CS 417-001 Introduction to the Theory of Computation
Spring 2018, Mon & Wed 11:00am-12:15pm, EMS E237

Instructor: Adrian Dumitrescu, EMS 1081, 229-4265, email: dumitres@uwm.edu.

Office Hours: (may change) Mon & Wed 12:45–1:30pm or by appointment.

TA: TBA

Final Exam: Friday, May 18, 12:30-2:30pm.

Course web-page: http://www.cs.uwm.edu/classes/cs417/

University policies and other information: http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf

Prerequisites: 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.


Outline: The theory of computation deals with 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, analysis of algorithms). Tentatively the following sections of the textbook will be covered. Some sections may be given as reading assignments. Additional related topics may be introduced.

0.1 Automata, Computability, and Complexity
0.2 Mathematical Notions and Terminology
0.3 Definitions, Theorems, and Proofs
0.4 Types of Proof
1.1 Finite Automata
1.2 Nondeterminism
1.3 Regular Expressions
1.4 Nonregular Languages
2.1 Context-free Grammars
2.2 Pushdown Automata
2.3 Non-context-free Languages
3.1 Turing Machines
3.2 Variants of Turing Machines
3.3 The Definition of Algorithm
4.1 Decidable Languages
4.2 Undecidability
5.1 Reducibility
5.2 A Simple Undecidable Problem
5.3 Mapping Reducibility

Grading scheme: In class participation 10%, Overall behavior and discipline 10%, Final exam 80%.

The exam is closed books and notes. No electronic devices are permitted. Makeup exams will not be given. 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. Being disciplined and having an active class participation is part of your grade. This means being active in class without disrupting the class and having a positive learning attitude. You are expected to attend class and participate in the discussions. People may have different ideas about possible approaches and discussions will help you get a better understanding of the ones that work. Finding errors and/or inaccuracies in the lecture notes or textbook or on the board is encouraged.

2. The following rules of good behavior and discipline need to be respected: You need to show respect to the instructor and your colleagues and respectfully exchange ideas and
opinions. You are expected to follow and participate in the discussion, and not be preoccupied with other activities.

Occupy your seat before the start time of the class, and avoid leaving or entering during lecture time; you are asked to not bring food or drinks to class. If you send email to the instructor you need to address it properly; *not* by the first name, etc.

When you are sick, avoid coming to class; if you still need to come (in an exceptional situation), you need to sit as isolated as possible in the back row and avoid contact with others (to minimize the chance of transmitting your illness to others).

3. Electronic devices, including laptops, tablets, phones, etc., can only be used for class purpose, and when directed so by the instructor. In particular, recording the lectures or taking pictures are not allowed.

4. Such devices are prohibited during exams; any such device should be turned off and put away (out of sight) in your bag. A student found in possession of an electronic device during an exam should be considered to be engaged in academic misconduct and should expect to receive a grade of zero on the exam. Before any exam you need to stow away your bag in the front area of the exam room; you can only retrieve your bag after handing in your exam before leaving the room. You will not be allowed to leave the exam room during the exam unless there is an emergency and/or you have obtained permission from the instructor.

5. Attendance is not part of your grade. However, if you missed a class, you should borrow the notes for that class from another colleague. 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. In addition, this will prepare you better for the written exams.

6. Homework assignments will be given and you will be asked to present your solutions in class. Homework is due for discussion usually one week after it was assigned, at the beginning of the respective class period. The homework will involve about 6-7 assignments. While you can discuss solutions to homework assignments with others, the solution must be prepared independently by you and so you would be comfortable in explaining it. If you discussed any assignments with others, specify their names in your solutions. Similarly, if you use other materials/sources you need to clearly specify them in your solutions. Note that the 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.

7. You are expected to provide justifications and arguments, that is, show your work, to support your answers in all your assignments and exams, regardless if the problem explicitly asked for it or not. Unjustified or poorly justified answers will receive little or no credit. When you are asked to give an algorithm for a specific problem you *first* need to explain your algorithm in words and present its main ideas; if possible, you should also attempt to provide a sequential enumeration of the main steps (see also the textbook for such algorithm descriptions).

8. 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.

9. *Plagiarism* or *cheating* is taking someone else’s work and calling it your own. Plagiarism is not allowed and will be dealt with severely; it is a form of academic misconduct. In particular, copying from other sources (including the internet) without proper citation is disallowed. More information on academic misconduct is available at [http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/](http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/)

10. Your work will be graded not only on the correctness of the result, but also on the quality of presentation. An understandable handwriting is expected.