

**Doctoral Preparation Exam 2011 January**

1. (15p) Explain the problem classes P, NP, and NP complete.
  2. (15p) State the SAT problem, and the 3-SAT problem. Using the fact that SAT problem is NP-complete, show that 3-SAT problem is NP-complete.
  3. (15p) Explain what is the flow network, and state the Maxflow-Mincut theorem.
  4. (15p) Explain what is PTAS (polynomial time approximation scheme), and what is FPTAS(fully PTAS).
  5. (15p) Explain any example of dynamic programming.
  6. (15p) State a definition of discrete time Markov Chain and its stationary distribution.
  7. (15p) State a definition of linear programming (LP).
  8. (15p) Explain procedure of the simplex method, or procedure of the ellipsoid method to solve LP. (explain one of them)
- Choose any problems you like (at most 7 problems) and answer them. If you get 60 or more points out of the total score of 120, you will pass.
  - Use separate answer sheets for each problem.
  - Use English for your answer.