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 $L \leq_m^P S$, 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 $A \leq^P$SAT, what can we conclude about A?

   c) If we know 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 $S \subset \mathcal{P}(U)$ of subsets of U, and $k \in \mathbf{N}$, 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. $L = \{e(T) : T \text{ accepts no more than 3 distinct inputs}\}$.