Course Description

ISE 505 Formal Foundations for Information Science

(Revised Fall 2010)

Course Description

In this course, students increase their understanding of the approach to information systems and science offered by formalisms. The course draws on previous mathematics courses to increase familiarity with formal syntax and language. It develops understanding and technical ability in handling discrete structures as well as the formal basis of qualitative reasoning. The course includes a review of fundamental material on set theory, functions and relations, and logic. It goes on to examine a variety of algebraic structures, formal languages, and geometries. Particular attention is given to those structures that form the basis of information systems. The course also discusses topics from information theory and algorithmic complexity.
Prerequisites: enrollment in one of the Departmental of Spatial Information Science and Engineering graduate programs, or permission of instructor.
Credits: 3

Course Goals and Objectives:

Course objectives

- To introduce students to formal languages and methods, as they apply to information systems.
- To develop in students an ability to express issues in information science in formal terms.
- To develop a formal understanding of information content and it representation in computing environments.
- To expose students to the application of formal approaches to the development and analysis of information systems.

Expected Outcomes:

- Understand relevance of formal techniques to information systems.
- Understand roles and functions of formal approaches to information systems.
- Understand core formal language and methods.
- Understand factors involved in applying formal approaches to information systems development.
- Ability to express issues in information system analysis and design in formal terms.

Faculty Information

Professor Mike Worboys
581-3679
worboys@spatial.maine.edu

Office Hours

I am in the office most hours of the day and feel free to drop by if you have a short question or two. Please feel free to phone or send e-mails as well. If you want to arrange a longer session, sending e-mail to set up an appointment is probably the simplest way to get a message through and a response.

Instructional Materials and Methods

Books:

Required: Discrete Mathematics, 3rd edition, S. Lipschutz and M. Lipson, Schaum's Outline Series, McGraw Hill, ISBN 0071470387, 1997.
Required: Discrete Structures Logic and Computability, 2nd edition, James Hein, Jones and Bartlett Publishers, ISBN: ISBN 0763718432, 2002

The texts will be supplemented with some additional reading materials on topics that they do not cover.

Students are expected to keep a "Course Diary", which contains all the work and experiments that are undertaken during the course, as well as their observations and reflections on their own learning process.

In the first half of the course, students work on a short paper on a specific issue in formal foundations of information system. They also make a short presentation to the group.

In the second half of the course, students work on a term paper that explores the connections between formal foundations and information systems engineering. They produce a written report, and make a presentation to the group.

Grading and Course Expectations

Grading criteria:

Short paper and presentation – 10%
Term paper and presentation – 30%
Course Diary – 30%
Final examination – 20%
Class participation 10%

If you are absent due to illness or similar valid excuse, please notify me of your situation at worboys@spatial.maine.edu immediately prior to or after your absence.

Tentative exam schedule:

Tentative times for exams will be listed.

Class Policies

Attendance and class participation are expected. Ten percent of the course grade is dependent on participation in class.

Late assignments, make-up, retake and rescheduled exams, and extra credit:

Assignments submitted after the due date are docked 10 percent per day and will not be accepted for credit after a week. If you miss an exam due to an illness or emergency, you must send notification prior to the exam by email and special arrangements must be made with the instructor to consider your situation.

Incomplete work:

Incomplete or insufficient work may not be made up. It merely receives a low grade.

Academic honesty:

Academic honesty is expected. Plagiarism is unacceptable in this course and will result in a failing grade. "Although a writer may use other persons' words and thoughts, they must be acknowledged as such." Joseph Gibaldi and Walter S. Achtert, MLA Handbook (Modern Language Association) 1977, p. 4.

Students with disabilities:

If you have a disability for which you may be requesting an accommodation, please contact either me or Ann Smith, Coordinator of Services for Students with Disabilities (Onward Building, 581- 2319), as early as possible in the term.

Extended disruption:

In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Course Schedule

(Note that Hi refers to chapter i of Discrete Structures Logic and Computability, 2nd edition, James Hein, and Lj refers to chapter j of Discrete Mathematics, 3rd edition, S. Lipschutz and M. Lipson.)

Weeks 1-4
- Course Introduction – What are formal foundations, and why do information systems need them?
- The basic language of formalisms: sets, functions, relations, and other structures, induction, recursion.
- (H1, H2, H3, H4, L1, L2, L3)

Week 5
- Algorithmic analysis (H5)

Week 6-7
- **Short papers and presentations**
- Logic (H6, H7)

Week 8
- Algebraic structures (H10)

Week 9-10
- Graphs and trees (L8, L9, L10)

Week 11-12
- Languages, grammars, automata (H11, L12)

Week 13-14
- Turing Machines, Church-Turing thesis, computability (H13, H14, L13)

Week 15
- **Term paper and presentations**
- **Final Exam**