

# DM553/MM850 – Complexity and Computability 2020 – Lecture 1

## Textbooks and notes

*Introduction to the Theory of Computation*, 3rd edition, by Michael Sipser, Cengage Learning, 2013. This is for the first half of the course, and it is available in the bookstore.

*Introduction to Algorithms*, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, and C. Stein, MIT Press, 2009. This and the extra notes will be used in the second half of the course.

Extra notes (available from Course Materials in Blackboard): These are from the following sources:

- *Computer Algorithms: Introduction to Design and Analysis*, second edition, by S. Baase, pages 9-10, 66-71, 124-133, 138-141, Addison-Wesley, 1987.
- *Parameterized Algorithms*, by Marek Cygan, Fedor V. Fomin, Łukasz Kowalik, Daniel Lokshtanov, Dániel Marx, Marcin Pilipczuk, Michal Pilipczuk and Saket Saurabh, pages 3-8, 12-14, 17-22, 51-55, Springer, 2016.

## Format

Lectures will be in English. Please read the appropriate sections in the textbook or notes before coming to class and bring your textbook with you. There will both be assignments which you are required to turn in and other problems and exercises which you should be prepared to discuss in the discussion sections (øvelserne/træningstimerne), usually shortly after the relevant lecture.

Check the electronic schedule regularly, since room and time changes can occur.

The “instruktør” for the course is David Hammer: hammer@imada.sdu.dk.

The results from your required assignments will be considered along with your performance at the oral exam for your grade in the course, though the performance at the oral exam will count much more. There will be 3 assignments. The assignments must be turned in on time using the Blackboard system, submitted via the menu item “SDU Assignment”. Turn in each assignment as a single PDF file. Do not use any Danish letters or other non-ASCII symbols in the name of the file. Keep the receipt it gives you proving that you turned your assignment in on time. You may work in groups of 2 to 3 students on the first and third assignments if you wish (this is encouraged). These 3 assignments are considered part of the exam and will affect your final grade, so cheating on these assignments is viewed

as cheating on an exam. You are allowed to talk about course material with your fellow students, but working together on assignments with students not in your group is cheating, as is allowing other students not in your group to see your solutions. (You can, however, talk with David or me.) Using solutions you find elsewhere, such as on the Internet, is also cheating. You may do the assignments in either English or Danish, but if you write them by hand, please do so very neatly.

The weekly notes and other information about the course are available through the World-wide Web. Use Blackboard or the URL:

<http://www.imada.sdu.dk/~joan/dm553/index.html>

If any students did not take DM507 at SDU, please contact Joan Boyar to see if you have the required background.

I have office hours 9:00–9:45 on Mondays and Thursdays.(I may cancel sometimes). You are welcome to come see me at other times; I am often in my office.

There will be an oral exam in June. The set of exam questions will be available later in the course, but will probably be the similar to that in 2018 (except that there will be less emphasis on regular languages and there will be a question on paramaterized complexity), which is on the course Web page. You may do your exam in Danish if you wish (in most cases it is advisable to do it in Danish).

### **Lecture, February 3**

We will begin with an introduction to the course. We will not cover chapter 0 of the textbook by Sipser, but you are advised to read parts which you are unfamiliar with or do not remember. We will very quickly cover much of sections 1.1, 1.2, and 1.3 in chapter 1 of Sipser's textbook, but we will not cover any proofs. We will cover section 1.4 more thoroughly.

### **Lecture, February 5**

We will begin on chapter 2 in Sipser, skipping the subsection on ambiguity.

### **Problems to be discussed on February 6**

From Sipser, do:

1. Page 85: 1.12.
2. Page 88: 1.32. Note that Theorem 1.25 is an example of a proof of closure of regular languages.

3. Give a nondeterministic finite automata which recognizes the language given by the regular expression in problem 1.19.a on page 86.
4. Page 88: 1.29.a, 1.29.c, 1.30.
5. Pages 90–91: 1.50, 1.51a,b,c.