CAS 701

Logic and Discrete Mathematics

Fall 2018

Course Outline

Dr. William M. Farmer

McMaster University

Revised: September 29, 2018

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

Instructor

Dr. William M. Farmer
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Web: `http://imps.mcmaster.ca/wmfarmer/`
Office Hours: To see me, please send me an email message with some times you are free.

Schedule

Lectures: TuTh 2:30–4:00 ITB 222

Course Web Site

This course will be administered via Avenue to Learn. Go to

`http://avenue.mcmaster.ca/`.

to access the course's Avenue to Learn page. Please send only normal email to the instructional staff; do not send mail via Avenue.

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 email 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 Instructor

It is the student's responsibility to be aware of the information on the course's Avenue to Learn page and to check regularly for announcements.

Calendar Description

"The course will cover some of the material encountered at the undergraduate courses on logic and discrete mathematics as well as advanced material on topics such as proof systems, sets, relations, and functions, recursion, type theory, and first and higher order logic systems. There will be emphasis on topics related to computer science and software engineering."

Mission

The mission of this course is to give students a graduate-level understanding of the logic and discrete mathematics that is needed for computer science and software engineering. By the end of the course the student should:

1. Understand what the mathematics process is and how it is employed in computing and engineering.
2. Understand the main kinds of values and structures that are used to build mathematical models.
3. Understand the logical principles underlying the mathematics process and embodied in first-order logic and simple type theory.
4. Be able to read and write both informal and formal mathematical proofs.
5. Be able to express mathematical ideas in propositional logic, first-order logic, and simple type theory.
6. Be familiar with the main kinds of mathematical technologies and software systems that are available today.

Students taking this course are expected to have some familiarity with propositional and first-order logic as well as basic undergraduate mathematics.

Textbooks

Recommended: M. Ben-Ari, *Logic for Computer Science*, Third Edition Springer, 2012. ISBN-13: 978-1447141280.

- The material in Chapters 1–3 and 7–9 will be covered.

Recommended: R. Hammock, *Book of Proof*, Second Edition, Richard Hammock, 2016. ISBN-13: 978-0989472111.

Work Plan

There will be lectures, M&Ms (see below), exercises, a project, a midterm test, and a final exam. Two 75-minute lectures per week will given by the instructor. The lectures will present the course topics and will illustrate their use with examples. Students will be expected to attend the lectures, submit M&Ms, complete the assigned exercises, and do a group project. The midterm test will be held on Thursday, November 1, 2018 during the regular lecture time at 2:30–4:00. The final exam will be scheduled during the final examination period at the end of the term.

At the end of each week, each student is required to submit to a discussion forum on Avenue a short paragraph (2–4 sentences) describing something from the week's experience that was especially meaningful or memorable to the student. These *meaningfuls and memorables (M&Ms)* are intended to help students to reflect on what they are learning and to give the Instructor insight into the student's learning process.

The exercises will be assigned in groups periodically during the term. They will involve solving problems, formulating mathematical models and examples, proving conjectures, and performing computations.

The project will consist of a short written presentation and oral presentation on a chosen mathematical technology or software system such as binary decision diagrams, logic programming, a computer algebra system, or a proof assistant. The project will be done in groups of two or three. Further details on the project will be presented in a document entitled *Project*.

Midterm Course Review

In the middle of the term, the students will have the opportunity to complete a survey on Avenue about how the course is going. In addition, each student will be invited to attend a course review session in which she can ask the Instructor questions about the course and give feedback directly to the Instructor. Attendance is optional. The feedback that is received from the course survey and course review sessions may be used to modify how the course is working.

Course Evaluation

Near the end of the term, each student will have the opportunity to evaluate the effectiveness of this course. The feedback that is received from the course evaluation is very valuable to the Instructor and will be used to improve the course in subsequent years.

Academic Dishonesty

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.

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.

Academic Accommodation

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or email `sas@mcmaster.ca`. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

Course Modifications

The Instructor and University reserve the right to modify elements of the course during the term. The university may change the dates and deadlines

for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course web sites weekly during the term and to note any changes. Your McMaster email is the one with the address ending in `@mcmaster.ca`. This is a separate email address from your Avenue address.

Other Policy Statements

1. Significant study and reading outside of class is required.
2. The student is expected to ask questions during class.
3. A student may use calculators and his or her texts and notes during the midterm test and final exam.
4. Exercises may not be submitted late and the midterm test and final exam may not be taken later without *prior* approval from the instructor.
5. The instructor reserves the right to require a deferred final exam to be oral.
6. Suggestions on how to improve the course and the Instructor's teaching methods are always welcomed.

Marking Scheme

The course grade will be based on the student's performance on the M&Ms, exercises, project, midterm test, and final exam as follows:

M&Ms	5%
Exercises	25%
Project	10%
Midterm test	20%
Final exam	40%
Total	**100%**

Notes:

1. The *M&Ms mark* is the percentage of weekly M&Ms that the student submitted during the term.
2. The *project mark* is worth 5% for the written presentation and 5% for the oral presentation.

Syllabus