Dr. Christian Scheideler
Johns Hopkins University

Baltimore, March 23 2005

Modern Complexity Theory

Spring 2005

Assignment 5

Problem 16 (4 points)**:**
A graph G is called *3-colorable* if 3 colors suffice to color its nodes so that no two adjacent nodes have the same color. Consider the problem

$$\text{3COL} = \{\langle G \rangle \mid G \text{ is 3-colorable}\}$$

Show that 3COL$\in$ IP. That is, design an interactive proof for 3COL and show that it satisfies the conditions of IP.

Problem 17 (3 points)**:**
Prove that NP is equal to the set of all languages L for which there exists a polynomial time checkable relation R_L such that

$$L = \{x \mid \exists y \ (x, y) \in R_L\}$$

and $(x, y) \in R_L$ only if $|y| \leq poly(|x|)$. Hint: consider the SAT problem.

Problem 18 (3 points)**:**
Look at the proofs in the lecture notes that #SAT$\in$ IP and PSPACE $\subseteq$ IP and use the information in these proofs to design an interactive proof for QSAT. (A proof of correctness is not required.)