EXPANDED COURSE DESCRIPTION
Lassonde School of Engineering
Electrical Engineering Computer Science
LE / MATH 1090 3.0 SECTION B
INTRO. TO LOGIC FOR COMPUTER SCIENCE
FALL 2018 / WINTER 2019

Last Modified Date: 08/29/2018

COURSE CALENDAR DESCRIPTION
The syntax and semantics of propositional and predicate logic. Applications to program specification and verification. Optional topics include set theory and induction using the formal logical language of the first part of the course. Prerequisite: SC/MATH 1190 3.00 or SC/MATH 1019 3.00. Course credit exclusion: SC/MATH 4290 3.00.

INSTRUCTOR(S)

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<th>Name</th>
<th>Section / Format / Term</th>
<th>Contact Email</th>
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<td>Tourlakis, George</td>
<td>Sec. B / LECT / F</td>
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ADDITIONAL INFORMATION

DON'T PANIC :-)  
(This course is very similar to a serious programming course; but easier)

Detailed Course Description:

Note: This course is a degree program requirement for Computer Science, Computer Security, and Computer and Software Engineering majors. It is expected and recommended to be taken in the second year of your studies as it is a prerequisite for a number of core (= required) 3rd year EECS courses.

Learning to use Logic, which is what this course is about, is like learning to use a programming language.

In the latter case, familiar to you from courses such as EECS 1021 3.0 or EECS1022 3.0, one learns the correct syntax of programs, and also learns what the various syntactic constructs do and mean, that is, their semantics. After that, one spends the rest of the course on increasingly challenging programming exercises, so that the student becomes proficient in programming in said language.

We will do the exact same thing in MATH1090: We will learn the syntax of the logical language, that is, what syntactically correct proofs look like. We will learn what various syntactic constructs "say" (semantics). We will be pleased to learn that correctly written proofs are concise and "checkable" means toward discovering mathematical "truths". We will also learn via a lot of practice how to write a large variety of proofs that certify all sorts of useful "truths" of mathematics.

While the above is our main aim, that is, to equip you with a Toolbox that you can use to discover and certify truths, we will on occasion also look at the Toolbox as an object of study and study some of its properties (this is similar to someone explaining to you what a hammer is good for before you take up carpentry). This study belongs to the "metatheory" of Logic.

The content of the course will thus be:

The syntax and semantics of propositional and predicate logic and how to build "counterexamples" to expose fallacies. Some basic and important "metatheorems" that employ induction on numbers, but also on the complexity of terms, formulas, and proofs will be also considered. A judicious choice of a few topics in the "metatheory" will be instrumental toward your understanding of "what's going on here". The mastery of these metatheoretical topics will make you better "users of Logic" and will separate the "scientists" from the
There are a number of methodologies or styles for writing proofs, and we will aim to gain proficiency in two of them. The **Equational** methodology and the **Hilbert** methodology. In both methodologies an important required component is the **systematic annotation of the proof steps**. Such annotation explains **why** we do **what** we do and has a function similar to comments in a program.

OK, one can readily agree that a computer science student needs to learn programming. But Logic? Well, the proper understanding of propositional logic is fundamental to the most basic levels of computer programming, while the ability to correctly use variables, scope and quantifiers is crucial in the use of loops, subroutines, and modules, and in software design. Logic is used in many diverse areas of computer science including digital design, program verification, databases, artificial intelligence, algorithm analysis, computability, complexity, and software engineering. Besides, any science that requires you to reason correctly to reach conclusions uses logic.

**Prerequisite:** MATH 1190 3.00 or EECS/MATH 1019 3.00.

**No Credit Retained (NCR) Note:** This course is not open for credit to any student who has passed MATH 4290 3.0.

**Course work and evaluation:** There will be **several** homework assignments worth, as a set, 33.33% (1/3 of the final grade) of the total final grade.

The homework must be **each individual's own work**. While consultations with the instructor, tutor, and among students, are part of the learning process and are encouraged, nevertheless, **at the end of all this consultation** each student will have to produce an **individual report** rather than a copy (full or partial) of somebody else's report.

The concept of "late assignments" does not exist in this course (because full solutions are posted on the due date).

**Last date to drop a Fall 2018 (3-credit) course without receiving a grade is Nov. 9, 2018.**

There will also be **one** mid-term (in-class) test worth 33.33% (1/3 of the final grade). **Note Date/Time:** Tuesday, October 30, 2018, 10:00-11:20.

**Note:** Missed tests with good reason (normally medical, and well documented) will have their weight transferred to the final exam. There are no "make up" tests. Tests missed for no acceptable reason are deemed to have been written and failed and are graded "0" (F). There are no "make up" assignments. The only time the weight of an assessed component is transfered to the final is when the component is missed with due cause (illness). This does not apply to assignments since the student has about 3 weeks to do any given assignment.

There will be a **Final Exam** during the University's Exam period. It will be worth 33.33% (1/3 of the final grade).


**Learning Objectives:** Students are expected to:
- correctly use propositional semantics, including truth tables, to establish that an arbitrary propositional formula is a tautology, or a tautological consequence of certain formulas, or a contradiction.
- correctly use propositional and predicate logic semantics toward demonstrating that certain statements (formulas) are not theorems;
- correctly use axioms and rules of inference in formulating proofs (Hilbert style and Equational) in both propositional and predicate logics to certify syntactically the validity of mathematical statements (formulas);
- correctly state and use the deduction theorem in proofs;
- correctly use resolution in propositional calculus as a proof technique;
- correctly use various techniques including mathematical induction to prove properties of the syntax of both propositional and predicate logics.
• correctly use the technique of adding and removing the universal and existential quantifiers in proofs;

If time permits: We will attempt to make time to cover a very brief introduction to computability from the Appendix of the text

ACADEMIC INTEGRITY LINKS
• Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
• Academic Integrity - http://lassonde.yorku.ca/academic-integrity

STUDENT LINKS
• Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
• Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
• Academic Accommodation for Students with Disabilities - http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/
• Counselling and Disability Services - http://cds.info.yorku.ca/
• York University’s Policies on Sexual Violence - http://secretariat-policies.info.yorku.ca/policies/sexual-violence-policy-on/
• York University’s Policies on Gender/LGBTQ*/Positive Space - http://rights.info.yorku.ca/lgbtq/

LAND ACKNOWLEDGEMENT
• We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
• The Indigenous Framework for York University: A Guide to Action can be found here: http://indigenous.info.yorku.ca/
• Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

Many courses utilize Moodle, York University’s course website system. If your course is using Moodle, click here to access it.
Moodle @ York University