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) $2^{2n}$
(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 $a_1a_2\ldots a_n$ with $a_i \in \{0, 1\}$ for $1 \leq i \leq n$. The output should be the reverse string $a_na_{n-1}\ldots a_1$.

(4 points)

Exercise 4:
Give a linear-time algorithm for $\text{Sat}$ which computes a truth assignment where at least half of the clauses are satisfied.

(2 points)

Exercise 5:
Prove that $\text{Sat}$ 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.