

### **Course material for the exam in DM553**

The material students are responsible for in connection with the exam is:

1. Pumping lemma for regular languages — Section 1.4 in Sipser
2. Pushdown automata and context-free languages — Sections 2.1–2.3 in Chapter 2 in Sipser
3. Turing machines — Chapter 3 in Sipser
4. Decidability — Chapter 4 in Sipser
5. Reducibility — Chapter 5 in Sipser, except not the part in section 5.1 about “reductions via computation histories”
6. Definitions concerning P, NP, NP-Completeness are relevant for both of the next two topics: The definition of time complexity classes is on page 279 in Sipser’s textbook, and the definition of P is on page 286. The definitions of NP and NP-Complete are in sections 7.3 and 7.4 of Sipser’s textbook.
7. NP-completeness proofs — Corollary 7.4.2 in Sipser and Chapter 34 in CLRS
8. Proof that CNF-SAT is NP-complete — This is the Cook-Levin Theorem in section 7.4 in Sipser, plus part of Corollary 7.42 in Sipser.
9. Information-theoretic lower bounds (lower bounds proven by counting leaves in decision trees), especially the average case bounds for sorting by comparisons — From the extra notes, up to and including section 2.4
10. Adversary arguments — From the extra notes on lower bounds, chapter 3
11. Median problem – worst case linear time algorithm and lower bound – section 9.3 in CLRS and section 3.5 in the extra notes on lower bounds.
12. Approximation algorithms — Chapter 35 in CLRS

13. Parameterized algorithms — From the textbook *Parameterized Algorithms*, by Marek Cygan, Fedor V. Fomin, Lukasz Kowalik, Daniel Lokshтанov, Dniel Marx, Marcin Pilipczuk, Michal Pilipczuk and Saket Saurabh, pages 3-8, 12-14, 17-22, 51-55, Springer, 2016.
14. All problems (for discussion sections) on the lecture notes.

Ask Joan if you have any questions.