Computing and Software 734

Formalized Mathematics

Winter 2008

Course Outline

Revised: 2 January 2008

Note: This course outline contains important information that may affect your grade. You should retain it throughout the term as you will be assumed to be familiar with the rules specified in this document.

Instructor

Dr. William M. Farmer
Office: ITB 163
Extension: 27039
E-mail: `wmfarmer@mcmaster.ca`
Web: `http://imps.mcmaster.ca/wmfarmer/`
Office hours: by appointment

Course Web Site

`http://www.cas.mcmaster.ca/~wmfarmer/CAS-734-08/`

Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Lecture Schedule

MW   9:00–10:30   ITB 225

Calendar Description

"Computer-supported, formalized mathematical reasoning for practical applications. Specification and verification in higher-order logic. Interactive theorem proving systems. Techniques for developing axiomatic theories."

Mission

The mission of this course is to teach students how to express and develop mathematics within a formal logic. By the end of the course the student should:

1. Understand what formalized mathematics is and what are the costs and benefits of employing formalized mathematics, particularly in software development.

2. Be able to express mathematical models as axiomatic theories in higher-order logic and set theory.

3. Be able to develop and analyze axiomatic theories using the IMPS Interactive Mathematics Proof System and at least one other interactive theorem proving system.

4. Have a suitable background for using formalized mathematics in the specification and analysis of complex systems such as software systems.

5. Be familiar with the major challenges that face researchers who are trying to make formalized mathematics into a practical discipline.

Work Plan

There will be two 75-minute lectures per week by the instructor. Students will be expected to attend the lectures, complete assigned exercises, and give short presentations to the class. Most of the exercises will require the use of an interactive theorem proving system. Students are required to learn how to use at least two interactive theorem proving systems, one being the IMPS Interactive Mathematics Proof System.

Marking Scheme

The course grade will be based on the student's performance on the exercises and presentations as follows:

Exercises	75%
Presentations	25%
Total	**100%**

Academic Integrity

You are expected to exhibit honesty and use ethical behavior in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behavior can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at

http://www.mcmaster.ca/academicintegrity/

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g., the submission of work that is not one's own or for which other credit has been obtained.

2. Improper collaboration in group work.

3. Copying or using unauthorized aids in tests and examinations.

Your work must be your own. Plagiarism and copying will not be tolerated! If it is discovered that you plagiarized or copied, it will be considered as academic dishonesty.

Students may be asked to defend their written work orally.

Other Policy Statements

1. Significant study and reading outside of class is required.

2. Students are expected to regularly attend the lectures and to ask questions.

3. 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 $80 - 7 \cdot 2 = 66$.

4. 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.

5. Suggestions on how to improve the course and the instructor's teaching methods are always welcomed.

Tentative Syllabus

00 Preliminaries

01 What is Formalized Mathematics?

02 Review of Mathematical Logic

03 Theory Development Techniques

04 The IMPS Interactive Mathematical Proof System

05 Other Interactive Theorem Proving Systems

06 Practice-Oriented Logics

07 The Little Theories Method