hypothesis testing); sections 8.1, 8.2, 8.3 and 8.4

Additional Information Teaching Methods

6 weeks with 4 hours lecturing each week. Exercise classes. Two R assignments, to be done in groups of 2.

Attendance to lectures and classes is not mandatory but strongly recommended.

Method of Assessment

The exam counts for 80%. Each of the assignments counts for 10%. To pass the course, the (unrounded) grade of the exam needs to be at least 5. The exam has a resit, the assignments do not.

Literature

Hossein Pishro-Nik, Introduction to Probability, Statistics and Random Processes. The book can be ordered but is also freely available on www.probabilitycourse.com.

Additional Information Target Audience

Bachelor Artificial Intelligence (year 2)

Recommended background knowledge

Elementary set theory

Calculus