CSE581
Computer Science Fundamentals: Theory
SPRING 2024
Professor Anita Wasilewska

Course Webpage:
http://www3.cs.stonybrook.edu/~cse581

Time: Tuesday, Thursday  1:00pm - 2:20 pm
Place: Mellville Library W4550

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
We will cover Chapter 2 (Introduction to Classical Propositional and Predicate Logic), a detailed OVERVIEW of parts of
Chapter 3 (Formal syntax and propositional extensional semantics, classical and non-classical), and of Chapters 4, 5, 6
(Proof Systems, Completeness Theorems, and Automated Theorem Proving Systems).

B2  ELEMENTS OF THE THEORY OF COMPUTATION
Harry R. Lewis and Christos H. Papadimitriou
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 Chapters 2, 3, 4 - in particular of Regular and Context Free
Languages, Finite Automata, and Turing Machines.

B3  CONCRETE MATHEMATICS: A Foundations for Computer Science
R. Graham, D. Knuth, O. Patachnik
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/UCLZp06JC9yi6M_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

Make-up Exams
The Course Policy on make-up exams, 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 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, a Practice Final (for extra credit), and a Final examinations.
We will also have each 2-3 weeks One Problem Quizzes for 1-2 extra points with dates advertised as they come.

None of the grades will be curved

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

TESTS cover Lectures and relevant portions of Book Chapters only for the material that was presented in our Class Lectures before the dates of tests. Practice Final will cover material after Midterm. Final will contain 1-2 Problems from Midterm material and Problems from from the material covered after Midterm.

Midterm (100pts) Midterm covers material from all Lectures given 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 of our choice and post the solutions for you to study for Final.

Final (100pts) - Final covers 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 Undergraduate Bulletin  https://www.stonybrook.edu/sb/bulletin/current/ 

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:

\[
\text{# of earned points divided by } 2 = \% \text{ grade.}
\]

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 Day of classes    Thursday, May 2

FINAL    - during the Finals Period May 6 - May 15

Course Schedule and Content

PART P1: LOGIC - from the book B1

Approximately 4-5 weeks of classes

We cover Chapter 2 (Introduction to Classical Propositional and Predicate Logic) and relevant parts of Chapter 3 (Formal syntax and propositional extensional semantics, classical and non-classical), Chapters 4, 6 (Proof systems and Automated Theorem Proving), and Chapter 7 (Introduction to Intuitionistic and Modal Logics)

We will cover some material from the following chapters and subjects.

1. Paradoxes and Puzzles - Chapter 1 - READING and a full Lectures VIDEO

2. Introduction to classical Logic - Chapter 2
   OVERVIEW Lectures in class and a full Lectures on VIDEO
3. **Formal Propositional Semantics: Classical and Many Valued** - **Chapter 3**
   OVERVIEW Lectures in class and a full Lectures VIDEO

4. **General Proof Systems: Syntax and Semantics** - **Chapter 4**.
   Relationship between proof systems and their semantics. Definition of notions of *soundness* and *completeness* of a given proof systems relatively to given semantics.
   OVERVIEW Lectures in class and a full Lectures VIDEO

5. **Hilbert Proof Systems: Completeness of Classical Propositional Logic** - **Chapter 5**.
   OVERVIEW Lecture in class and a full Lecture VIDEO

6. **Automated Proof Systems:Completeness of Classical Propositional Logic** - **Chapter 6**.
   Automated Gentzen proof systems for Classical logic. Constructive proof of the Completeness Theorem.
   OVERVIEW Lectures in class and a full Lecture VIDEO

7. **Introduction to Intuitionistic and Modal logic** - **Chapter 7**.
   READING and a full Lectures VIDEO

**PART P2: DISCRETE MATHEMATICS and THEORY OF COMPUTATION** - from the book **B2** and Lecture Notes
Approximately *4 - 5 weeks* of classes.
The **Midterm** is scheduled after the Spring Break for Thursday, March 21 and will cover material from PARTS P1 and P2 covered in class before the Spring Break

I will have a comprehensive REVIEW for MIDTERM SPECIAL LECTURE on Thursday, March 5 to prepare you for the Midterm

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 of Regular and Context Free Languages, Finite Automata, and Turing Machines. We will also present additional, more advanced topic of the Discrete Mathematics in a series of Special Lectures created for this course.

**PART P3: CONCRETE MATHEMATICS** - from the book **B3** and special Lecture Notes
Approximately *4 - 5 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.

**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/](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](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](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.