



"I THINK YOU SHOULD BE MORE EXPLICIT
HERE IN STEP TWO."

CSE 259: Logic in Computer Science (Spring 2017)

(Information herein is subject to change with or without notice.)

Course Description:

Logic has been called the “calculus of computer science”. The argument is that logic plays a fundamental role in computer science, similar to that played by calculus in physical sciences and other engineering disciplines. Indeed, logic plays an important role in computer architecture (Boolean logic, digital gates, hardware verification), software engineering (specification, verification), programming languages (semantics, type theory, logic programming), databases (relational algebra, database query language), artificial intelligence (automated theorem proving, knowledge representation), algorithms and theory of computation (complexity, computability, expressiveness), etc.

This course is a mathematically solid introduction to propositional logic, first order logic, logic programming, and their applications in computer science.

Students who complete this course will

1. Understand the syntax and semantics of propositional logic;
2. Understand the syntax and semantics of first-order logic;
3. Understand how to prove various properties of logical systems;
4. Understand the role of logics in computer science;
5. Be able to use a logic programming language and its implementations.

Course Information:

Time and Place: MWF 2:00 – 2:50PM, BYAC110 (Lecture); MW 12:55 - 1:45 PM (Recitation), BYAC240

Instructor: Yu (“Tony”) Zhang (yzhan442@asu.edu) Office Hours: Friday 10:00AM-noon, and by appointment, BYENG 558

TA: Arpit Sharma (asharm73@asu.edu) Office Hours: Monday 3:00-4:00PM, Wednesday 3:00-4:00PM, and by appointment, Centerpoint

TA (Grader): Deepak Choudhary (dpkchoudhary49@gmail.com)

Textbook and Handouts:

- Textbook (Strongly Recommended):
Logic in Computer Science: Modeling and Reasoning about Systems (2nd edition), Huth and Ryan, Cambridge (ISBN-13: 978-0521543101)
- Handouts:
Problem sets and additional materials will be provided as handouts by the instructor.

Topics:

- Introduction: What is Logic
 - History of logic
 - Overview of logic in computer science
- Propositional Logic: Syntax
 - Well-formed formulas
 - Unique readability (uniqueness of parsing)
- Propositional Logic: Semantics
 - Interpretations, truth tables, satisfaction
 - Satisfiability, entailment, validity
 - CNF / DNF
- Propositional Logic: Proof Theory
 - Induction: strong induction, structural induction
 - Deduction: axioms and inferences in natural deduction
 - Resolution
 - Soundness and completeness of propositional logic
- First-order Logic: Syntax and Semantics
 - Terms, well-formed formulas
 - Interpretations, satisfaction, Herbrand models
 - Satisfiability, entailment, validity
 - Normal forms: prenex normal form, negation normal form, Skolem normal form
 - Substitution

- First-order Logic: Proof Theory
 - Natural deduction for first-order logic
 - Soundness and completeness of first-order logic

- Logic Programming (Answer Set Programming)
 - History
 - Definition of stable models
 - Properties of stable models

- Logic Programming Methodology
 - Generate and test
 - Generate, define and test

- Puzzle Solving by Logic Programming
 - N-Queens puzzle
 - Logic puzzles
 - Sudoku-like grid puzzles
 - Blocks World

Attendance:

Attendance to lectures and recitation sections is measured based on the following criteria: arriving to class on time; paying attention during lectures; respectful listening when the instructor or your peers are speaking; your ability to be fully engaged in your learning without texting, checking your phone or email, or participating in other digital distractions; your ability to stay awake, etc. Keep in mind you start the semester with ALL your points, so don't lose them! Two times late to class, or two times distraction (at the instructor's discretion) will count as one absence. **One absence will lose 1% of your ENTIRE course credit.**

Notification: If a student has to miss a class/test/homework for reasons out of his/her control, he/she should send the instructor an email as soon as possible, but no later than the class/deadline. Bring him an official document (e.g., if you are sick, a doctor's note stating that you are unable to attend/work for a specific period).

Class Participation:

In class, we will discuss problems from each handout except for the ones marked as exercise problems for your own. A volunteer will get bonus credits by successfully presenting a solution in class (an attempt does not count) and upload a written solution on piazza **within 24 hours** of the presentation. The instructor will announce what problems to be discussed in next class, and anyone who wants to present can start writing the solution on the board before the next class starts. If there are more than one volunteer, the chance will be given to the one who has the least credits. Among those who can claim equal chances, the priority goes to the one who wrote the solution first on the board. Successful **solution + presentation + piazza upload** will count 1% bonus credits and

you can earn a **maximum of 5%** bonus credits throughout the course. These should be solutions that you found by yourself, **without help from others**, books and online sources.

Electronic Homework:

Several times during the semester you will receive e-mail messages or printouts with homework problems. **Submission of homework is done via Blackboard; submissions should be compiled on Overleaf as a single PDF file.** Always use the template provided to you, which is adapted from the “Computer Science Homework Template” on Overleaf.

- When you work on these problems, you may **ONLY** consult the textbook, handouts, and your notes. You may discuss with your peers the class materials **but should not discuss the solutions to the problems themselves or share any written solutions, including solution sketches.**
- **Late homework will NOT be accepted** (except for reasons out of the student’s control).
- If you cannot come up with a satisfactory solution, submit your attempted solutions **AND** explain why you think it is not completely satisfactory.
- In some cases, the instructor or the TA may send you additional questions or ask you to clarify your solutions. If you get such a message, you must respond **within 24 hours**; otherwise, we will **NOT** be able to consider your response. You’re responsible for any credit loss due to late responses.

Tests:

There will be two exams and about four quizzes. The first exam will be given after we finish propositional logic. Exams will be announced about 10 days in advance. Quizzes may not necessarily be announced in advance. **There will be no make-up tests or quizzes** (except for reasons out of the student’s control).

Project:

The group term project is to use the logic-programming tool learned in the course to solve some combinatorial search problems, such as puzzles. You may choose your own topic, or the instructor may assist you in selecting one. There will be project proposal due in the middle of the semester, and the final project presentations in class.

Recitation Sections:

The TA will lead recitation sections to help you clarify subject matter that was either not fully understood or inadequately addressed in the limited time of lecture. The TA will lead problem-solving sessions. **Attendance will be checked.**

Piazza:

Discussions, questions & answers are handled via Piazza. **DO NOT** send emails of questions directly to the instructor or TAs; **they will be ignored.** The instructor and TAs will try to respond to any question as soon as possible and within **24 hours**. Please check existing questions before posting a new one since it may have already been asked and answered.

The class Piazza page is at:

- <http://piazza.com/asu/spring2017/cse259/home>

To sign up:

- <http://piazza.com/asu/spring2017/cse259>

Important announcements will be posted on either Piazza or Blackboard. Grades will be posted on the blackboard. Lecture slides will be posted at:

- <http://www.public.asu.edu/~yzhan442/teaching/CSE259>

Unless there is a good reason, anonymous posting is strongly discouraged, and will be deleted.

Grading:

Homework	20%
Project	20%
Quizzes	20%
First Exam	15%
Second Exam	25%
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Total	100%

Final grades will be determined as follows:

- A+: ≥ 95
- A: 90–94.9
- A-: 85–89.9
- B+: 80–84.9
- ...

Grading Questions:

If you believe that there is a mistake in grading, you must inform the TAs or the instructor (who graded the work which will be made clear on the work returned) **within 48 hours** when the graded work was returned to you; otherwise, we will NOT be able to make any changes to the grading.

Laptop/Tablet/Smartphone/Electronic Equipment Policies:

The use of these items is **strongly discouraged** during class hours, **including using them to TYPE notes**. Typing tends to interfere with others listening to the lectures. Taking written notes (i.e., using stylus) on these devices are fine but please be QUIET.

Academic Dishonesty:

If we suspect an academic dishonesty (e.g., cheating or plagiarism), we will report to the Dean's office. If it is decided to be a dishonesty case, the student will get assigned XE, and the AIP file will be maintained in the Dean's office for the violator for 6 years or until the student graduates.

The following is a quote from

<https://provost.asu.edu/sites/default/files/AcademicIntegrityPolicyPDF.pdf>

STUDENT OBLIGATIONS

Each student must act with honesty and integrity, and must respect the rights of others in carrying out all academic assignments. A student may be found to have engaged in academic dishonesty if, in connection with any Academic Evaluation or academic or research assignment (including a paid research position), he or she:

- Engages in any form of academic deceit;
- Refers to materials or sources or uses devices (e.g., computer disks, audio recorders, camera phones, text messages, crib sheets, calculators, solution manuals, materials from previous classes, or commercial research services) not authorized by the instructor for use during the Academic Evaluation or assignment;
- Possesses, reviews, buys, sells, obtains, or uses, without appropriate authorization, any materials intended to be used for an Academic Evaluation or assignment in advance of its administration;
- Acts as a substitute for another person in any Academic Evaluation or assignment; Uses a substitute in any Academic Evaluation or assignment;
- Depends on the aid of others, including other students or tutors, in connection with any Academic Evaluation or assignment to the extent that the work is not representative of the student's abilities;
- Provides inappropriate aid to another person in connection with any Academic Evaluation or assignment, including the unauthorized use of camera phones, text messages, photocopies, notes or other means to copy or photograph materials used or intended for Academic Evaluation;
- Engages in Plagiarism;
- Uses materials from the Internet or any other source without full and appropriate attribution;
- Permits his or her work to be submitted by another person in connection with any Academic Evaluation or assignment, without authorization;
- Claims credit for or submits work done by another;
- Signs an attendance sheet for another student, allows another student to sign on the student's behalf, or otherwise participates in gaining credit for attendance for oneself or another without actually attending;

- Falsifying or misrepresenting hours or activities in relationship to an internship, externship, field experience, clinical activity or similar activity; or
- Attempts to influence or change any Academic Evaluation, assignment or academic record for reasons having no relevance to academic achievement.

The Grade of “XE”

1. The XE grade denotes failure through academic dishonesty. The XE grade will be recorded on the student’s official and unofficial transcript with the notation “failure due to academic dishonesty.”
2. No student with an XE grade on his or her transcript shall be permitted to represent that University in any extracurricular activity or to run for or hold office in any recognized student organization.
3. An AIP file will be maintained in the Dean’s office for the violator for 6 years or until the student graduate.