



## DD2440, Advanced Algorithms, 2014

Topics in the order they are planned to appear. There might be changes if there is a need for re-planning as there are substantial changes compared to last years course.

More details on the lectures that has been appears in the notes by scribes on the home page.

There might also be re-planning due to discussion with the students during early lectures. Some topic(s) might be added or removed.

### 1 Lectures that have taken place

**Sep 24** Introduction to the course. Formal models of computation, sorting. Lower bounds in comparison model. Discussion of sorting in other models.

**Sep 25** Hashing. Pairwise independent hash-functions. Two level hashing for a data-structure with  $O(n)$  space and  $O(1)$  search time.

**Sep 29** Median finding. Analysis of quickselect. Deterministic median finding with  $O(n)$  comparisons. Lower bounds of  $n$  comparisons.

### 2 Topics that we plan to cover.

1. Integer factorization and primality testing. Some elementary number theory, efficient modular arithmetic and GCDs. Pollard- $\rho$  method, maybe elliptic curve factoring and quadratic sieve.
2. Fast Fourier Transform. Efficient arithmetic on large integers, including division (possible a guest lecture on the package GMP).
3. Approximation for NP-hard optimization problems. Linear Programming and special heuristics for Traveling Salesman problem.
4. Max-Cut by semi-definite programming.
5. Parallel algorithms. Some model discussion but algorithms will be done in circuit model. Addition, multiplication and sorting.
6. Computational Geometry. Line-sweep and some example (finding the pair of closest points or all pairs of intersecting line segments).
7. Kolmogorov complexity and data compression.

### **3 Possible extra topics as voted on first lecture**

In order of popularity.

1. Quantum algorithms for integer factorization.
2. Matching in general graphs.
3. Planarity of graphs.