
Proseminar (English) - Information Sheet -



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Department of Mathematics

Lecturer:

Dr. Robert Haller-Dintelmann

Dr. Sören Kraußhar

Dr. Nicole Megow

WS 2011/12

October 20, 2011

Proseminar "A Second Course on Real Functions"

Lecturer: Dr. Robert Haller-Dintelmann

Content

After the course Analysis II, where you have seen lots of variables, this proseminar invites you to reconsider functions of just a single variable. One could say this is just a special case, still I want to explore with you some interesting, and sometimes even astonishing, aspects of such functions. We will discover that there is much fascinating mathematics in functions of one variable.

You will encounter:

- A function that is nowhere continuous, but fulfills the mean-value theorem on every interval.
- The answer to: If I have an arbitrary subset of \mathbb{R} , does there exist a function that is continuous on exactly this set and nowhere else?
- A continuously differentiable function that has no local extrema, but nevertheless the set $\{x \in \mathbb{R} : f'(x) = 0\}$ is uncountable.
- The Cantor set – a rather big "nothing".

The proseminar is based on the book of A.C.M van Rooij and W.H. Schikhof with the same title. There is also a German proseminar with the same topic. You will get copies of the relevant chapters in the preliminary meeting.

Preliminary Meeting: In room S215/301 on Monday, October 24th 2011, at 1:30 PM

Proseminar "Several Topics in Topology"

Lecturer: Dr. Sören Kraußhar

Content

This proseminar will cover the following topics:

1. METRIC SPACES

- Open and closed sets
- Convergence, completeness and continuity
- spaces of continuous functions

2. GENERATION OF TOPOLOGICAL SPACES

- Elementary properties of topologies
- bases and subbases of topologies
- product and quotient topologies

3. COMPACTNESS

- Theorem of Heine Borel
- Tychonov's Theorem

4. SEPARATION AXIOMS

- T_1 spaces and Hausdorff spaces
- Other separation axioms

LITERATURE

- "Introduction to Topology and Modern Analysis" by George F. Simmons, Krieger Publishing Company
- Lecture notes: Topology by Prof. Dr. Karl-Hermann Neeb

Preliminary Meeting: In room S215/401 on Tuesday, November 1st 2011, at 9:50 AM

Proseminar "Proofs from THE BOOK"

Lecturer: Dr. Nicole Megow

Content

"Paul Erdős liked to talk about The Book, in which God maintains the perfect proofs for mathematical theorems, following the dictum of G. H. Hardy that there is no permanent place for ugly mathematics. Erdős also said that you need not believe in God but, as a mathematician, you should believe in The Book..." Aigner, Ziegler: Proofs from the BOOK.

Martin Aigner and Günter Ziegler published a book "Proofs from the BOOK" with candidates of such perfect proofs that contain brilliant ideas, clever insights, and wonderful observations. Many topics were suggested by Erdős himself, though he died before the book was written. The collection of problems spans number theory, geometry, analysis, combinatorics, and graph theory.

This seminar deals with a selection of topics from "Proofs from the BOOK". The presentations will be held in the end of the semester in one (or two) full-day colloquium.

Literature: Aigner, Martin; Ziegler, Günter (2009). Proofs from THE BOOK (4th ed.). Berlin, New York: Springer-Verlag.

Preliminary Meeting: In room S410/142 on Tuesday, November 1st 2011, at 9:00 AM
