

CSE581 Computer Science Fundamentals: Theory Fall 2025

Professor Anita Wasilewska

Course Webpage:

<http://www3.cs.stonybrook.edu/~cse581>

Time: Tuesday, Thursday 2:00pm - 3:20 pm

Place : JAVITS 102

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 to students e-mails

Teaching Assistants tba on Brightspace

TA Office Location 2126 Old CS Building

COURSE TEXTBOOKS

B1 LOGICS FOR COMPUTER SCIENCE: Classical and Non - Classical

Anita Wasilewska

Springer Nature Switzerland AG 2018 SBN 978-3-319-92590-5 ISBN 978-3-319-92591-2 (e-book)

We will cover Chapter 2 (Introduction to Classical Propositional and Predicate Logic) and an OVERVIEW of **some parts** of Chapters 3, 4, 5. In particular we define extensional semantics for classical and many valued Logics, followed by definitions General, Hilbert, and Automated Proof Systems, and a proof of Completeness Theorem for the Classical Propositional Logic.

B2 ELEMENTS OF THE THEORY OF COMPUTATION

Harry R. Lewis and Christos H. Papadimitriou

Prentice Hall, Second Edition, 1998

We cover Chapter 1. This is Discrete Mathematics Basics segment of the course. We supplement it by Special Discrete Mathematics Lectures. We also present an OVERVIEW of **some parts** of Chapters 2 - 4, in particular we discuss Regular and Context Free Languages, Finite and Push Down Automata, and Turing Machines.

B3 CONCRETE MATHEMATICS: A Foundations for Computer Science

R. Graham, D. Knuth, O. Patashnik

Addison-Wesley Publishing Company, Third edition, 1989

We cover content of Chapter 1 (Recurrent and Closed Form Formulas, Repertoire Method), some of Chapter 2 (Sums and Recurrences, Finite and Infinite Calculus, Infinite Sums), and some of Chapter 4 (Number Theory).

VIDEO LECTURES

We have a YOUTUBE CHANNEL: **LOGIC, THEORY OF COMPUTATION**

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

The first 4 Video Lectures are for the Theory of Computation and cover Chapter 1 to Chapter 5 of the book **B2**. The Logic Lectures follow and cover all 11 Chapters of the book **B1**.

The YOUTUBE CHANNEL contains a set of professional **VIDEOS** filmed in Stony Brook TV Studio.
Please use them as a supplement to class Lectures when you study at home

Course Graduate Bulletin Description:

The SBU Graduate Program in Data Science (DAS) features both MS and PhD degree programs in Data Science. It is jointly offered by the Department of Applied Mathematics and Statistics (AMS), and the Department of Computer Science (CS), both part of the College of Engineering and Applied Sciences (CEAS). Students will receive vigorous training in Data Science encompassing topics such as statistical analysis, big data analysis/management and fundamentals of computing.

Prerequisite: no prerequisites

Credits: 3 credits

COURSE STRUCTURE

The course presents **Fundamentals of Computer Science Theoretical Foundations** divided into THREE PARTS:

P1 Logic, **P2** Discrete Mathematics, Theory of Computation, **P3** Concrete Mathematics.

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

WORKLOAD and GRADING PRINCIPLES

WORKLOAD There will be **2 Midterms**, and a **Final** examination

Midterm 1 (100pts) Midterm 1 covers material from all Lectures given in class before Midterm1

Midterm 2 (100pts) Midterm 2 covers material from all Lectures given in class before Midterm 2

Final (100pts) - Final covers material from Midterm1, Midterm 2, and material Lectured after Midterm 2

Records of students points are kept on Brightspace. Contact **TAs** for information about grading, grades changes, etc....

Make-up TESTS POLICY We give makeup tests only in documented cases of Illness or other documented emergencies.

We 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/>

GRADING PRINCIPLES

HONESTY of students is the most important part of the class work.

All TESTS are "closed book" - no cell phones, no computers, desks must be empty - no extra papers, no communication with other students. **Professor** supervises all tests together with course TAs. Anybody **violating** these rules would have to immediately submit the test to the **Professor** and **leave** the class.

Student will get **0pts** for the TEST and will be reported, if needed, to the University **Academic Judiciary** as stated and explained the the Syllabus' **Academic Integrity Statement**

Extra Credit There will be 2 One Page **Quizzes** , each for 10pts given in class for extra points. You can earn up to **20pts** extra credits for the course.

FINAL GRADE COMPUTATION

You can earn up to 300 points + x extra credit points = (300 + x) points during the semester.

None of the grades will be curved

The grade will be determined in the following way:

of earned points divided by 3 = % 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

PRELIMINARY TESTS SCHEDULE

This is a preliminary schedule. The changes and updates, if any, will be advertised in the GENERAL NEWS section the course webpage

MIDTERM 1 Tuesday, **October 7**

Fall Break October 13 - October 14

MIDTERM 2 Tuesday, **November 11**

Thanksgiving Break November 26 - 30

Last Day of classes December 8

FINAL during Final Period - December 10 - 18, exact date t.b.a

Extra Credit Quizzes Schedule

Quizzes are given on TUESDAYS during last 25 minutes of class September 23 and November 25

Remark Pay attention to Extra Credit Quizzes schedule - there is **no makeups**.

COURSE SCHEDULE and CONTENT

PART P1: LOGIC - from the book B1

Approximately **4 weeks** of classes

We cover Chapter 2, **relevant parts** of Chapters 3, 4, 5.

In particular we will cover **some material** from the following chapters and subjects.

- 1. Chapter 1** Paradoxes and Puzzles - READING and a full Lectures VIDEO
- 2. Chapter 2** - Introduction to classical Logic
Propositional and predicate languages and Intuitive classical Semantics. Basic propositional and predicate tautologies.
Equational Laws for quantifiers.
OVERVIEW Lectures in class and a full Lectures on VIDEO
- 3. Chapter 3** - Formal definitions of model, counter model, tautology. Some many valued semantics.
OVERVIEW Lectures in class and a full Lectures VIDEO

4. Chapter 4 - General Proof Systems: Syntax and Semantics

Relationship between proof systems and their semantics. Definition of notions of *soundness* and *completeness* of a given proof systems relatively to given semantics.

OVERVIEW Lecture in class and a full Lectures VIDEO

5. Chapter 5 - Hilbert Proof Systems: Completeness of Classical Propositional Logic

OVERVIEW Lecture in class and a full Lecture VIDEO

PART P2: DISCRETE MATHEMATICS and THEORY OF COMPUTATION - from the book B2 and Lecture Notes

Approximately **8 weeks** of classes.

We will cover in detail Chapter 1 of **B2**. This is Discrete Mathematics Basics segment of the course. We supplement it by Special Discrete Mathematics Lectures and present OVERVIEW Lectures of Chapters 2, 3, 4 - in particular we cover classes of Regular

and Context Free Languages, and heir relationships with Finite Automata, and and Push-down Automata. We will also present additional, more advanced topic of the Discrete Mathematics in a series of Special Lectures created for this course.

The **Midterm 1** is scheduled before the Fall Break for **October 9** and will cover material from PARTS **P1** and **P2** covered in class before the test.

PART P3: CONCRETE MATHEMATICS - from the book B3 and special Lecture Notes

Approximately **2 weeks** of classes.

We will cover content of Chapter 1 (Recurrent and Closed Form Formulas, Repertoire Method), some of Chapter 2 (Sums and Recurrences, Finite and Infinite Calculus, Infinite Sums), and some of Chapter 4 (Number Theory).

The book **B3** *Concrete Mathematics: A Foundations for Computer Science* introduces the mathematics that supports advanced computer programming and the analysis of algorithms. It is both a partner to abstract mathematics and a blending of *CONTINUOUS* and *DISCRETE* mathematics. It is defined in the book as "a controlled manipulation of (some) mathematical formulas using a collection of techniques for solving problems". Original textbook was an extension of "Mathematical Preliminaries" part of Knuth book *ART OF COMPUTER PROGRAMMING*. Concrete Mathematics is supposed to help reader (and hopefully will) in the art of writing programs, or thinking about them.

SYLLABUS STATEMENTS

Basic Needs

If you are concerned about resources related to your basic needs, including access to nutritious food and stable housing, please contact the Student Support Team. They will be able to listen to your story, connect you with possible resources, and provide stigma-free support.

Academic Dishonesty Statement

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.

SASC Student Accessibility Support Center

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