Mathematics-Computer Science 4215H – Mathematical Logic
TRENT UNIVERSITY, Winter 2021

Instructor

Stefan Bilaniuk (pronounced Стефан Біланюк)
office: ~~ENW 337~~
hours: Mondays 10:00-10:50 & 20:00-20:50, Thursdays 12:00-12:50, and Fridays 20:00-20:50, or by appointment, all via Zoom.
phone: ~~705 748-1011 x7474~~
home: 705 742-7862 [Do *not* call between 9 p.m. and 8 a.m. unless it's an emergency.]
e-mail: `sbilaniuk@trentu.ca`
web: `euclid.trentu.ca/math/sb/`

Department of Mathematics

Colleen Berrigan
office: ~~SC 327~~
hours: ~~Weekdays 08:30-16:30~~
phone: ~~705 748-1011 x7715~~
e-mail: `math@trentu.ca`

Prerequisite

MATH 2200H, or permission of the instructor.

Text

A Problem Course in Mathematical Logic, Version 1.6, Stefan Bilaniuk, 2003. It's free and can be downloaded from: `http://euclid.trentu.ca/math/sb/pcml/` Licensed under the GNU Free Documentation License, Version 1.2 or later.

Meetings

This course will have some pre-recorded lectures, mainly to introduce new topics or to go over some of the proofs, but in a problem course students, given the definitions and the statements of the results, mostly develop the material for themselves. There will be a weekly seminar, via Zoom, 11:00-11:50 on Thursdays, as well as the office hours noted above, to provide explanations, hints, and other support.

Marking Scheme

There will be eleven weekly assignments and a take-home final examination. The best ten assignments will each count for 7% of the final mark and the final exam will count for the remaining 30%. Assignments will be accepted after the due date at the instructor's sole discretion. Students who miss more than one assignment for reasons beyond their control should contact the instructor as soon as possible.

This scheme may be modified in *exceptional* circumstances, such as a lengthy absence due to illness. Any such modification will require the agreement of both the student and the instructor.

Learning Outcomes

This course is an introduction to the study of propositional and first-order logics as mathematical objects in their own right, through the Soundness, Completeness, and Compactness Theorems. Following the modified Moore method, the successful student in this problems course will, given the definitions and statements of results, some examples, and some hints, prove most of the results for themselves.

Schedule

Please note that where the material covered is concerned this schedule is a polite fiction: no lesson plan survives contact with students unchanged ...

Weeks 1–2. *(11–22 January) Classes begin on Monday, 11 January.* Chapters 1 & 2. Language of propositional logic: atomic formulas, connectives, formulas. Semantics of propositional logic: truth assignments, entailment. Assignment #1 due on Friday, 22 January.

Weeks 3–4. *(25 January – 5 February)* Chapters 3 & 4. Deductions in propositional logic: axiom schema, inference, deductions. Consistency of sets of formulas, maximally consistent sets,

the Soundness Theorem for propositional logic. Assignment #2 due on Friday, 29 January, and Assignment #3 due on Friday, 5 February.
Weeks 5–6. *(8–12 & 22–26 February)* Chapters 4 & 5. Metamathematics of propositional logic: the Completeness and Compactness Theorems. First-order languages: variables, constants, functions, terms, relations, connectives, quantifiers, formulas, sentences. Assignment #4 due on Friday, 12 February, and Assignment #5 due on Friday, 19 February.
~~**Catch-up**~~ **Reading Week.** *(15–19 February)* Between Weeks 5 and 6. Enjoy!
Weeks 7–8. *(1–12 March)* Chapter 6. Semantics of first-order logic: structures, assignments, satisfaction, entailment, tautologies, contradictions, entailment for connectives and quantifiers. Assignment #6 due on Friday, 5 March, and Assignment #7 due on Friday, 12 March.
Weeks 9–10. *(15–26 March) The last day to withdraw from Winter courses is Monday, 15 March.* Chapters 6–8. Semantics of first-order logic: extension languages and structures. Deductions in first-order logic: axiom schema, inference, deductions, Generalization Theorem. Metamathematics of first-order logic: Soundness Theorem, consistency, maximal consistency. Assignment #8 due on Friday, 19 March, and Assignment #9 due on Friday, 26 March.
Weeks 11–12. *(29 March – 9 April)* Chapters 8 & 9. Metamathematics of first-order logic: sets of witnesses, the Completeness and Compactness Theorems. Applications of the Compactness Theorem. Assignment #10 due and take-home exam distributed on Friday, 2 April, and Assignment #11 due on Friday, 9 April. *Friday, 9 April, is the last day of classes.*
Winter Examination Period. *(12–23 April)* Take-home exam due on Wednesday, 21 April.

Academic integrity

> *Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from a 0 grade on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's Academic Integrity Policy. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more –* `www.trentu.ca/academicintegrity`

For clarity, the following guidelines will apply in MATH 4215H:

> You are permitted and encouraged to work with others and ask anyone willing (especially the instructor!) for explanations, hints, and suggestions for the assignments, and to consult whatever sources you wish. However, **all work submitted for credit must be written up entirely by yourself, giving due credit to all the sources of help and information that you actually used.** There will be greater restrictions on the take-home final examination, which will be spelled out on the exam.

Access to instruction

> *It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Student Accessibility Services Office (SAS), Blackburn Hall Suite 132, 705 748-1281,* `sas@trentu.ca`*. For Trent University in Oshawa Student Accessibility Services Office contact 905 435-5102, ext. 5024. Complete text can be found under Access to Instruction in the Academic Calendar.*

Blackboard and Web Archive Page

All course materials will be posted to or linked from the course Blackboard site. A web page at `euclid.trentu.ca/math/sb/4215H/` will archive this material.

Last modified 2020-12-30.