1. What do we know about the deterministic time and space complexity of co-NP? (Give a brief argument that your claims are true.)

2. True or False:
   - If \( L_1 \) is not recognizable, and \( L_1 \subseteq L_2 \), then \( L_2 \) is not recognizable.
   - If \( L \) is NP-complete, and \( L \leq^p S \), then \( S \) is NP-complete.
   - If \( L \) is NP-complete, then \( L \) is decidable in exponential time.
   - If \( L \) is decidable in exponential time, then \( L \) is NP-complete.

3. Reductions
   a) What does it mean that \( f \) is a reduction from \( A \) to \( B \)?
   b) If we know \( A \leq^P \text{SAT} \), what can we conclude about \( A \)?
   c) If we know \( \text{SAT} \leq^P A \), what can we conclude about \( A \)?

For each of the following languages, choose one of the following classes, and prove that this language is in that class: in P, in NP, decidable, semidecidable, or not semidecidable. The best grade will be given for the tightest bound.

4. The set of graphs that have paths of length at least 3.

5. Set Cover: Given a universe \( U = \{1, \ldots, n\} \) and a set \( S \subseteq \mathcal{P}(U) \) of subsets of \( U \), and \( k \in \mathbb{N} \), is there a set \( S' \subseteq S \) of \( k \) subsets of \( U \) whose union is \( U \)?
   For instance, if \( n = 4 \) and \( S = \{\{1, 2\}, \{1, 3\}, \{1, 4\}\} \), then \( \langle U, S, 3 \rangle \) is in Set Cover, but \( \langle U, S, 2 \rangle \) is not.

6. \( L = \{e(T) : T \text{ accepts no more than 3 distinct inputs}\} \).