

Module Handbook (<https://modhb.uni-kl.de/>)

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Course MAT-02-12-K-1

Mathematics for Computer Science Students: Combinatorics, Stochastics, and Statistics (4V+2U, 8.0 LP)

Course Type

SWS	Type	Course Form	CP (Effort)	Presence-Time / Self-Study
-	K	Lecture with exercise classes (V/U)	8.0 CP	156 h
4	V	Lecture		56 h
2	U	Exercise class (in small groups)		28 h
(4V+2U)			8.0 CP	84 h
				156 h

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SWS	4V+2U
CP, Effort	8.0 CP = 240 h
Position of the semester	1 Sem. in SuSe
Level	[1] Bachelor (General)
Language	[DE] German
Lecturers	Böhm, Janko, Dr. (WMA DEPT: MAT) (/staff/4/) Kunte, Michael, Dr. (WMA DEPT: MAT) (/staff/22/) + further Lecturers of the department Mathematics
Area of study	[MAT-Service] Mathematics for other Departments
Lifecycle-State	[NORM] Active

Possible Study achievement

- Verification of study performance: **proof of successful participation in the exercise classes (ungraded)**
- Details of the examination (type, duration, criteria) will be announced at the beginning of the course.

Combinatorics:

- Binomial coefficients,
- applications (e.g. complete brackets),
- sieve formula, application: counting prime numbers,
- counting mappings, words,
- counting injective mappings, permutations,
- counting surjective mappings, applications (e.g. partitions of sets), equivalence relations,
- partitions of numbers,
- multisets,
- equivalence classes of mappings.

Stochastics:

- probability spaces,
- discrete distributions (e.g. binomial, Poisson),
- continuous distributions (e.g. normal, exponential),
- conditional probability, Bayesian formula, independence,
- random variables, expected value and variance,
- independence of random variables, covariance and correlation,
- applications (for example, runtime analysis of Mergesort and Quicksort),
- Markov inequality, Hoeffding inequality,
- weak and strong law of large numbers,
- central limit theorem,
- Markov chains, hidden Markov models,
- Monte Carlo simulation, simulation of distributions, application (e.g. Monte Carlo ray tracing).

Statistics:

- estimating parameters,
- confidence interval,
- testing hypotheses,
- tests for expected value,
- adaptation test, independence test,
- application (e.g. pseudo-random numbers),
- linear regression.

Literature

- B. Kreuzler, G. Pfister: Mathematik für Informatiker: Algebra, Analysis, Diskrete Strukturen,
- M. Wolff, P. Hauck, W. Küchlin: Mathematik für Informatik und Bioinformatik,
- M. Aigner: Diskrete Mathematik,
- U. Krengel: Einführung in die Wahrscheinlichkeitstheorie und Statistik.

Materials

Further literature will be announced in the lecture; exercise material will be provided.

Registration

Registration for the exercise classes via the online administration system URM (<https://urm.mathematik.uni-kl.de>) (<https://urm.mathematik.uni-kl.de>).

Requirements for attendance (informal)

[MAT-02-11-M-1] (/mhb/modules/MAT-02-11-M-1/) and [MAT-02-13-M-1] (/mhb/modules/MAT-02-13-M-1/) or [MAT-02-90-M-1] (/mhb/modules/MAT-02-90-M-1/)

Requirements for attendance (formal)

References to Course [MAT-02-12-K-1]

Module	Name	Context	
[MAT-02-12-M-1 (/mhb/modules/MAT-02-12-M-1/)]	Mathematics for Computer Science Students: Combinatorics, Stochastics, and Statistics	P: Obligatory	4V+2U, 8.0 LP
[MAT-12-10P-M-3 (/mhb/modules/MAT-12-10P-M-3/)]	Build-Up Module Mathematics (for Students of Physics)	WP: Obligation to choose	4V+2U, 8.0 LP