1. Express $a \lor b = c \land d$ in equivalent 3CNF form.

2. Show that if $\mathbf{NP} = \mathbf{P}^{SAT}$, then $\mathbf{NP} = \mathbf{coNP}$.

3. Let $MAX-INDSET = \{<G, k>:$ the size of the largest independent set of G is $k\}$
   Show that $MAX - INDSET \in \mathbf{P}^{SAT}$.

4. Answer the following questions:

   (a) Show that there a language $L \in DTIME(2^{2^n})$ but $L \notin DTIME(2^{n^k})$,
       where k is a constant.

   (b) For a language L we define $U_L = \{1^n :$ binary representation of n is in $L\}$.
       Show that L is decidable if and only if U_L is decidable.

   (c) What is the time complexity to decide U_L when $L \in DTIME(2^{2^n})$?

   (d) Is there a decidable language in $\mathbf{P/poly}$ that is not in $\mathbf{P}$?

5. A language $L \subseteq \{0,1\}^*$ is *sparse* if there is a polynomial p such that
   $|\{0,1\}^n \cap L| \le p(n)$ for all $n \in \mathbb{N}_0$.
   Prove that every sparse language is in $\mathbf{P/poly}$.