

**CSE371 MAT371
LOGIC
SPRING 2024
Professor Anita Wasilewska**

Course Webpage:

<http://www3.cs.stonybrook.edu/~cse371>

Time: Tuesday, Thursday 4:00pm - 5:20 pm

Place : Earth&Space 079

Professor Anita Wasilewska

e-mail anita@cs.stonybrook.edu

Office phone (631) 632 8458

Office location: New Computer Science Department, office 208

Office Hours: Tuesday, Thursday 6:00 pm - 7:00 pm and by Appointment

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

Teaching Assistants tba on Brightspace

TAs office hours: tba

TA e-mail to be announced

TA Office Location 2126 Old CS Building

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 supplement 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 **Video 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 Undergraduate Bulletin Description:

A survey of the logical foundations of mathematics: development of propositional calculus and quantification theory, the notions of a proof and of a model, the completeness theorem, Godel's incompleteness theorem. This course is offered as both CSE 371 and MAT 371

Prerequisite: CSE 150 or CSE 215 or MAT 200 or MAT 250

Credits: 3 credits

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 Problems located at the end of the chapters. Problems are similar to the examples and and detailed solutions in the Chapter and previous tests solutions posted on the course webpage. Use them for extra practice.

TESTING

All tests are will given in CLASS.

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

Make-up Exams

The Course Policy on make-up exams, is consistent with university policy on Student Participation in University Sponsored Events, he policy on Final Exams and the New York State Education Law regarding Equivalent Opportunity and Religious Absences as defined in the UNDERGRADUATE BULLETIN <https://www.stonybrook.edu/sb/bulletin/current/>

Course statement

Additionally, we would provide make-up tests in a case of legally documented health problems

GRADING PRINCIPLES and WORKLOAD

Workload

There will be a Midterm test, a Practice Final (for extra credit), and a Final examination.

We will also have each 2-3 weeks One Problem Quizzes for 1-2 extra points given in class without fixed dates.

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 Brightspace

Contact the **ONLY TAs** for information about grading, grades changes, etc....

TESTS cover Lectures and Book Chapters only for the portion of material that was **covered** in class before the dates of tests. Practice Final will cover material after Midterm. Final will contain 1-2 Problems from Midterm material and Problems from the material covered after Midterm.

Tests problems will be taken mainly from examples, exercises and problems solved in the Book or will be similar to problems from previous Tests as published on the course Webpage.

Midterm (100pts)

Midterm will cover material from all Lectures given in class before Midterm

Practice Final (15 extra pts) - it is an in class test and will have Problems from material covered after Midterm.

We will correct only one problem and post the solutions for you to study for Final.

Final (100pts)

Final will cover mainly material Lectured after Midterm but there will be 1-2 questions from Midterm material.

TESTS POLICY

We **give makeup** tests in all documented cases of Illness or other documented emergencies.

We also follow the policy on **make-up exams**, which is consistent with university policy on **Student Participation in University Sponsored Events**, the policy on **Final Exams** and the New York State Education Law regarding **Equivalent Opportunity** and **Religious Absences** as stated in the **Ungergraduate Bulletin** <https://www.stonybrook.edu/sb/bulletin/current/>

Previous TESTS

I posted a collection of past 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%.

TESTS PRELIMINARY SCHEDULE

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

We will have each 2-3 weeks **One Problem Quizzes** for **1-2 extra points** given in class. The first one will be on Thursday, **February 1**, the next will follow in 2- 3 weeks intervals advertised in class

Spring Break March 11 - March 17

MIDTERM Thursday, **March 21**

Practice Final Thursday, **April 25**

Last Class Thursday, May 2

FINAL - during the Finals Period May 6 - May 15

COURSE CONTENT

The course will follow the book very closely and in particular we will cover **some 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 Hauptatz 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.

Academic Dishonesty

The following statement about academic dishonesty, is required to be included in syllabi for all undergraduate courses:

"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. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at the academic judiciary website."

Be advised that any evidence of academic dishonesty will be treated with utmost seriousness. Those involved will be prosecuted to the fullest extent permitted by the University and College policies.

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.

Academic Technologies Statement

Academic Technologies has created optional statements that you can add to your syllabus that include support information for students who need to use tools that Stony Brook provides such as: Brightspace, Respondus Lockdown Browser, Digication, VoiceThread, and TurningTechnologies.

General IT help information is available at

<https://you.stonybrook.edu/academictechnologyservices/technology-statements-for-syllabi/>