

# CS 417-001 Introduction to the Theory of Computation

## Spring 2011, MoWe 2:00PM - 3:15PM, EMS E190

**Instructor:** Adrian Dumitrescu, EMS 1081, 229-4265, email: [dumitres@uwm.edu](mailto:dumitres@uwm.edu).

**Office Hours:** (may change) Monday and Wednesday 4:00–5:00pm or by appointment.

**TA:** Drew Onderko, email: [donderko@uwm.edu](mailto:donderko@uwm.edu)

**Final Exam:** 12:30–2:30PM, Tuesday, May 17.

**WWW:** <http://www.cs.uwm.edu/classes/cs417/>

**Prerequisite:** JR St; MATH 221(P) (Honors Calculus) or 232(P) (Calculus and Analytic Geometry); Grade of C or better in CS 317(217)(P).

**Level:** U/G.

**Textbook:** M. Sipser, *Introduction to the Theory of Computation*, 2nd edition, 2006. Thomson Course Technology.

**Outline:** The theory of computation deals with the fundamental mathematical properties of computer hardware and software. We will study the capabilities and limitations of various models of a computer and determine what can and what cannot be computed. Some of the topics to be covered will be relevant to other CS courses (e.g., programming languages, compilers). Tentatively the following sections of the textbook will be covered. Some sections may be given as reading assignments. Additional related topics may be introduced.

1. 0.1 Automata, Computability, and Complexity
2. 0.2 Mathematical Notions and Terminology
3. 0.3 Definitions, Theorems, and Proofs
4. 0.4 Types of Proof
5. 1.1 Finite Automata
6. 1.2 Nondeterminism
7. 1.3 Regular Expressions

8. 1.4 Nonregular Languages
9. 2.1 Context-free Grammars
10. 2.2 Pushdown Automata
11. 2.3 Non-context-free Languages
12. 3.1 Turing Machines
13. 3.2 Variants of Turing Machines
14. 3.3 The Definition of Algorithm
15. 4.1 Decidable Languages
16. 4.2 The Halting Problem
17. 5.1 Reducibility
18. 5.2 A Simple Undecidable Problem
19. 5.3 Mapping Reducibility

**Grading scheme:** Homework and quizzes 20%, Midterm exam 35%, Final exam 45%.

The exams are closed books and notes. No electronic devices are permitted. Makeup exams will not be given. Class participation is encouraged: if a student's total score lies at the border between two grades, being active in class and regular attendance may raise the student's grade to the higher of the two grades.

By a Graduate School requirement, a graduate student taking this U/G level course must do additional work in some assignments and exams.

### Remarks:

1. Homework assignments will be given and discussed in class; you may be asked to present your solutions in class. Quizzes based on homework problems may be given in class. Homework is due usually one week after it was assigned, at the beginning of the respective class period. Note that the midterm and final exams may use problems directly taken from homework assignments, so you are strongly advised to do the homework. It is unlikely that you will perform well in this course without a substantial effort to work on and understand the assignments.

2. You are expected to provide justifications and arguments to support your answers in all your assignments and exams, regardless if the problem asked for it or not.
3. You are strongly advised to take written notes throughout the course, since not all topics may be covered in the textbook or the coverage/approach might differ from that in class.
4. If you have to miss an exam or the deadline of an assignment because of an emergency, please contact the instructor at the earliest possible opportunity (use both e-mail and phone). If the instructor is not reachable, then try to contact the department secretary at 229-4677. No arrangements will be made for missed exams, unless these rules are followed and an acceptable evidence of legitimate emergency is submitted.
5. *Cheating* is taking someone else's work and calling it your own. Cheating is not allowed and will be dealt with severely. More information on academic misconduct is available at <http://www.uwm.edu/Dept/Acad.Aff/policy/academicmisconduct.html>
6. Your work will be graded not only on the correctness of the result, but also on the quality of presentation.