Topics for the exam in DM551

The topics are:

1. Basic counting problems (pigeonhole principle, generalized permutations and combinations, etc.)

2. Inclusion-exclusion with applications (hatcheck problem, Sieve of Eratosthenes, etc.)

3. Linear recurrence relations (definitions, solution form, (non-)homogeneous recurrence relations, applications in counting problems)

4. Discrete probability, random variables and bounds – expected value, variance, Bayes' Theorem, Markov's inequality, Chebyshev's inequality and Chernoff bounds

5. Discrete probability – examples of probability distributions, Coupon Collector's Problem

6. The probabilistic method, Monte Carlo algorithms, the Birthday Problem

7. Randomized algorithms – contention resolution, global mincut in graphs, hiring problem

8. Randomized algorithms – randomized approximation for MAX 3-SAT, Quicksort, median finding and selection,

9. Universal hashing

10. Network flows

11. String matching – naive algorithm, Rabin-Karp algorithm

There is a prerequisite for the exam (a "forudsætningsprøve). It will be posted on December 21 and be due on January 3 at 23:59. You will only have to upload a PDF file to SDU Assignment in Blackboard saying when you would like your exam or that you have no preferences. If you have a very good reason for your preference, please state it in your uploaded file (another exam the same day is a much better excuse than having trouble getting out of bed in the morning). You should also write if this is a re-exam for you and you want the "topics/questions" from last year. Since this is used for scheduling exams, please do this prerequisite even if you have had it approved in a previous year. You should not do it if you are only planning to take the re-exam, since there will be a re-exam in this prerequisite. (It will be posted on February 1 and due on February 10.)

The oral exam will take place on January 25, 26 and 27 (also using January 28 possibly). You will receive a list through Blackboard of the order students in DM551 will take the exam along with a starting time for the first student to draw a question. These lists cannot be used to exactly calculate an exam time since some students may not show up. If a student is not there, the next student on the list who is present will be taken. When there are no more students ready to be taken, the external examiner may leave, so show up plenty early to make sure you are examined. Two hours before your expected exam time is probably safe enough. The first first few students should show up at the start time.

You will draw a topic from the list of topics listed above. The suggestions listed in parentheses are not part of the topic, but merely meant as inspiration; there may be other possibilities to talk about. The suggestions not in parentheses define which topics are in which question, when the main subject is the same. Remember that if you choose the easiest material then it is harder to get a top grade, so if you aim high (which many of you should), then choose something where you can show your qualities. If you just want to pass/get a decent grade, you may choose some of the easier material. In any case do not choose something which you are not sure you can handle.

After drawing a "topic/question", you will have almost 30 minutes to prepare your presentation. During this time you may use the book and your notes. You may also make short notes that will help you to organize your presentation, but that will have no other technical content. At the exam itself you are not allowed to look at anything but these short notes. You will be asked to stop looking if we feel this is necessary.

The exam will take about 30 minutes per person, but the last five will be for the external examiner and Joan to discuss your grade. Prepare your presentation (before the day of the exam) so that it takes about 10 to 15 minutes (preferably closer to 10). Make sure you cover what you consider the most important ideas from your topic, though this may mean that you need to skip some details. Your presentation may be interrupted with questions or cut short to go on to other topics. Towards the end of the 30 minute period, you will typically also be asked short questions not related to the material you talked about. The censor and I may ask about your solutions for the two assignments, so you must be able to explain that. You are welcome to use examples from the two assignments to illustrate the topic you are covering in the question you got.

The main focus is on demonstrating understanding and usage of concepts and methods and to a lesser extent whether you can derive complicated formulas, such as deriving the Chernoff bound formulas. Of course, you must be able show that you understand the basic formulas and how to use them. You are welcome to choose a small example and use that to illustrate the topic you got. Remember to write a lot on the blackboard and to only talk about the question asked (to avoid wasting time).

You may do your presentation in either Danish or English (though Danish is strongly recommended if it is your native language).

Come ask Joan if you have any questions.