1 Exam questions, DM839 summer 2014

1. Fundamental problems and bounds
   - Coupon collector
   - Hashing
   - Markov's inequality anmd Chebyshev's inequality
   - Chernoff bounds
2. Markov chains, definitions and properties
   - Digraph analogue
   - Ergodic Markov chains
   - Stationary distribution
   - Random walks in undirected graphs
   - Coupling of Markov chains.
3. Markov chains, applications in algorithm analysis
   - Analysis of 2-SAT and 3-SAT algorithm
   - Problem 4A and 4B from the project.
4. The Monte Carlo method
   - Randomized (ϵ, δ)-approximation algorithms
   - Approximate sampling.
   - The Markov chain Monte Carlo method
   - The Metropolis algorithm
5. The probabilistic method
   - Basic counting
   - Using expectation arguments
   - Derandomization using conditional expectations
   - Lovász local lemma
6. Color-coding
   - Basic idea, dynamic programming
   - Expected running time
   - Derandomization via perfect hash functions.
7. Examples of randomized algorithms
   - Finding hamiltonian cycles in random graphs
   - Finding a perfect matching in a regular bipartite graph
   - Packet routing in sparse networks
   - 2-SAT and 3-SAT algorithms