Approximation Algorithms
Summer term 2009

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Exercise Set 1

Exercise 1:
Show that for any polynomial $p(n)$ and any constant c there is an integer n_0 such that $2^{cn} > p(n)$ holds for all $n \geq n_0$.

(3 Points)

Exercise 2:
Let $f(n)$ and $g(n)$ be any two of the following functions. For each pair, determine whether $f(n) = \mathcal{O}(g(n))$ or $f(n) = \Omega(g(n))$ or $f(n) = \Theta(g(n))$ holds:

(a) n^2	(b) $n^2 \log n$	(c) 2^n
(d) $n^{\log n}$	(e) 2^{2^n}	(f) n^2 if n is odd, 2^n otherwise

(4 Points)

Exercise 3:
Describe a Turing machine which mirrors a string. As an input, it should accept a string $a_1 a_2 \dots a_n$ with $a_i \in \{0, 1\}$ for $1 \leq i \leq n$. The output should be the reverse string $a_n a_{n-1} \dots a_1$.

(4 points)

Exercise 4:
Give a linear-time algorithm for SAT which computes a truth assignment where at least half of the clauses are satisfied.

(2 points)

Exercise 5:
Prove that SAT remains NP-complete if each clause contains exactly three literals and each variable is contained in at most four clauses.

(4 points)

Please return the exercises until Tuesday, **April 21st, at 2:15 pm**.