

INFO-I 201

Mathematical Foundations of Informatics

Department of Human-Centered Computing

Luddy School of Informatics, Computing, and Engineering, IUPUI

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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.

General Education Course and Substitutions

This is an Analytical Reasoning, List-B General Education 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 and functions, mathematical induction, and graph theory.

Course Learning Outcomes (CLOs)

Upon successful completion of this course, students will be able to:

1. Construct the truth tables and truth trees for a logical formula.
2. Determine whether formulas are tautologies, logically equivalent, consistent, or valid.
3. Construct a formal proof to verify the validity of a logical argument.
4. Formalize information in the form of logical sentences.
5. Define sets and perform operations associated with sets.
6. Prove subset inclusion and set identities.
7. Define relations and function.

8. Analyze problems and propose solutions using the tools and theories of predicate logic.
9. Prove formulas that involve numbers using weak inductions
10. Apply graph theory into practice to solve real-world problems

Program-level Learning Outcomes (PLOs)

Please visit <https://soic.iupui.edu/undergraduate/degrees/informatics/learning-outcomes/> to view the complete list of the program-level learning outcomes for B.S. in Informatics. This course is designed to mainly demonstrate the following PLO:

A2. Apply knowledge and skills of logic and discrete mathematics

Mapping of Program-level and Course-level Learning Outcomes and IUPUI+

Program-level Learning Outcomes	Level of Knowledge*	Course Learning Outcomes	Profiles of Learning for Undergraduate Success	Assessment
A2. Apply knowledge and skills of logic and discrete mathematics	I	C4, C5, C7	P1.1. Communicator: Evaluates information	Homework 4 Homework 7
		C3, C9	P2.1. Problem Solver: Thinks critically	Homework 5 Homework 6
		C1, C2, C8	P2.3. Problem Solver: Analyzes, synthesizes, and evaluates	Homework 1 Homework 2 Homework 3 Homework 8
		C6, C10	P3.4. Innovator: Makes decisions	Homework 10

*Indicators of level of knowledge: I – Introduce; R – Reinforce; M – Master

Textbooks

1. Math foundations of Informatics, 2nd Edition. Recommended and Reserved in the IUPUI Library.

Author: E. Haghverdi

Edition: 2nd edition

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

ISBN: 1-4211-0697-3

2. Discrete Mathematics with Application. Reserved in the IUPUI Library.

Author: Susanna S. Epp.

Edition: 4th edition

Publisher: Brooks Cole. 2011

ISBN: 0-495-39132-8

3. Connecting Discrete Mathematics and Computer Science

Author: David Liber-Nowell

Edition: 2nd edition

Publisher: Cambridge University Press

ISBN: 978-1-00-915049-1

Supplemental Website

The supplemental website at <https://info201.sitehost.iu.edu> is specially created for this course. It provides solutions to examples, exercises, homework, and quiz problems. Solutions are shown in slideshows so you can see how problems are solved step-by-step. Understanding a solution step-by-step is essential to learning math concepts and developing problem-solving skills.

The site is organized into modules, which match the modules in the Canvas course site. In each module page, you will find four tabs: Examples, Exercises, Homework, and Quizzes. Solutions to examples are available as soon as the module is available; solutions to exercises, homework, and quizzes are available right after their deadlines.

This site is available only to the students who are currently enrolled in the I201 online section. It authenticates users with IU CAS. For the best experience, please visit the site on a desktop or laptop computer. The link to the site is also available in the left sidebar navigation menu.

Flipped Classroom Approach

"Flipped classroom" is a pedagogical approach in which direct instruction moves to the individual learning space and the group learning space is transformed into a dynamic, interactive learning environment where students learn to apply concepts and engage in creative activities in the subject matter. The following is what I expect from you in each module:

- **Study** the PPT slides or watch the pre-recorded videos of prior to class meetings on your own schedule.
- **Attend** scheduled classes. During the class, we will work on Top Hat quizzes, examples, exercises, homework assignments, group activities, etc.
- **Participate** in discussions to reflect on your learning and interact with other peers both inside and outside class.
- **Work** on the homework assignments. The types of problems you will find in homework assignments are similar to those in examples and exercises in lectures. Before you start the homework assignment, be sure you have studied those examples and exercises. Start working on the homework early. Doing coursework at the last minute will not cut it in an online class. Most assignments will take longer than you expect to complete. If you need helps from others, you will need to allow time, at least one day, for others to respond to your request.
- **Take** the quiz. After you have completed all the other activities, you may now take the quiz. Quizzes are available on Thursday's homework sessions.

Class Schedule

Propositional Logic	Truth tables	January 9 – 12
	Truth trees	January 13 – 19
	Arguments	January 20 – 26
	Translation	January 27 – February 2
	Natural deduction proofs	February 3 – 16
Set Theory	Set theory and proof	February 17 – 23
Relations	Functions and relations	March 3 – 9
Predicate Logic	Introduction and quantifiers	March 10 – 23
	Syntax and semantics	March 24 – 30
	Translation and examples	March 30 – April 6
Mathematical Induction	Mathematical induction	April 7 – 13
Graph Theory	Graphs and trees	April 14 – 20
Exams	Exam 1	March 2, 1 – 2:50 pm, IT 155
	Exam 2	April 27, 1 – 2:50 pm, IT 155

Grading Plan and Policy

Activity	% of Total
Class participation (Including TopHat quizzes)	5
Attendance	10
Homework assignments	25
Quizzes	20
Exercises	10
Exam I	15
Exam II	15
Total	100

The table below shows the minimum percentage for each letter grade. Please note percentages will not be rounded up when grades are determined.

Letter Grade	Minimum %	Interpretation
A+	97.0	Professional level work, showing highest level of achievement
A	93.0	Extraordinarily high achievement, quality of work; shows command of the subject matter
A-	90.0	Excellent and thorough knowledge of the subject matter
B+	87.0	Above average understanding of material and quality of work
B	83.0	Mastery and fulfillment of all course requirements; good, acceptable work
B-	80.0	Satisfactory quality of work
C+	77.0	Modestly acceptable performance and quality of work
C	73.0	Acceptable performance and quality of work
C-	70.0	Minimally acceptable performance and quality of work
D+	67.0	Unacceptable work (course must be repeated for credit)
D	63.0	Unacceptable work
D-	60.0	Unacceptable work
F	0	Unacceptable work

Expectations, Guidelines, and Policies

Attendance and Participation Policy

IUPUI policy is that attendance is mandatory for all undergraduate classes. A basic requirement of this course is that you will attend all class meetings, arrive on time, and participate in all class activities. Attendance is required for this class. It entails being present and attentive for the entire class period. 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.

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 may be organized into learning groups. Even though 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. Expectations of your class participation include:

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

Class attendance and participation together account for 10% of your final grade. You earn attendance and participation credits by attending classes and participating in learning activities.

The following table shows how attendance score is calculated from your attendances.

Number of attendances	Number of absences	Attendance score
30	0	10
29	1	10
28	2	10
27	3	7.5
26	4	5
25	5	2.5
24	6	0
23 or less	7 or more	F (Final course grade)

You may miss two classes, excused or unexcused, before your attendance score is reduced. Each additional absence, unless it can be excused due to one of the following reasons, reduces your attendance score by 2.5 points or 2.5% of your final course score. More than six absences result in a final course grade of F. Missing class may also reduce your participation score and course grade by eliminating opportunities for class participation. For all absences, you are responsible for all covered materials and assignments.

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

To be excused, an absence must be approved at least one week before the class date. You must explain your absence with the submission of appropriate documentation to the satisfaction of the instructor. If the absence is due to some unanticipated event, documents must be submitted to the instructor within one week after you return 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.

Signing in to Classes

In each class, you must sign in using the sign-in application at <http://info201.sitehost.iu.edu/signin> to record your attendance. You may also access the sign-in app via a link in the Canvas course site. If you do not sign in while in class, you shall be marked absent. 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 from the instructor or the class shall be marked absent. When you sign in, your sign-in time and IP address of the computer you use to sign in are recorded. After you sign in, your attendance report displays. This attendance report is the only official document of your attendance.

Tardy Policy

Regular tardiness disrupts the class and affects the learning of other students. All students are expected to be on time in each class. Punctuality is a measure of responsibility. An accumulation of regular tardiness could reduce your overall course grade. The tardy policy is structured as follows:

- Tardy (< 10) minutes = the grace period
- Tardy (10 – 30) minutes = 1 tardy
- Tardy (> 30) minutes = 1 absence
- 3 tardies = 1 absence

Correcting Errors in Scores and Attendances

If a score or attendance is incorrectly recorded in Canvas or in the attendance report, correction must be made within a week of the item posted. One week after an item is posted, it will not be changed. Requests for correcting such errors must be submitted in writing (e.g. emails) and must be accompanied with proper proofs. If your request gets approved, the correction will be made; if the request does not get approved, you will receive an explanation why the request cannot be approved.

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 evidence to the satisfaction of the instructor. Proper evidence must be able to show you attended the class in question. Examples of evidences may include the work you completed in class, or emails from at least two classmates who could vouch and explain your attendance. If you are vouching someone’s attendance, you need to explain and provide appropriate evidences.

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.

Plagiarism undermines the academic integrity of Indiana University. Plagiarism will not be tolerated. Anyone 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>

Diversity in the Classroom

I am committed to creating a positive learning environment where diverse perspectives are recognized and valued as a source of strength. I request that all students work with me to create a classroom culture based on open communication, mutual respect, and inclusion. As a class we will approach all discussions with respect and civility. Disagreements and debates in academic discourse are expected and welcome, but personal attacks are never OK, and will not be tolerated. I strive to ensure an open and welcoming classroom for all students. If I ever miss the mark, please don’t hesitate to come and talk to me. We are all learning together.

Caregiver Responsibilities Policy

I have great respect for students who are balancing their pursuit of education with the responsibilities of caring for children or other family members. If you run into challenges that require you to miss a class, please contact me. There may be some instances of flexibility we can offer to support your learning.

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>.

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: <https://studentcentral.iupui.edu/register/index.htm>.

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 <https://studentcentral.iupui.edu/register/administrative-withdrawal.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 Student Rights, Responsibilities, & Conduct is available at <http://studentcode.iu.edu/>.

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. In addition, only the accommodations listed on the AES forms will be provided. The instructor will not approve requests for any accommodations that are not listed on the AES forms. For more information, please visit IUPUI Adaptive Educational Services website at <http://aes.iupui.edu/>.

Religious Observation: IUPUI respects the right of all students to observe their religious holidays and will make reasonable accommodation, upon request, for such observances. Students seeking accommodation for religious observances MUST submit a request in writing to the course instructor by the end of the second week of the semester and should use the Request for Course Accommodation Due to Religious Observance Form. More information on the IUPUI Policy on Religious Holidays is available here: <https://studentcentral.iupui.edu/calendars/holidays/course-accommodation-form.html> [Links to an external site.](#). Failure to comply with the university policy will result in no accommodations given later in the semester.

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 <https://protect.iu.edu/emergency-continuity/index.html>.

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.