

# DM553 – Complexity and Computability – 2016

## Lecture 13

### Lecture, April 11

We will show that CNF-SAT, CLIQUE, VERTEX COVER, INDEPENDENT SET, and SUBSET SUM are NP-Complete. See chapter 34 in CLRS.

### Lecture, April 14

We will show that HAMILTONIAN CIRCUIT is NP-Complete. Then we will start on lower bounds from section 2.4 in the notes. (Part of this is also in section 8.1 of CLRS.)

### Lecture, April 18

We will cover sections 3.1, 3.2, and 3.3 from the notes.

### Problems to be discussed in U14 on April 21

1. Do the problems from previous notes which haven't yet been covered.
2. In the CLRS textbook, do the following:
  - 34.5-6.
  - 34-3.
3. Give an information-theoretic lower bound on the number of comparisons necessary to merge two sorted lists. (Use Stirling's approximation, formula 3.20 in the CLRS book.) How does this compare with the upper bound.
4. What result do you get when using an information theoretic lower bound (in the straight-forward manner) to find a lower bound on finding the median element in an array?
5. Suppose you want to sort an array of  $n$  bits (put all the zeros before all the ones). Let the operation you can use be checking if a particular element in the array is a zero or a one. Give an efficient algorithm to do this sorting. Prove an information-theoretic lower bound on how many times you need to check elements in the array.
6. Practice presenting the Cook-Levin theorem for each other in pairs.