Approximation Algorithms
Summer term 2009

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Exercise Set 13

Exercise 1:
Let $PCP_\epsilon(r(n), q(n))$ be the same as $PCP(r(n), q(n))$ except that the constant $\frac{1}{4}$ is replaced by ϵ. Show that $NP \subseteq PCP_{n^{-\delta}}(\log^2 n, \log n)$ for every $\delta > 0$.

(3 Points)

Exercise 2:
Prove: $NP \subseteq coRP \Rightarrow NP \subseteq RP$

(4 Points)

Exercise 3:
Let k-MaxGSat be the following problem: Given n variables $x_1, \ldots, x_n$ and a set of m boolean functions $\Phi = \{\Phi_1, \ldots, \Phi_m\}$ using k variables each, find a truth assignment such that the number of satisfied functions is maximized. The goal is to show that there is no polynomial 2-approximation algorithm unless $P = NP$.
To do so, find a k and a polynomial reduction f from Sat to k-MaxGSat with the following property: If I is a yes-instance of Sat, then all boolean functions in $f(I)$ are satisfiable. Otherwise, at most half of the functions in $f(I)$ are satisfiable.
Hint: Since Sat $\in NP$ *there is a* $(log(n), 1)$*-verifier* $\mathcal{V}$*. Use* $\mathcal{V}$ *to construct boolean formulas with the desired properties.*

(5 Points)

Please return the exercises until Tuesday, **July 21nd, at 2:15 pm**.