CAS 734 (Formalized Mathematics)

Winter 2014

00 Preliminaries

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Instructor

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Mission

- Formalized mathematics is mathematics that is expressed and developed within a formal logic.
- It is the basis for formal methods employed in computing and other disciplines.
- Formal mathematics is usually done with the aid of a mechanized mathematics system called a proof assistant that provides support for the development of axiomatic theories and for proving conjectures.
- The mission of this course is to introduce students to the field of formalized mathematics and to teach them how to develop mathematics formally using a proof assistant.

Learning Objectives

Students should know and understand:

1. The costs and benefits of formalized mathematics.
2. The techniques for specifying mathematical models as axiomatic theories.
3. The techniques for developing axiomatic theories.
4. The tools employed in practice-oriented logics.
5. The little theories method.

Students should be able to:

1. Express mathematical models as axiomatic theories.
2. Develop axiomatic theories using a proof assistant.

Organization

- Lectures: Tu & Th 10:00–11:30 in ITB 222.
- Course web site:

  http://imps.mcmaster.ca/courses/CAS-734-14/.

- Course outline: Read it closely!.
- Textbook: None required.

Work Plan

- Lectures are given by the instructor.
- Presentations are given by the students.
  - Each should be about 20 minutes long.
- Exercises are done by the students outside of class.
- Each student learns to use a proof assistant.
  - The proof assistant is chosen from a list of suggestions.
  - The student works alone or with a partner.
  - The exercises require the use of a proof assistant.
  - The presentations will describe and demonstrate the student's chosen proof assistant.
- No tests or exams

Suggested Proof Assistants

- ACL2.
- Agda.
- Coq.
- HOL Light.
- Isabelle/HOL.
- Mizar.
- PVS.

Academic Dishonesty

- Students are expected to exhibit honesty and use ethical behavior in all aspects of the learning process
- Academic dishonesty consists of misrepresentation by deception or by other fraudulent means
- Academic dishonesty includes:
  - Plagiarism
  - Copying
  - Improper collaboration
- Academic dishonesty can result in serious consequences
- Your work must be your own. Plagiarism and copying will not be tolerated!
- Students may be asked to defend their written work orally

Discrimination

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact their Department Chair and the Human Rights and Equity Services (HRES) office as soon as possible.

Other Policy Statements

1. Each student is strongly urged to submit a completed Questionnaire and Biographical Sketch which is available on the course web site.
2. Significant study and work outside of class is required.
3. Students are expected to regularly attend the lectures and to ask questions.
4. Exercises that are submitted late and presentations that are given late will be penalized 2% for each late day. For example, if an exercise was given a mark of 80 but was turned in one week late, the actual mark will be $80 - 7 \cdot 2 = 66$.
5. Suggestions on how to improve the course and the instructor's teaching methods are always welcomed.

Marking Scheme

Exercises	60%
Presentations	40%
Total	**100%**

Syllabus

00 Preliminaries

01 What is Formalized Mathematics?

02 Review of Mathematical Logic

03 Simple Type Theory

04 Axiomatic Mathematics

05 Proof Assistants

06 Practice-Oriented Logics

07 The Little Theories Method

08 Student Presentations