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Winter 2007

## CS 740-01: Algorithms, Complexity and the Theory of Computability

Thomas Sudkamp

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CS 740  
Algorithms, Complexity and the Theory of Computability  
Syllabus: Winter 2007

Time: 8:00-9:15 Tuesday, Thursday  
Room: 056 University Hall  
Instructor: Professor Sudkamp  
Office Hours: 2:00-4:00 Tuesday, Thursday  
and by appointment, Room 431 REC  
email: tsudkamp@cs.wright.edu  
phone: 775-5118

The objective of this course is to use the formal algorithmic system provided by Turing machines as a tool to analyze the complexity of decision and optimization problems and the algorithms that solve them. The topics to be covered include

- the definition of the time and space complexity of a deterministic algorithm
- the classes of deterministic polynomial and non-polynomial time languages
- the complexity of nondeterministic algorithms
- the P=NP question (relationship between solvability by deterministic and nondeterministic polynomial time algorithms)
- the implications of a solution to the P=NP question
- NP completeness and examples of NP complete problems
- classes of NP complete problems
- techniques for approximate solutions of NP complete problems

Additional topics on computational complexity will be covered as time permits. In particular, the relationship between complexity defined by Turing machines and that of 'high-level' algorithmic systems will be discussed.

The required text is the third edition of *Languages and Machines: An Introduction to the Theory of Computer Science*

**Prerequisites:** The official prerequisites for this course are CS 466/666 (Formal Language Theory) and CS 410/610 (Computability Theory) or the completion of equivalent material. If you have not completed these courses or equivalent courses at another university, you are responsible for mastery of the background material presupposed in this course. In particular, it is assumed that you are familiar with Turing machines of various types (multi-tape, nondeterministic), the use of Turing machines to recognize languages and to solve decision problems, and problem reduction. This

material can be found in Chapter 8 (sections 8.1---8.7) and Chapter 11 of *Languages and Machines*.

**Exams and Grades:** A midterm exam and a final exam will be given in this course. There will be two homework assignments that will be handed in and graded. The exams and assignments will have the following weight in the determination of the course grade:

Midterm: 35%      Thursday, February 1  
Final: 45%        Tuesday, March 13 8:00—10:00  
Homework: 10% each

The final exam may be in class, take home, or some of each (to be determined at a later date). There will be no make-up exams other than for documented emergencies. Be sure to arrange your schedule to be available for the exam periods. The exams will be open book, open notes, etc.

Additional homework and reading assignments will be given regularly. Successful completion of these assignments will prepare you for the examinations. Class time will be used to answer questions concerning these problems.

**Office Hours:** My office hours for the winter quarter are 2:00 to 4:00 and immediately after class on Tuesday and Thursday. I will be in my office considerably more than those hours, and you are welcome to stop in any time I am there. I will also be pleased to make appointments with you at other times if you need to see me but cannot make my office hours.

Email may be used to obtain the answers to simple questions, such as "what did we cover in class" or "what was today's homework assignment". Email, however, is not appropriate for obtaining help on the technical topics of the course. Technical assistance needs to be given in a face-to-face manner so I can learn where you are having difficulties and then help you to overcome them.

**Attendance and Course Policies:** Attendance at classes is strongly recommended. If you miss a class, it is your responsibility to obtain class notes and assignments from other students to be prepared for subsequent topics. As noted above, there will be no make-up exams except for documented emergencies. In addition, there will be no grades of incomplete given except for documented emergencies that preclude students from completing the course. The sufficiency of the emergency and the documentation will be my decision.