CSE541
LOGIC for COMPUTER SCIENCE
Fall 2022

Professor Anita Wasilewska

Course Webpage:
http://www3.cs.stonybrook.edu/~ cse541

Time: Tuesday, Thursday 6:30 pm - 7:50 pm

Place : Frey Hall 100

Professor Anita Wasilewska

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Office phone (631) 632 8458

Office location: New Computer Science Department, office 208

Office Hours: Tuesday, Thursday 1: 30 pm - 2:30 pm item[] In person in the Office

I also read emails DAILY and respond within a day- two to students e-mails

Teaching Assistants tba on course webpage

TAs office hours: tba

TA e-mail tba

TA Office Location tba

Course TEXTBOOK

Anita Wasilewska

LOGICS FOR COMPUTER SCIENCE: Classical and Non - Classical

Springer Nature Switzerland AG 2018 2018

SBN 978-3-319-92590-5 ISBN 978-3-319-92591-2 (e-book)

https://www.springer.com/us/book/9783319925905

VIDEO LECTURES

We have a YOUTUBE CHANNEL: **LOGIC, Theory of Computation**

https://www.youtube.com/channel/UCLZp06JC9yit6M_YW3XuvIw

The first 4 Lectures are for the Theory of Computation, the **LOGIC Lectures** follow.

The YOUTUBE CHANNEL contains a set of **VIDEOS** filmed in Stony Brook TV Studio that cover Chapter 1 to Chapter 11 of the BOOK.

Please use them as a suplement to my Lectures when you study at home.

Course webpage contains TWO SETS of **Lectures SLIDES**

L1. A set of very detailed **CLASS Lectures** that are complementing the **Videos Lectures**.

CLASS Lectures are more detailed and contain many more examples and problems than the Videos Lectures. There are 3 - 5 CLASS Lectures for one Chapter of the book. i.e for one VIDEO Lecture.

The Class Lectures. contain a lot examples and carefully written detailed **solutions** for many of the homework problems.

L2. VIDEO Lectures are created especially for the Book Chapters VIDEOS so students can follow the **Video Lectures**, chapter by chapter, with exactly the same slides in hand that were used in the the VIDEOS.

Course Goal

The goal of the course is to make student understand the need of, and to learn the formality of logic. 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 language, definitions and problems.

I will progress relatively slowly, making sure that the pace is appropriate for the students in class. The book is written with students on my mind so that they can read and learn by themselves, even before coming to class. For sure, it is also essential to study after the class.

Important

Students are responsible to study chapters examples and problems solutions that are not included in the Lectures Slides and do the Homework Assignments located at the end of the chapters. They may be included in Quizzes and Tests.

TESTING

ALL QUIZZES and TESTS, including the FINAL Examination will be given in CLASS.

The PRELIMINARY schedule is posted below and on the course webpage. Changes will be posted on the course webpage and on Blackboard Announcements.

WE DO NO NOT GIVE MAKE-UP TESTS.

GRADING PRINCIPLES and WORKLOAD

Workload

There will be 2 Quizzes, Midterm, a Practice Final (for extra credit), and Final examinations

The consistency of your efforts and work is the most important for this course.

None of the grades will be curved

Records of students points are kept on BLACKBOARD

Contact the TA for information about grading, grades changes, etc....

TESTS and **Quizzes** cover Lectures and Book Chapters only for the portion of material that was

covered (see Weekly STUDY PLAN) before the dates of tests.

Quizzes (total 50 pts)

There will be 2 quizzes, 25 points each

No make-up for quizzes except of important, well proven reasons

Each quiz will consist of **3 - 5 questions**

Quizzes and Tests problems will be taken mainly from examples, exercises and problems solved in the

Textbook and from Homework Assignments located at the end of the chapters of the book,

or will be similar to problems from previous Quizzes and Tests as published on the course Webpage.

Midterm (75pts)

Midterm will covers material from Q1 and material covered after Q1 in class before Midterm

Practice Final (15 extra pts) - it is a take home test

Final (75pts)

Final will cover mainly material covered after Midterm including material from Q2 and covered after Q2, and on Practice Final. But there will be 1-2 questions from the material covered before Midterm.

Extra Credit I may give some extra credit problems on Tests.

Test and Quizzes Policy

We **do not give makeup** tests or quizzes except for documented cases of illness or other emergencies.

In a case of documented **cheating** a student or all others involved get **0pts** for a test.

Previous TESTS and Quizzes

I posted a collection of past Quizzes and Tests on the course Webpage. They are designed to help you to learn what you have learned and what you still may not understand.

Final grade computation

You can earn up to 200 points + x extra credit points = (200 + x) points during the semester.

Extra points are BENEFICIAL for students as they add to the TOTAL number of points!!

None of the grades will be curved

The grade will be determined in the following way:

# of earned points divided by 2 = % grade.

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

100 – 95 % is A, 94 – 90 is $A-$,
89 – 86% is $B+$, 85 – 83 % is B, 82 – 80 % is $B-$,
79 – 76 % is $C+$, 75 – 73 % is C, 72 – 70 % is $C-$,
69 – 60 % is D range and F is below 60%.

QUIZZES and TESTS UPDATED SCHEDULE

Changes, if any, will be posted on Blackboard and the course Webpage

Q1 Tuesday **September 27**

Fall Break October 10 - 11

MIDTERM Thursday, **October 20**

Q2 Thursday, **November 17**

Thanksgiving Break November 23 - 27

Practice Final - posted **November 29** - due **December 1**

Last Day of classes December 5

FINAL - **December 8**, 5:30pm - 8:00pm

COURSE CONTENT

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

1. Paradoxes and Puzzles (Chapter 1)

2. Introduction to classical Logic (Chapter 2).
Propositional and predicate languages. AI languages. Basic propositional and predicate tautologies. Equational Laws for quantifiers.

3. Propositional Semantics: Classical and Many Valued (Chapter 3).
Formal propositional languages. Classical semantic: formal definitions of model, counter model, tautology. Equivalence of propositional languages, Some many valued semantics.

4. General Proof Systems: Syntax and Semantics (Chapter 4).
General definition and examples. Definition of a formal proof. Relationship between proof systems and their semantics. 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.

5. Hilbert Proof Systems: Completeness of Classical Propositional Logic (Chapter 5).
Hilbert style proof systems for classical propositional logic. Proofs of the Deduction theorem, and two different proofs of the Completeness theorem.

6. Automated Proof Systems:Completeness of Classical Propositional Logic (Chapter 6).
Automated Gentzen type proof systems: RS, RS1, RS2 for Classical logic. Examples of the automatic proof-search. Constructive proof of the Completeness Theorem. Original Sequent Gentzen proof systems GL, G, LK or Classical logic.. Completeness and Hauptxatz Theorems.

7. Introduction to Intuitionistic and Modal logic (Chapter 7).
Hilbert and Gentzen style proof systems for Intuitionistic logic. Heuristic decision procedures. Relationship between Intuitionistic and Classical logics. Hilbert style proof systems for Modal logics S4 and S5. Relationships with Intuitionistic logic.

8. Classical Predicate Semantics and Proof Systems (Chapter 8).
Formal Predicate Languages. Classical semantics. Predicate Tautologies, Hilbert proof systems. Completeness theorem.

9. Hilbert Proof Systems: Completeness of Classical Predicate Logic (Chapter 9).
Reduction of Predicate logic to Propositional logic. Proof of the Completeness Theorem.

10. Predicate Automated Proof Systems: Completeness of Classical Predicate Logic (Chapter 10).
Automated Gentzen type proof system QRS. Constructive proof of the Completeness Theorem.

11. Formal Theories and Gödel Theorems (Chapter 11).
Definition and examples of formal theories. Formal theory of Natural numbers PA (Peano Arithmetic). Consistency and Completeness of formal theories. Gödel Incompleteness Theorems.

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or via e-mail at: sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

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

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.