

Information Modeling

University of Illinois School of Information Sciences

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IS561-A

Fall 2017

Monday, Wednesday 8:00-9:20 AM

131 Animal Sciences

4 GR hours

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Course Description

An introduction to the foundations of information modeling methods used in current information management applications. The specific methods considered include relational database design, conceptual modeling, and ontologies. The basic concepts underlying these methods are sets, relations, entities, and logics. Applications considered include relational database design and RDF/OWL semantic web languages. Set theory and logic are emphasized as the foundational frameworks for information modeling in general, and for contemporary web-based information management and delivery systems (including semantic web technologies) in particular.

Pre- and Co-requisites

None.

Course Overview

Two sorts of students are anticipated and the course objectives are similar but slightly different for each group. In neither case is prior relevant knowledge assumed.

- LIS561 prepares students anticipating generalist responsibilities (as directors, managers, general staff, etc.) to be effective leaders in making decisions about the design, development, and evaluation of information systems, services, and policies, helping their organizations and communities deal with all aspects of the difficult technology challenges ahead.

- LIS561 prepares students anticipating careers as technology specialists to efficiently acquire and maintain superior information modeling skills throughout their careers and to play leadership roles in the design, development, and evaluation of information systems, services, and policies.

Consistent with the iSchool goal of producing leaders and not just competent professionals we focus on developing a deep understanding that will have long-term benefits and prepare students to engage the hardest problems facing organizations and society.

Of course LIS561 alone cannot fully realize these objectives; it makes a partial contribution, focusing on the principles and concepts of information modeling. A partial contribution, but a necessary one: the connection between a deep understanding of information modeling concepts and the challenging information management problems facing us today is profound.

Strategy

The course examines the major modeling approaches currently in use in information management: relational modeling, conceptual modeling, and ontologies, focusing on underlying concepts and principles. The course is thus simultaneously a foundations course and a survey course.

Learning Objectives

1. Develop fluency in reading and understanding formal definitions.
2. Understand the role of abstraction in making systems design choices.
3. Contrast deep vs. superficial differences in modeling languages.
4. Recognize practical implications of trading expressive power for tractability.
5. Appreciate the fundamental role of a very small set of inter-related concepts.

Course Materials

All required readings for this class are available online. They are listed in the references section at the end of this syllabus.

About Dave Dubin

David Dubin is a Research Associate Professor at the School of Information Sciences. His research explores the foundations of information representation and description as well as issues of expression and encoding in documents and digital information resources.

Teaching Assistants

About Jacob Jett

Jacob employs formal methods to examine issues in the conceptual foundations of information access, organization, and retrieval, especially with regards to web and data semantics. Knowledge representation techniques and modeling exercises, such as ontology development and conceptual modeling, represent a sizable area of overlap in his research.

About Kangjae Lee

Kangjae Lee is a Ph.D. student in Informatics. He has experience in research on ontology models and location-based service (LBS) in 3D indoor spaces. His current research interest is on the impact of environmental factors and their associations with physical activity in the context of spatial and temporal dimensions.

About Lo Lee

Lo Lee is a first year PhD student at the School of Information Sciences. Her current research interest is on the design of interactive media. She is particularly interested in examining citizen science platforms that are used to launch public collaborative scientific projects.

Library Resources

<http://www.library.illinois.edu/lis/>
lislib@library.illinois.edu
Phone: (217) 300-8439

Writing and Bibliographic Style Resources

The iSchool has a Writing Resources Moodle site <https://courses.ischool.illinois.edu/course/view.php?id=1705> and iSchool writing coaches also offer free consultations. We highly recommend this!

The campus-wide Writers Workshop also provides free consultations. For more information see <http://www.cws.illinois.edu/workshop/>

Academic Integrity

Please review and reflect on the academic integrity policy of the University of Illinois, http://admin.illinois.edu/policy/code/article1_part4_1-401.html to which we subscribe. By turning in materials for review, you certify that all work presented is your own and has been done by you independently, or as a member of a designated group for group

assignments. If, in the course of your writing, you use the words or ideas of another writer, proper acknowledgment must be given (using APA, Chicago, or MLA style). Not to do so is to commit plagiarism, a form of academic dishonesty. If you are not absolutely clear on what constitutes plagiarism and how to cite sources appropriately, now is the time to learn. Please ask me! Please be aware that the consequences for plagiarism or other forms of academic dishonesty will be severe. Students who violate university standards of academic integrity are subject to disciplinary action, including a reduced grade, failure in the course, and suspension or dismissal from the University.

Statement of Inclusion

Inclusive Illinois Committee Diversity Statement

As the state's premier public university, the University of Illinois at Urbana-Champaign's core mission is to serve the interests of the diverse people of the state of Illinois and beyond. The institution thus values inclusion and a pluralistic learning and research environment, one which we respect the varied perspectives and lived experiences of a diverse community and global workforce. We support diversity of worldviews, histories, and cultural knowledge across a range of social groups including race, ethnicity, gender identity, sexual orientation, abilities, economic class, religion, and their intersections.

Accessibility Statement

To obtain accessibility-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the [Disability Resources and Educational Services](#) (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call (217) 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu.

Basic Needs Issues

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Assistant Dean for Student Affairs for support. Furthermore, please notify the professor if you are comfortable in doing so.

Emergency response: Run, Hide, Fight

Emergencies can happen anywhere and at any time. It is important that we take a minute to prepare for a situation in which our safety or even our lives could depend on our ability to react quickly. When we're faced with any kind of emergency – like fire, severe weather or if someone is trying to hurt you – The [University of Illinois Police Department](#) recommends three options: [Run, hide or fight](#).

Assignments and Evaluation

All assignments are required for all students. All work must be completed in order to pass this class. Late or incomplete assignments will not be given full credit unless the student has contacted the instructor prior to the due date of the assignment (or in the case of emergencies, as soon as practicable). Comprehension quizzes may be repeated for an improved grade within one week of receiving the initial grade.

Assignments, Exercises & Grade Distribution

- Comprehension quizzes (usually due on Friday): 35%
- Group classroom exercises: 22%
- Modeling scenario memoranda: 40%
- Participation and engagement in class and on forums: 3%

Grading Scale:

94-100 = A
90-93 = A-
87-89 = B+
83-86 = B
80-82 = B-
77-79 = C+
73-76 = C
70-72 = C-
67-69 = D+
63-66 = D
60-62 = D-
59 and below = F

Comprehension quizzes

Comprehension quizzes are based on the reading assignments, and are completed online. Their purpose is to help you ensure that you understand the concepts and methods presented by the authors of our readings. A link to each quiz will be posted to the Moodle calendar.

Group classroom exercises

Classroom exercises involve practice with the course content and its application in information modeling scenarios. Engagement with the problem at hand, cooperation with group members, and thoughtful spoken and written treatment of issues that arise are the most important factors in assessing your contributions in this setting, just as they are in the working world.

Modeling Scenario Memoranda

These are short written assignments (typically 1-2 pages) that are connected to modeling exercises and the case studies that frame them. The memos offer analyses and recommendations to (and request clarifications from) a hypothetical audience of professional colleagues, clients, or supervisors.

Assesment of your work on these exercises will be based on the clarity of your writing and your success in presenting the appropriate tone. For recommendations on tone in business writing, consult the resources at [this link](#).

Topic Schedule

Week 1: August 28 and 30

- Propositional Logic, Part 1
 - **Required Readings:** Benthem et al. 2014a

Week 2: September 4 and 6

- Models and Domains
 - **Required Readings:** Jubien 1997a, 1997b
- Propositional Logic, Part 2
 - **Required Readings:** Bach 1989

Week 3: September 11 and 13

- Predicate Logic, Part 1
 - **Required Readings:** Benthem et al. 2014b

Week 4: September 18 and 20

- Predicate Logic, Part 2
- Sets and relations
 - **Required Readings:** Partee 2006

Week 5: September 25 and 27

- Functions
- UML Part 1: notation
 - **Required Readings:** Seidl et al. 2015

Week 6: October 2 and 4

- UML Part 2: classes and sets
 - **Required Readings:** Seidl et al. 2015
- Normal forms, Part 1
 - **Required Readings:** Kent 1983

Week 7: October 9 and 11

- Relational Algebra
- Normal forms, Part 2

Week 8: October 16 and 18

- Syntax and Grammar
 - **Required Readings:** Rosen 1988

Week 9: October 23 and 25

- Semantics and Interpretation, Part 1
 - **Required Readings:** Bach 1989

Week 10: October 30 and November 1

- Semantics and Interpretation, Part 2
- The RDF model and language
 - **Required Readings:** Manola et al. 2014

Week 11: November 6 and 8

- RDF, Part 2

Week 12: November 13 and 15

- Ontologies
 - **Required Readings:** Hitzler et al. 2012

Thanksgiving Holiday: November 20 and 22

Week 14: November 27 and 29

- Inference and reasoners

Week 15: December 4 and 6

- Description Logics
 - **Required Readings:** Krötzsch et al. 2012

Week 16: December 11 and 13

- Wrapup and Evaluation

Readings

Bach, E. 1989. "Background and Beginning, Worlds Enough and Time." In *Informal Lectures on Formal Semantics*. Albany, NY, 1–32.

<https://uofi.box.com/s/lfqsrzjkhzdzml9d2g5w0ndtyvn0ndom>.

Bentham, J van, Ditmarsch, H van, Eijck, J van, and Jaspars, J. 2014a. "Chapter 2: Propositional Logic". In *Logic in Action*. Amsterdam, NL, 2.1–2.37.

<http://www.logicinaction.org/docs/ch2.pdf>.

Bentham, J van, Ditmarsch, H van, Eijck, J van, and Jaspars, J. 2014b. "Chapter 4: The World According to Predicate Logic". In *Logic in Action*. Amsterdam, NL, 4.1–4.53.

<http://www.logicinaction.org/docs/ch4.pdf>.

Hitzler, P, Krötzsch, M, Parsia, B, Patel-Schneider, P F, and Rudolph, S. 2012. "OWL 2 Web Ontology Language Primer". <http://www.w3.org/TR/owl2-primer/>.

Jubien, M. 1997a. "Numbers". In *Contemporary Metaphysics: An Introduction*. Cambridge MA, 24–35. <https://uofi.box.com/s/jckt75igz7p4we1yaaoub64f54t8na1c>.

Jubien, M. 1997b. "Platonism". In *Contemporary Metaphysics: An Introduction*. Cambridge MA, 36–62. <https://uofi.box.com/s/jckt75igz7p4we1yaaoub64f54t8na1c>.

Kent, W. 1983. "A Simple Guide to Five Normal Forms in Relational Database Theory". *Commun. ACM* 26.2, 120–125.

<http://doi.acm.org.proxy2.library.illinois.edu/10.1145/358024.358054>.

Krötzsch, M, Simancík, F, and Horrocks, I. 2012. "A Description Logic Primer". *arXiv preprint arXiv:1201.4089*. <http://arxiv.org/abs/1201.4089>.

Manola, F, Miller, E, and McBride, B. 2014. "RDF 1.1 Primer".

<https://www.w3.org/TR/2014/NOTE-rdf11-primer-20140624/>.

Partee, B H. 2006. "Basic Concepts of Set Theory, Functions and Relations".

http://people.umass.edu/partee/NZ_2006/Set%20Theory%20Basics.pdf.

Rosen, K H. 1988. "Languages and Grammars". In *Discrete Mathematics and its Applications*. New York, 552–563. <https://uofi.box.com/s/nomrry0e4cone88xvnciaf14gg93t68h>.

Seidl, M, Scholz, M, Huemer, C, and Kappel, G. 2015. "The Class Diagram". In *UML @ Classroom: An Introduction to Object-Oriented Modeling*. Eds. M. Seidl, M. Scholz, C. Huemer, and G. Kappel. Cham, 49–84. http://dx.doi.org/10.1007/978-3-319-12742-2_4.