

COS 522 Complexity — Homework 1.

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Total of 125 points. Due February 20, 2006

Important note: In all the exercises where you are asked to prove something you need to give a *clearly written* and *rigorous* proof. If a proof is made up of several steps, consider encapsulating each step as a separate claim or lemma. While the proof should be rigorous, remember that it will be read by a human and not a computer. So while you should be accurate and convincing, intuition and simplicity are preferred to excessive formality and verbosity. Use your common sense to decide which points are clear and obvious, and which deserve more elaboration and explanations. You can use results from class, but not results from the text that were not proven (or at least stated) in class. If you're not sure whether you can or can not use a particular result, please do not hesitate to email me.

Exercise 0. Skim the Appendix, in particular paying attention to Sections A.2 (probability) and A.5 (basic facts from linear algebra).

Exercise 1 (20 points). Do Exercise 7.10 (random walk fails for directed graphs).

Exercise 2 (30 points). Do Exercise 7.11 ("non-algebraic" analysis of connectivity algorithm).

Exercise 3 (10 points). Do Exercise 21.2.

Exercise 4 (20 points). Do Exercise 21.3.

Exercise 5 (20 points). Do Exercise 21.5.

Exercise 6. Do either Exercise 21.9 (for **20 points**) or Exercise 21.10 (for **30 points**).