

INFO I201

Mathematical Foundations of Informatics

Department of Human-Centered Computing

Indiana University School of Informatics and Computing, Indianapolis

Instructor: Louie Zhu, Ph.D.

Prerequisites

Math M118 or higher is strongly recommended. This course assumes students possess mathematical skills covered in high school mathematics. Appendix A of the textbook (Haghverdi, 2007, p. 109) lists some basic mathematical skills you need to have. You may use this list to relearn these skills and refresh your knowledge of high school mathematics.

Substitutions

This is an Analytical Reasoning, List-B course. This course cannot be substituted for any MATH/STAT course that may be required of any IUPUI student.

Course Description

An introduction to the suite of mathematical and logical tools used in information sciences, including finite mathematics, automata and computability theory, elementary probability and statistics, and basics of classical information theory

Extended Course Description

This course explores methods of analytical, abstract, and critical thinking and reasoning. It covers tools in logic and discrete mathematics. These tools form an important mathematical foundation for many of the disciplines in the informatics and computing areas and are widely used in information sciences. Topics include propositional and predicate logic, natural deduction proof system, sets, relations, functions, and mathematical induction.

Textbooks

Required

Title: Math foundations of Informatics, 2nd Edition

Author: E. Haghverdi

Edition: 2nd edition

Publisher: ClassPak Publishing, IU, Bloomington, Indiana, 2007

ISBN: 1-4211-0697-3

Reserved available at the University Library reservation desk

Title: Discrete Mathematics with Application

Author: Susanna S. Epp.

Edition: 4th edition

Publisher: Brooks Cole. 2011

ISBN: 0-495-39132-8

Recommended

Title: Logic: An introduction (Fundamentals of Philosophy)

Author: Grey Restall

Publisher: Routledge, 2006

ISBN: 978-0-415-40068-8

Principles of Undergraduate Learning (PUL)

Learning outcomes are assessed in the following areas:

- 1A. Core communication: written, oral and visual skills
- 1B. Core communication: quantitative skills
- 1C. Core communication: information resources skills
- 2. Critical thinking
- 3. Integration and application of knowledge
- 4. Intellectual depth, breadth, and adaptiveness
- 5. Understanding society and culture
- 6. Values and ethics

This course is designed to demonstrate one or more of the University's principles of undergraduate learning (PULs), with emphasis on PUL 1B, 2, and 4.

Learning Outcomes

Upon completion of this course, students will be able to	PUL	Assessment
1. Construct the truth tables and truth trees for a propositional formula.	PUL 1B, 2, 4	HW 1, Quiz 1, Exam 1
2. Determine whether formulas are tautologies, logically equivalent, consistent, or valid.	PUL 1B, 2, 4	HW 2, 3, Quiz 2, 3, Exam 1
3. Construct a formal proof to verify the validity of a logical argument.	PUL 1B, 2, 4	HW 4, 5, Quiz 4, 5, Exam 1
4. Translate an argument from English to propositional logic.	PUL 2, 4	HW 3, Quiz 3, Exam 1
5. Define sets and perform operations associated with sets.	PUL 2, 4	HW 6, Quiz 6, Exam 1
6. Prove subset inclusion and set identities.	PUL 2, 4	HW 7, Quiz 7, Exam 1
7. Define relations and function.	PUL 1B, 2, 4	HW 7, Quiz 7, Exam 1

8. Analyze problems and propose solutions using the tools and theories of predicate logic.	PUL 1B, 2, 4	HW 8, 9, Quiz 8, 9, Exam 2
9. Give formal proofs of arguments in predicate logic.	PUL 2, 4	HW 10, Quiz 10, Exam 2
10. Prove formulas that involve numbers using weak inductions	PUL 2, 4	HW 11, Quiz 11, Exam 2

Expectations, Guidelines, and Policies

Homework assignments

1. **Reading:** Reading materials from the required textbook will be assigned regularly. Although they will not be collected and graded, they are critical to your success in this course.
2. **Homework:** Homework assignments are assigned weekly. Each assignment consists of a set of problems chosen from the textbooks and other sources. Problems in an assignment are typically working problems. Students are asked to critically analyze the problems and then propose and justify solutions to them. Homework assignments are designed to help students understand the materials covered in class lectures. All assignments are paper based.

Quizzes

There is usually a quiz along with every homework assignment. Quizzes assess your understandings of materials covered in lectures and homework assignments. All quizzes are paper based.

Exams

There are two exams. Neither exam is cumulative for the entire course. Exam I is over Chapters 1, 2, and 3; Exam II is over Chapters 4 and 5. All exams consist of problems that are similar to those in homework assignments and quizzes, but may be more complex and difficult.

Tentative weekly schedule

Week	Date	Topic	Homework	Quiz/Exam
1	Jan. 8	<ul style="list-style-type: none"> • Course introduction • Propositional logic, part 1 		Syllabus Quiz
2	Jan. 15	<ul style="list-style-type: none"> • Propositional logic, part 2 	HW 1	Quiz 1
3	Jan. 22	<ul style="list-style-type: none"> • Propositional logic, part 3 	HW 2	Quiz 2
4	Jan. 29	<ul style="list-style-type: none"> • Propositional logic, part 4 	HW 3	Quiz 3
5	Feb. 5	<ul style="list-style-type: none"> • Propositional logic, part 5 	HW 4	Quiz 4
6	Feb. 12	<ul style="list-style-type: none"> • Propositional logic, part 6 	HW 5	Quiz 5
7	Feb. 19	<ul style="list-style-type: none"> • Set theory, part 1 	HW 6	Quiz 6
8	Feb. 26	<ul style="list-style-type: none"> • Set theory, part 2 	HW 7	Quiz 7

9	Mar. 5	• Practice session		Exam I
10	Mar. 12	• Spring break		
11	Mar. 19	• Predicate logic, part 1		
12	Mar. 26	• Predicate logic, part 2	HW 8	Quiz 8
13	Apr. 2	• Predicate logic, part 3	HW 9	Quiz 9
14	Apr. 9	• Predicate logic, part 4	HW 10	Quiz 10
15	Apr. 16	• Mathematical induction		
16	Apr. 23	• Practice sessions	HW 11	Quiz 11
17	May 1	• None		Exam II

Grading

Activity	% of Total
Attendance	5
Participation (individual and group)	10
Homework assignments	20
Quizzes	20
Exam I	20
Exam II	25
Total	100

Minimum percentage for each letter grade:

Letter Grade	Minimum %	Interpretation
A+	97	Professional level work, showing highest level of achievement
A	93	Extraordinarily high achievement, quality of work; shows command of the subject matter
A-	90	Excellent and thorough knowledge of the subject matter
B+	87	Above average understanding of material and quality of work
B	83	Mastery and fulfillment of all course requirements; good, acceptable work
B-	80	Satisfactory quality of work
C+	77	Modestly acceptable performance and quality of work
C	73	Minimally acceptable performance and quality of work

C-	70	Unacceptable work (course must be repeated for credit)
D+	67	Unacceptable work (course must be repeated for credit)
D	63	Unacceptable work
D-	60	Unacceptable work
F	0	Unacceptable work

Attendance Policy

A basic requirement of this course is that you will attend every class, arrive on time, and participate in all class activities. Class attendance is required for this course. It entails being present and attentive for the entire class period. Attendance shall be taken in every class at <https://www.iupui.edu/~info201/signin>. If you do not sign in while in class, you shall be marked absent. The instructor is required to submit to the Registrar a record of student attendance, and action shall be taken if the record conveys a trend of absenteeism. If one signs in then leaves, the sign-in record will be deleted and the class shall be marked absent. Leaving a class early must get approval by the instructor or the class shall be marked absent.

Only the following are acceptable excuses for absences:

- Death in the immediate family (e.g. mother, father, spouse, child, or sibling)
- Hospitalization or serious illness
- Jury duty; court ordered summons
- Religious holidays
- University/school coordinated athletic or scholastic activities
- An unanticipated event that would cause attendance to result in substantial hardship to one's self or immediate family

Excused absences must be explained with the submission of appropriate documentation to the satisfaction of the instructor. Documents must be submitted to the instructor within one week of returning to class after the absence. Absences that do not satisfy the above criteria are considered unexcused. To protect your privacy, doctor's excuses should exclude the nature of the condition and focus instead on how the condition impacts your attendance and academic performance.

Please note a minor illness such as cold or flu is not considered a valid excuse for missing a class. If you have a serious illness, a psychological disorder, or a chronic health condition, consider going through the Adaptive Educational Services (AES) office.

Missing class reduces your grade through the following grade reduction policy: You are allowed two excused or unexcused absences. Each absence thereafter, unless excused, will result in a reduction of 1 point (out of 100 points) of your final course grade. If you miss more than six classes (equivalent to three weeks of classes), you will automatically get an F for the course grade. Missing class may also reduce your grade by eliminating opportunities for class participation and interaction with peer classmates and instructor. For all absences, the student is responsible for all covered materials and assignments

Participation Policy

Learning is not a passive process. All learning requires active participation. You will be doing collaborative learning activities in every class. You will learn not only from your instructor and the course materials, but also from one another. Students will be organized into groups during the first week. These are your groups for the entire semester. Sometimes working in groups can be difficult. Working in teams and learning to communicate and listen are key skills to develop and improve and they are part of the course objectives. Each group will work on in-class activities together and will lead class discussions on a rotating basis. Class participation will be assessed at both the group and individual levels and each is worth five percent (5%) of your final course grade. Therefore, ten percent (10%) of the course grade will depend on participation and contributions to class activities.

Expectations for class participation at the individual level include:

- a. Engagement: Proactively and regularly volunteer, contribute to class discussion, ask relevant questions, or respond to others' questions.
- b. Attention: Actively and respectfully listen to your instructor and peers and maintain full engagement throughout class.
- c. Behavior: Never display disruptive or inappropriate behavior in class and never use smart phone or laptop to conduct course unrelated activities.

At the end of every 4th week, student will evaluate other members in the same group for their participation and contributions on a 1-5 scale, using the following criteria. Each student's individual participation score will be determined using the peer evaluation results.

	Developing, but below expectations (1 – 2 points)	Accomplished/ Meets expectations (3 – 4 points)	Exemplary/ Displays leadership (5 points)
Engagement	Infrequently or never contribute to class discussion, ask any relevant question, or respond to others' questions.	Often contribute to class discussion, ask relevant questions, or respond to others' questions	Proactively and regularly contribute to class discussions, ask relevant questions, or respond to others' questions.
Attention	Sometimes do not pay attention/respectfully listen to the instructor or peers.	Rarely fail to pay attention/respectfully listen to the instructor or peers.	Actively and respectfully listen to the instructor and peers and maintain full engagement throughout class.
Behavior	Sometimes display disruptive or inappropriate behavior in class; sometimes use my smart phone or laptop to conduct course unrelated activities.	Rarely display disruptive or inappropriate behavior in class; never use my smart phone or laptop to conduct course unrelated activities.	Never display disruptive or inappropriate behavior in class; never use my smart phone or laptop to conduct course unrelated activities.

Class participation at the group level will be graded using a 1-5 scoring system. All students in the same group will receive the same group score. Expectations for class participation at the group level include:

- a. Complete group activities with good quality and timely.
- b. Share group work to the whole class.
- c. Lead class discussions as assigned.
- d. Stay focused on group activities.
- e. Get all members participated in activities.

Assignment Policy

This course may be difficult, and may involve concepts and terms you've never encountered. Budget your time accordingly. To ensure fairness to all students, no extra work, extra credit, or anything outside the regular homework and quizzes will be assigned.

Homework assignments are typically assigned on Wednesday and due Wednesday of the following week in class. Exact due date and time will be included in the assignment instructions. Students are responsible for the deadline. Each lab session on Wednesday will include a discussion of the homework problems. The following rules will apply to all assignments:

- a. To receive full credits, an assignment must be turned in by its deadline.
- b. A late assignment is acceptable if it is not more than one hour later than the deadline. A 40% penalty will be applied.
- c. Any work turned in more than one hour late is not acceptable.
- d. Partially completed work will be accepted for partial credits.
- e. The lowest homework assignment score is dropped.

Quiz and Exam Policy

All quizzes are closed book and timed. They must be completed in class within 10 minutes. There will be no makeup quizzes. A missed quiz will receive a zero score. The lowest quiz score will be dropped.

There are two exams. Both exams are closed book and timed. There will be NO makeup exams. Calculators are disallowed. You can bring a standard 8 ½" x 11" paper with notes and formulas.

If you have to miss an exam due to an excused absence, you may request to take the exam before the regularly scheduled date and time. This special accommodation must be requested at least one week in advance. No post-event accommodation will be granted.

Correction of Errors

If a score or attendance is incorrectly recorded on Canvas or the Sign-in application, correction must be made within a week of the item posted. One week after an item is posted, it will not be changed. A maximum of two "I-forgot-to-sign-in" errors in the entire semester may be fixed. To have an "I-forgot-to-sign-in" error fixed, you must provide proper evidences to the satisfaction of the instructor. Proper evidences must be able to show you actually attend the class in question. These evidences may include the work you completed in class or emails from at least two classmates who could vouch your

attendance. Your attendance report will display after you sign in every time. Be sure you carefully review your report and notify me via emails any discrepancy.

Honor Code

Passcode or password is used to ensure closed-book quiz, exam, or sign-in is completed in class. Leaking a password or passcode to allow someone to take the quiz or exam or to sign in outside class is against the course policies and a violation of Students Conduct code.

You may discuss your homework and projects with classmates. However, all submitted work must be your own. In the case of a group assignment, you must document who you worked with and describe the nature of your collaboration. Presenting other people's work as your own without properly crediting the actual source constitutes fraud.

Presenting other people's work as your own without properly crediting the actual source constitutes fraud. Plagiarism undermines the academic integrity of Indiana University. Plagiarism will not be tolerated. Any one detected as having been plagiarizing will be disciplined according to the IUPUI Student Code of Conduct. Multiple incidences of plagiarism may result in an F of the course grade. Academic misconduct will be reported using this form: <http://studentaffairs.iupui.edu/doc/student-rights/academic-misconduct-reporting-form.pdf>

Taking Good Notes in Class

Presentation software will be used to present text and diagrams. However, due to the complexity of mathematical equations and formulas, the whiteboard will be used to present formulas and equations. Answers to practice questions and examples presented in class will not be included in presentation slides. Instead, they will be presented and explained in class using the whiteboard. This will allow the instructor to show students the logic behind the answers. The instructor strongly believes this approach benefits the students more than simply presenting the answers. Therefore, it is critical for every student to take good notes in class. Learning to take lecture notes is a key skill to succeed academically.

Course Communications

Communication for this course will be administered via Canvas. All announcements, assignments, grades, emails, etc. will take place in that medium. Please refrain from relying on direct email for course-related questions to the instructor if avoidable. The instructor should respond to emails within 48 hours, excluding weekends and holidays, and announce periods of extended absence in advance.

Incomplete

The instructor may assign an Incomplete (I) grade only if at least 75% of the required coursework has been completed at passing quality and holding you to previously established time limits would result in unjust hardship to you. All unfinished work must be completed by the date set by the instructor. Left unchanged, an Incomplete automatically becomes an F after one year. For more information, please visit <http://registrar.iupui.edu/incomp.html>.

Use of Personal Electronic Device

“Personal electronic device” means any device that electronically communicates, sends, receives, stores, reproduces, or displays voice and/or text communication or data. These include, but are not limited to, cellular phones, pagers, smart phones, music and media players, gaming consoles, tablets, laptops, and personal digital assistants. Using such a device distracts the student using the device, his/her neighbors, and the professor. Additionally, this usage is viewed as disrespectful to all others. The quality of the learning experience suffers when these discourteous distractions occur. Therefore, use of such a device is strictly prohibited when a class session is undertaking. They shall be kept out of sight and powered off or silenced during a class meeting. If such a device must be kept on due to a special medical circumstance for self or family member, prior approval by the instructor shall be obtained. Use of a tablet or laptop may be permitted if it is for taking notes or conducting instructional activities. Students should check with the instructor about permissible devices in class.

Right to Revise

The instructor reserves the right to make changes as necessary to this syllabus. If changes are necessitated during the term of the course, the instructor will immediately notify students of such changes and nature of change(s) on Canvas Announcements.

Other Policies

IUPUI Course Policies: A number of campus policies governing IUPUI courses may be found at the following link: http://registrar.iupui.edu/course_policies.html.

Classroom Civility: To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones, engagement in private conversations and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, surfing the Internet, and posting to Facebook or Twitter during class are not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes “a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued” (IUPUI Strategic Initiative 9). IUPUI prohibits “discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or [veteran] status” (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

Administrative Withdrawal Policy: A basic requirement of this course is that students participate in all class discussions and conscientiously complete all required course activities and/or assignments. If a student is unable to attend, participate in, or complete an assignment on time, it is the student’s responsibility to inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and a student who has been administratively withdrawn from a course is ineligible for a tuition refund. Contact the

instructor with questions concerning administrative withdrawal. For more information, please visit <http://registrar.iupui.edu/withdrawal-policy.html>.

Code of Conduct: All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program. The Code of Academic Misconduct is available at <http://www.iu.edu/~code/code/responsibilities/academic/index.shtml>.

Accommodation Statement: Students needing accommodations because of a disability need to register with Adaptive Educational Services (AES) office and complete appropriate forms issued by AES before accommodations will be given. The AES office is located in Taylor Hall, UC 100. You can also reach the office by calling 274-3241.

If you need any special accommodation, please talk to the instructor in the first or second week of the semester. Requests for post-event accommodations will not be approved. In other words, if you do not request accommodations prior to a test or the deadline of an assignment, you may not after the fact get accommodations such as changing a grade, dropping a test, retaking the test, or extending the deadline of the assignment.

For more information, please visit the official web site of the IUPUI Adaptive Educational Services office at <http://aes.iupui.edu/>.

Emergency Preparedness: Safety on campus is everyone's responsibility. Know what to do in an emergency so that you can protect yourself and others. For specific information, visit the emergency management website at <http://protect.iu.edu/emergency>.

Bringing children to class: To ensure an effective learning environment, children are not permitted to attend class with their parents, guardians, or childcare providers.

Mission Statement

The Mission of IUPUI is to provide for its constituents excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.

Statement of Values

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.