Information: The final exam is open book and will be divided in the following way:

- 30%: Problems from the material of guides 1 and 2 [DPV 0, 2-6]
- 70%: Problems from the topics of this guide

Topics:

1. Huffman encoding
   (a) Definition of the compression problem
   (b) Huffman encoding algorithm
   (c) Tracing of the Huffman encoding algorithm
   (d) Analysis of Huffman encoding using a min-heap
2. Dynamic programming
   (a) Using tables instead of recursion
   (b) Edit distance algorithm
   (c) Chain matrix multiplication
   (d) All pairs shortest paths problem
   (e) Floyd Warshall's Algorithm
3. Max Flow Problem [DPV 7.2, CLRS 26.1, 26.2]
   (a) Definition of the problem
   (b) Flow properties
   (c) Ford and Fulkerson's Algorithm
   (d) Cut properties
   (e) Max flow - min cut
   (f) Correctness of Ford and Fulkerson's Algorithm
   (g) Analysis of Ford and Fulkerson's algorithm
   (h) Edmonds Karp Algorithm
4. Maximum Bipartite Matching [DPV 7.3, CLRS 26.3]
   (a) Definition of polynomial reductions
   (b) Description of the problem
   (c) Reduction to Max flow

5. P and NP [DPV 8.2, CLRS 34.1-34.2]
   (a) Definition of Turing Machine [lecture 17, 18]
   (b) Decision, Optimization, and Search problems
   (c) Polynomial time reducibility ($\leq_P$)
   (d) Definition of P
   (e) Definition of NP (verification, non-deterministic)
6. NP-hard [DPV 8.2, CLRS 34.3-34.4]
   (a) Definition of NP-hard
   (b) Definition of NP-complete
   (c) Relationships among the classes P, NP, NP-hard, NP-complete
7. NP-complete problems [DPV 8.3, CLRS 34.5]
   (a) Reduction from Turing Machines to CNF-SAT
   (b) CNFSAT $\leq_P$ 3SAT
   (c) 3SAT $\leq_P$ Clique
   (d) Clique $\leq_P$ Vertex Cover
   (e) 3SAT $\leq_P$ Subset sum
8. Coping with NP-completeness [DPV 9.1, 9.2, CLRS 35.1]
   (a) Pseudopolynomial time algorithm for Subset Sum
   (b) Backtracking; Branch and Bound
   (c) Approximation Algorithms
   (d) Vertex Cover approximation algorithm
   (e) Concepts of APX, PTAS, PTAS reducibility