

Warsaw University of Technology | Doctoral School No. 3

Course offered in the Doctoral School No. 3
– Spring semester of the 2021/2022 academic year

TITLE
The probabilistic method 2
CONDUCTING UNIT
Doctoral School No. 3
SCIENTIFIC DISCIPLINE
Mathematics
IMPLEMENTING UNIT
112000 - Faculty of Mathematics and Information Science
SUMMARY DESCRIPTION
<p>The aim of the course is to familiarize the students with probabilistic methods used in combinatorics and theoretical computer science.</p> <p>The course is planned to take two semesters and the topics covered are divided into two parts (one for each semester).</p> <p>The first one is devoted to the overview of the main tools used in the area:</p> <ul style="list-style-type: none">- The Basic Method,- Linearity of expectation,- Alternations,- The Second Moment,- The Local Lemma,- Correlation Inequalities,- Martingales and Tight Concentration,- The Poisson Paradigm,- Pseudorandomness. <p>The second part is more oriented on the areas where the probabilistic tools can be applied.</p> <ul style="list-style-type: none">- Random Graphs,- The Erdos-Renyi Phase Transition,- Circuit Complexity,- Discrepancy,- Geometry,- Codes, Games, and Entropy,- Derandomization,- Graph Property Testing. <p>The course is based on the textbook by Alon and Spencer.</p>

FULL DESCRIPTION

Content.

The aim of the course is to familiarize the students with probabilistic methods used in combinatorics and theoretical computer science.

The course is planned to take two semesters and the topics covered are divided into two parts (one for each semester).

The first one is devoted to the overview of the main tools used in the area:

- The Basic Method,
- Linearity of expectation,
- Alternations,
- The Second Moment,
- The Local Lemma,
- Correlation Inequalities,
- Martingales and Tight Concentration,
- The Poisson Paradigm,
- Pseudorandomness.

The second part is more oriented on the areas where the probabilistic tools can be applied.

- Random Graphs,
- The Erdos-Renyi Phase Transition,
- Circuit Complexity,
- Discrepancy,
- Geometry,
- Codes, Games, and Entropy,
- Derandomization,
- Graph Property Testing.

Organization.

We meet once a week for two hours. During each meeting we discuss the next topic (according to [Alon, Spencer]).

All students are expected to be prepared for the discussion, but every week there is one designated person, whose responsibility is to moderate the meeting.

LITERATURE

Noga Alon, Joel H. Spencer: The Probabilistic Method, Third Edition. Wiley-Interscience series in discrete mathematics and optimization, Wiley 2008, ISBN 978-0-470-17020-5, pp. I-XV, 1-352

LEARNING OUTCOMES

After completing the course, the students are expected to know basic probabilistic tools used in various areas of mathematics and computer science.

They can apply these tools in their own research projects.

ASSESSMENT METHODS AND CITERIA; COURSE COMPLETION FORM

Grading.

There is no exam, the final grade is based on the coursework (in particular, during the meetings the particular students moderates, but also during other meetings).

Formatilities.

Attendance is obligatory (unless there are serious circumstances).

The course is taught in English. The number of ECTS points related to the course is 4 per semester.

LANGUAGE OF THE COURSE		ECTS CREDITS
English		4
TYPE OF CLASSES	NUMBER OF HOURS	COURSE INSTRUCTOR
Ćwiczenia (CWI)	30	Agnieszka Piliszek, dr; Paweł Rzążewski, dr inż.