CSE541 LOGIC for COMPUTER SCIENCE
Spring 2015

Professor Anita Wasilewska

web page: http://www.cs.stonybrook.edu/~ cse541/

Meets: Tuesday, Thursday, 1:00pm - 2:20 pm

Place: ESS 079

Professor Anita Wasilewska

e-mail address: anita@cs.sunysb.edu

Office phone number: 632 8458

Office location: Computer Science Department building, office 1428.

Professor Office Hours: Tuesday, Thursday, 11:30am - 12:30 pm and by appointment.

TA: t.b.a

TA Office Hours: tba

Textbook:

AN INTRODUCTION TO CLASSICAL and NON-CLASSICAL LOGICS
Anita Wasilewska

This is a book in progress

Full Book Text and Lecture Slides are in Downloads on the course web page.

Course Reading Book: Introduction to Mathematical Logic, Fourth Edition
Elliot Mendelson

Course Description: The goal of the course is to make student understand the need of logic as a field and to learn the its formality and basic techniques. I will progress relatively slowly, making sure that the pace is appropriate for all students in the class. The book is written with students on my mind so that they can read and learn by some parts by themselves. The book, and the course is developed to teach not only intuitive understanding of different logics, but (and mainly) to teach formal logic as scientific subject, with its languages, definitions, main theorems and problems.

Grading

There will be TWO MIDTERMS and a FINAL examination. There also will be assigned sets of homework problems students must work out and learn for the tests. The complete solutions to all problems are posted on the course webpage. Students are also responsible to learn and work put all Examples and Exercises in the text book and some PROOFS of the main Theorems.

Homework Problems

Students are responsible for working out and writing DETAILED solutions for Exercises-Homework Problems posted on the course web page and posted in the book.

Solutions to ALL of them are posted - but I encourage students to work on them without looking at the solutions- and check the results with posted solutions.

Students are also responsible to learn and work out all Examples and Exercises in the text book as well as some PROOFS of the main Theorems.

GRADES for the tests will depend on the form, details, and carefulness of written solutions.

TESTS: there will be 3 regular tests and two practice tests

Midterms 1, 2 (100pts each)

Final (100pts)

Practice Midterm 1 (10 extra points)

It is a practice IN CLASS test

Practice Final or **Practice Midterm 2** (10 extra points)

It is a practice take home test.

All test are CLOSED NOTES and CLOSED BOOK. If a student is found using notes or a book during a test, he/she will receive AUTOMATICALLY **0 pts for a given test**.

Practice tests policy

Practice tests are designed to help you to learn what and how much you have learned and what you still don't understand from the material covered by the test. You can take them for your own practice (don't need to submit it), or for extra points (need to submit it).

Final grade computation

During the semester you can earn 300pts or more (in the case of extra points). The grade will be determine in the following way: # of earned points divided by 3 = % grade.

The % grade is translated into letter grade in a standard way i.e.

100 - 90 % is A range; A (100-96%) A- (95- 90%),

89 - 80 % is B range: B- (80 - 83%), B (84 -86%), B+ (87 -89%) ,

79 - 70 % is C range: C- (70- 72%), C (73-76%), C+(77-79%),

69 - 60 % is D range and F is below 60%.

None of grades will be curved

Remark that by the Syllabus you can get **20 extra points** that are PART of computation of your grade in the course.

I might add additional **20 extra points** for work in the course to be **allowed** to count for the grade computation

In case of **additional extra points above allowed 40pts** - they might be counted in your grade computations - but **only for grades below A range** that is a range for passing Ph.D. Quals.

It means that your **grade A range** can be obtained by **ONLY** using your **tests grades** plus additional **40 extra points**- if obtained by additional assignments

It means also that the highest grade one can obtain by using extra points above **allowed 40pts** is B+

All grades **below A- range** will be normalized accordingly

Course Contents and Schedule

The course will follow the book very closely and in particular we will cover some , or all of the following subjects chapters.

Part one Motivation, history, syntax and semantics for classical propositional calculus. Formal symbolic propositional and predicate languages, formal definitions of model, counter model, tautology for propositional logic.

Part two Semantics for some three valued logics.

Part three Formal deductive systems, called also *proof systems*. General definition and examples. Definition of a formal proof. Relationship between proof systems and their semantics, i.e general definition of notions of **soundness and completeness** of a given proof systems relatively to given semantics. Definition of a logic as a complete proof system.

Part four Hilbert style proof systems for classical propositional logic. Proofs of DEDUCTION theorem, and two different proofs of the COMPLETENESS theorem for propositional classical logic.

Part five Automated Gentzen type proof systems 1: RS proof system for classical propositional logic. Examples of the automatic proof-search. Constructive proof of COMPLETENESS theorem. Original Gentzen proof system.

Part six A Hilbert style proof system for Intuitionistic Logic. Relationship between Intuitionstic and Classical logics.

Part seven Automated proof systems 2: Gentzen proof system for Intuitionistic Logic. Heuristic decision procedures.

Part eight Languages and semantics for classical predicate logic; Hilbert Proof systems and proof of completeness theorem.

Part nine Automated Gentzen type proof systems 3: QRS proof system for classical predicate logic. Examples of the automatic proof-search. Constructive proof of COMPLETENESS theorem. Original Gentzen proof system for classical and Intuitionistic predicate Logics.

Part ten A Hilbert style proof systems for Modal Logics S4 and S5. Relationships with Intuitionistic Logic.

In particular we will cover the following chapters.

Chapter 1 Introduction: Mathematical Paradoxes and Computer Science Puzzles

Chapter 2 Introduction to Classical Propositional Logic (reading)

Chapter 3 Propositional Languages

Chapter 4 Classical Propositional Semantics

Chapter 5 Some Extensional Three and Many Valued Logics Semantics

Chapter 6 Classical tautologies, Logical Equivalences and Equivalences of Languages

Chapter 7 General Proof Systems

Chapter 8 Hilbert Proof Systems; Deduction Theorem

Chapter 9 Two Proofs of Propositional Classical Logic Completeness Theorem.

Chapter 10 Hilbert Proof Systems for Intuitionistic Propositional Logic, Connections between Classical and Intuitionistic Logics.

Chapter 11 Classical Automated Proof systems for Classical Propositional Logic: System RS and original Gentzen System.

Chapter 12 Gentzen Proof Systems for Intuitionistic Logic

Chapter 13 Predicate Logic Languages, Classical Predicate Logic Semantics, Hilbert Proof system and proof of Completeness Theorem.

Chapter 14 Automated Proof systems for Classical Predicate Logic: System QRS and original Gentzen System.

Chapter 15 Hilbert and Gentzen Proof Systems for Intuitionistic Predicate Logic

Chapter 16 Introduction to Modal Logics, Modal S4 and S5 and its connections with Intuitionistic logic.

Mendelson Book Goedel Incompleteness Theorem

TESTS SCHEDULE

This is preliminary schedule and it might be changed.

Changes will be advertised on the course web page.

Practice Midterm 1 Thursday, March 5, in class.

Midterm 1 Tuesday, March 10, in class.

Spring Break March 16 -23

Midterm 2 Tuesday, April 28, in class.

FINAL Finals week May 13 - 22, exact time and place t.b.a.

Academic Integrity Statement Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Stony Brook University Syllabus Statement If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or http://http://studentaffairs.stonybrook.edu/dss They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website:

http://www.sunysb.edu/ehs/fire/disabilities.shtml