Algorithms and Complexity 2014 Mästarprov2: Complexity

Mästarprov 2 should be solved individually in written form and presented orally. No collaboration is allowed.

Written solutions should be handed in latest on Tuesday, May 6th 17.00, to Johan or Mladen (personally or in mailbox). Be sure to save a copy of your solutions. Mästarprov 2 is a mandatory and rated part of the course. The test consists of four tasks. The test is roughly graded as follows: Two task correctly solved give an E. Three tasks correctly solved give a C and all tasks correctly solved give an A. You can read more about the grading criteria and the final grade on the course web page. The report should be written in English.

In all problems you should give an analysis of the time complexity of your algorithm and you should be able to argue for its correctness.

1. Some problem

2. Partitioning of a network

Let us assume that we have a network consisting of persons and that we have a relation *friend* where *friend*(*Jonas*, *Anna*) = 1 tells us that Jonas and Anna are friends and *friend*(*Anna*, *Linda*) = 0 tells us that Anna and Linda are not friends. The relation is assumed to be symmetric and reflexiv but not necessarily transitiv. If P is the set of all persons in the network and $A \\ \in P$, then we say that the set A has friendship denisity (FD) = k if the probability that two differnt persons choosen randomly from A are friends is k. Another way of stating it is that $\frac{\#[\text{pairs of friends in } A]}{\binom{|A|}{2}} = k$.

3. Viggo's problem

4. Paths in a network