

Course Syllabus

ISE 301 Formal Foundations for Information Systems

(Revised Spring 2005)

Course Description

In this course, students develop an understanding of the approach to information systems development offered by formalisms. The course draws on previous mathematics courses to consolidate familiarity with formal syntax and language. It develops understanding and technical ability in handling discrete and geometrical formal structures. The course covers set theory, functions and relations, logic (propositional and predicate calculi), algebraic structures, partially ordered sets, lattices, Boolean algebras, graphs, digraphs, formal languages, formal models of computation, and algorithms. Lec 3. Cr 3. Prerequisites: GEE 103, ISE 102, or permission of instructor.

Course Goals and Objectives:

Course objectives

- To introduce students to formal languages and methods, as they apply to information systems. (Program Outcome 1, 11)
- To develop in students an ability to express abstract issues in information science in formal terms. (Program Outcome 1)
- To develop a formal understanding of information content and its representation in computing environments (Program Outcome 1)
- To expose students to the application of formal approaches to the development and analysis of information systems. (Program Outcomes 3,4)

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 available during my published office hours. If you want to arrange a longer session e-mail is the simplest way to get a message through and a response.

Instructional Materials and Methods

Books:

Required: Discrete Mathematics, 2nd edition, S. Lipschutz and M. Lipson, Schaum's Outline Series, McGraw Hill, ISBN 0070380457, 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. The additional materials will also be used to provide a problem-oriented approach to some of the topics, as well as alternative treatments to those in the main texts.

Some non-traditional teaching methods are used in the course. We will frequently use short (three to five minute) class activities for students to discuss issues in small groups before reporting to the larger group.

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 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:

Term paper and presentation – 30%

Course Diary – 30%

Tests and examinations – 30%

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.

Course Schedule

Week 1

Course Introduction – What are formal foundations, and why do information systems need them?

The basic language of formalisms: sets, functions, and relation I.

Week 2

The basic language of formalisms: sets, functions, and relations II.

Functions and algorithms

Week 3

Reasoning about information systems, syntax and semantics, the propositional calculus.

Week 4

Propositional and predicate calculi I

Week 5

Predicate calculus II
Week 6
Graph Theory I:
Class Test I
Week 7:
Graph Theory II:
Week 8
Number structures: natural numbers, integers, rational, reals, continuity, denseness.
Week 9
Algebraic structures I: algebraic specifications, semigroups
Week 10
Algebraic structures I: groups, rings, fields
Week 11
Languages, grammars and automata I
Week 12
Languages, grammars and automata II
Class Test II
Week 13
Turing Machines, computability
Week 14
Orderings, posets, linear orderings, well-orderings, lattices, Boolean algebras
Week 15
Lattices, Boolean algebras
Term paper and presentations
Week 16
Revision and **Final Exam**