INFO-I 201  
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.

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 propositional 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. Translate an argument from English to propositional logic.
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. Give formal proofs of arguments in predicate logic.
10. Prove formulas that involve numbers using weak inductions

**Program-level Learning Outcomes (PLOs)**

Please visit [https://soic.iupui.edu/undergraduate/degrees/informatics/learning-outcomes/](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+**

<table>
<thead>
<tr>
<th>Program-level Learning Outcomes</th>
<th>Level of Knowledge*</th>
<th>Course Learning Outcomes</th>
<th>Profiles of Learning for Undergraduate Success</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C3, C9</td>
<td>P2.1. Problem Solver: Thinks critically</td>
<td>Homework 5. Homework 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C1, C2, C8</td>
<td>P2.3. Problem Solver: Analyzes, synthesizes, and evaluates</td>
<td>Homework 1. Homework 2. Homework 3. Homework 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C6, C10</td>
<td>P3.4. Innovator: Makes decisions</td>
<td>Homework 10</td>
</tr>
</tbody>
</table>

*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
### Tentatively Weekly Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Homework</th>
<th>Quiz/Exam</th>
</tr>
</thead>
</table>
| 1    | • Course introduction  
      • Propositional logic: introduction and truth tables | Syllabus   | Quiz        |
| 2    | • Propositional logic: truth trees                                  | HW 1       | Quiz 1      |
| 3    | • Propositional logic: satisfiability, tautology, and contradiction, logical equivalence and consistency | HW 2       | Quiz 2      |
| 4    | • Propositional logic: argument validity and translation             | HW 3       | Quiz 3      |
| 5    | • Formal proofs: natural deduction proofs, conjunction and implication | HW 4       | Quiz 4      |
| 6    | • Formal proofs: disjunction and negation                            | HW 5       | Quiz 5      |
| 7    | • Set theory: concepts and operations                                | HW 6       | Quiz 6      |
| 8    | • Set theory: set proofs, function and relations                     | HW 7       | Quiz 7      |
| 9    | • Fall break  
      • Practice sessions                                           |            |             |
| 10   | • Predicate logic: introduction and quantifiers                       |            | Exam 1      |
| 11   | • Predicate logic: syntax and semantics                              | HW 8       | Quiz 8      |
| 12   | • Predicate logic: translation and examples                          | HW 9       | Quiz 9      |
| 13   | • Predicate logic: more examples                                     | HW 10      | Quiz 10     |
| 14   | • Mathematical induction: concepts  
      • Happy Thanksgiving                                              |            |             |
| 15   | • Mathematical induction: examples and practice                      | HW 11      | Quiz 11     |
| 16   | • Practice sessions                                                  |            |             |
| 17   | • None                                                                |            | Exam II     |
Grading Plan and Policy

<table>
<thead>
<tr>
<th>Activity</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class participation (Attendance, attitude, investment in course)</td>
<td>10</td>
</tr>
<tr>
<td>Homework assignments</td>
<td>20</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20</td>
</tr>
<tr>
<td>Exam I</td>
<td>25</td>
</tr>
<tr>
<td>Exam II</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

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

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

Homework Assignments

1. **Reading**: Reading materials from Haghverdi’s textbook will be assigned regularly. Although they are not required, they are helpful 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 work problems. Students are asked to critically analyze the problems and then propose and
Quizzes

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

There will be unannounced pop quizzes throughout the semester. They are given in class without notice. These serve to ensure that you are keeping up with the reading and with the material presented in lecture. Pop quizzes will be open note.

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.

Expectations, Guidelines, and Policies

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 course assignments 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 is accepted for partial credits.
e. The lowest homework assignment score is dropped.

Quiz and Exam Policy

Except the syllabus quiz, all quizzes are timed. They must be completed in class within given minutes. Scheduled quizzes are closed note and pop quizzes are open note. There will be no makeup quizzes and no early quizzes under any circumstances. You will receive a zero if you miss a quiz. The lowest quiz score will be dropped. All exams are closed book and timed. A missed exam cannot be made up. An early exam is not permitted unless the absence can be excused. If you miss an exam, you will get a zero for that exam. Calculators are disallowed during the exams. However, you can bring a standard 8 ½” x 11” paper with notes and formulas as a reference during the exam.
**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. Class attendance is required for this course. 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:

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.

Class attendance and participation together are worth of 10 points, which 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.

<table>
<thead>
<tr>
<th>Number of attendances</th>
<th>Number of absences</th>
<th>Attendance score</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>27</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>26</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>24</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>23 or less</td>
<td>7 or more</td>
<td>F (Final course grade)</td>
</tr>
</tbody>
</table>

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://go.iupui.edu/i201](http://go.iupui.edu/i201) 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 (< 5) minutes = the grace period
- Tardy (5 – 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

Taking Good Notes in Class

Presentation software will be used to present text, diagrams, and formulas in class. However, due to the complexity of mathematical equations and formulas, the whiteboard will be used to present them. The presentation slides will not include solutions to practice questions and example problems. The instructor will present and explain them in class using the whiteboard. Doing so 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 solutions. 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

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. It includes, but is 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 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. Smart phones are only permitted to sign in
at IU Central Authentication Service (CAT).

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 Student Rights, Responsibilities, & Conduct is available at [http://studentcode.iu.edu/](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/](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](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.