Institut for Matematik og Datalogi
Syddansk Universitet

September 1, 2020
JFB

# DM551/DM851 – Algorithms and Probability – 2020
# Lecture 1

## Textbooks and notes

*Discrete Mathematics and Its Applications*, 8th edition, by K. Rosen, McGraw Hill, 2019. Same textbook as used for Discrete Methods. This textbook will be used most, and we start with it.

*Introduction to Algorithms*, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, and C. Stein, MIT Press, 2009. Same textbook as used for Algorithms and Data Structures.

Extra notes (available from Course Materials in Blackboard): This includes parts of chapter 13 from *Algorithm Design*, by J. Kleinberg and É. Tardos, Addison Wesley, 2005.

## Format

For both lectures and discussion sections (øvelserne/træningstimerne), some will be online and some are planned to be at the university. Check the schedule. Lectures will be in English. Please read the appropriate sections in the textbook or notes before each lecture and have it available.

The "instruktor"s (TAs) for the course are Martin Lorenzen, marlo17@student.sdu.dk, and Sissel Banke, siban17@student.sdu.dk. The discussion sections will take place in Danish, unless there are non-Danish speakers present. If you do not speak Danish, please let your TA know.

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, usually shortly after the relevant lecture.

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 2 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 assignment if you wish (this is encouraged). These 2 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 Sissel, Martin, 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.

In addition, there is a prerequisite for the exam that you must complete (by an as yet undecided date in December) in order to be able to take the exam in January. This prerequisite will not require any significant amount of time to complete it. It will be submitted via Blackboard, through "SDU Assignment", as described above.

The lecture notes and other information about the course are available on the course homepage. Use Blackboard or the URL:

http://www.imada.sdu.dk/∼joan/dm551/index.html

I have virtual office hours 9:00–9:45 on Mondays and Thursdays, when I am not teaching then or have other commitments. I may announce alternate times. There will be a Zoom URL posted in Announcements in Blackboard.

Zoom links for lectures and discussion sections will also be posted in Announcements for this course in Blackboard. Online lectures will be recorded and recordings will be placed in Course Recordings in Blackboard, as will recordings of discussion section classes. Office hours will not be recorded. You will be muted on entry to the Zoom session, and you are asked to turn off your video.

I would like to have students point out technical problems by turning on their microphones and saying something. Please generally use the "chat" option in Zoom for questions (I can ask you to turn on your microphone briefly if your comment is not suitable for the chat).

There is a discussion board in Blackboard under Discussion Board. When you have questions outside of lecture or discussion section times and the answer might be relevant to more than one person, please post your questions there, so others can see the answer. There is also a thread in the discussion board for students who want to ask questions of other students.

The first lecture is via Zoom on Tuesday, September 1, 12:15-14. The second is September 3, 8:15-10. Since the second overlaps with my office hours, I will hold them 10:30-10:45 that day. If you would like to talk me without everyone hearing during the pause during a lecture, let me know when you can see that I am physically there, and we can move into a breakout room. That is how I will handle office hours, too, though you may start in a waiting room there.

For online lectures and discussion section classes, if you cannot make it for the entire class (because of another course where you have to be at SDU just before or after it), you will probably not disturb others too much if you arrive late or leave early, so you are encouraged to do that, rather than just not coming. Then you can participate actively in part of it. If you plan to do this for discussion section classes and you have some particular problems you are interested in, you may write your TA (enough before class so they are likely to read it) an email saying which problems these are.

There will be an oral exam in January. The set of exam questions will be available later

in the course, but will probably be somewhat similar to that in 2019, when Jørgen Bang-Jensen taught the course, and/or in 2018 when I last taught it. Those sets of questions are available 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, September 1

We will begin with an introduction to the course. Starting in the textbook by Rosen (all sections refer to this textbook until some other textbook is mentioned), we will cover sections 6.1 (fairly quickly) and 6.2 in chapter 6.

## Lecture, September 3

We will cover sections 6.3 and 6.4 and probably 6.5.

## Problems to be discussed on September 9

In Rosen, do the following problems from Rosen's textbook. They may not all be covered, though the more interesting ones probably will be. If there is a particular problem you would like explained, please tell your TA (Sissel or Martin) at the beginning of class.

In general, if the answer is going to involve very large numbers, you do not need to compute it; just write a formula for it, such as $2^{12}$ or $\frac{12!}{6!}$. This applies throughout the course, especially to assignments.

Note the preparation work needed for problem 76 in Section 6.1.

1. Section 6.1: 1, 5, 34, 41, 46, 50, 52, 62, 64, 76 (write out a proof from this last one at home and bring it with you – you will critique each other's proofs – see http://imada.sdu.dk/∼joan/dm553/proofs.pdf).

2. Section 6.2: 4b, 10, 20, 24, 28, 35, 38, 40.

3. Suppose there are at least $n \geq 2$ people in a room. Assume that for any two people in the room, they either both know each other, or neither knows the other. Prove that there are at least two people in the room who know the same number of people.