Problem Set no. 2

Given: December 8, 2016
Due: December 22, 2016

Exercise 2.1 (a) Obtain an $O(n^\omega \log n)$-time algorithm for computing the *diameter* of an unweighted directed graph. (The diameter is the maximum distance in the graph.)
(b) For every $\varepsilon > 0$, obtain an $O(n^\omega \log n)$-time algorithm for computing $(1+\varepsilon)$-approximations of all distances in an unweighted directed graph.

Exercise 2.2 Obtain a version of Seidel's algorithm that uses only Boolean matrix multiplications.

Exercise 2.3 (a) Obtain a deterministic $O(n^\omega)$-time algorithm for finding *unique* witnesses.
(b) Let $1 \leq d \leq n$ be an integer. Obtain a randomized $O(n^\omega)$-time algorithm for finding witnesses for all positions that have between d and $2d$ witnesses.
(c) Obtain a randomized $O(n^\omega \log n)$-time algorithm for finding all witnesses.

Exercise 2.4 Consider the APSP algorithm for directed graphs. The claim that the elements in the matrix D in the i-th iteration are of absolute value at most Ms, where $s = (3/2)^{i+1}$, is not true. Explain why and how it can be fixed.