Design and analysis of algorithms

Exam

27.11.2015

Instructions:

Answer using *Finnish* or *English* language

1. Are the following claims TRUE or FALSE? Answer only if you know. Don't guess. Correct answer +1 point and incorrect -1 point. If no answer then 0 points. No arguments needed but allowed if you think your answer requires clarification.
   a. Calculating Fibonacci number F(N) by divide-and-conquer takes $O(2^N)$ time.
   b. Minimum spanning tree (MST) can be derived from concluded from travelling salesman problem (TSP) solution in O(1) time by removing one edge.
   c. Christofides algorithm can provide result that is 40% longer than the optimal solution, but never solution that is longer than 60%.
   d. Turing machine can be simulated by Random Access Machine in $O(N^2)$ time.
   e. If there exists an NP-hard problem that can be solved polynomial time by non-deterministic Turing machine, then P=NP.
2. Explain "Dining philosophers" problem. Give an algorithm to solve. Analyze its time complexity.
3. Give pseudo code of Prim's algorithm. Give at least three different data structures for implementing the algorithm in practice. Compare their time complexities when used within Prim.