HW5, CPSC 468/568, Due April 12, 2016

Throughout this assignment, if a proof or step of a proof follows directly from a definition given or a theorem proven in class or in a reading assignment, then you may simply say that, *i.e.*, you need not reproduce proofs given in class or in the reading.

Problem 0 *(0 points)*:

Read Chapter 17 of your textbook.

Problem 1 *(10 points)*:

Problem 8.4 in your textbook.

Problem 2 *(15 points)*:

The first part of problem 8.6 in your textbook. By "first part," we mean that you are to ignore the question that starts "Can you generalize …"

Problem 3 *(25 points)*:

Problem 8.8 in your textbook. Part (a) is worth 15 points, and part (b) is worth 10 points.

Problem 4 *(15 points)*:

(a) (10 points) Prove that TQBF is PSPACE-hard under logspace reductions.

(b) (5 points) Prove that TQBF is not in NL.

Problem 5 *(20 points)*:

(a) (15 points) Prove that, if P = NP, then there is a randomized polynomial-time algorithm that $\frac{1}{2}$-approximates #SAT. (The meaning of the term "$\frac{1}{2}$-approximates" is given in Def. 17.13.)

(b) (5 points) Improve the result of part (a) to show that, if P = NP, then there is a deterministic polynomial-time algorithm that $\frac{1}{2}$-approximates #SAT.

Problem 6 *(15 points)*:

The complexity class FewP consists of all sets S for which there exist a deterministic polynomial-time verifier M and polynomials p and q with the following properties: For all x, the number of $w \in \{0,1\}^{p(|x|)}$ such that $M(x,w) = 1$ is at most $q(|x|)$; for all $x \in S$, the number of $w \in \{0,1\}^{p(|x|)}$ such that $M(x,w) = 1$ is at least 1.

Prove that FewP is contained in $\oplus$P.