CSE 6321 - Problem Set 3
Due lecture on April 18th

Collaboration is permitted; looking for solutions from external sources (books, the web, material from previous years, etc.) is prohibited.

1. Show that if every NP-hard language is also PSPACE-hard, then PSPACE = NP.

2. Show that TQBF restricted to formulas where the part following the quantifiers is in conjunctive normal form is still PSPACE-complete.

3. Read the definition of MIN-FORMULA from Problem set 2.
   (a) Show that MIN−FORMULA ∈ PSPACE.
   (b) Explain why this argument fails to show that MIN−FORMULA ∈ coNP: If φ ∉ MIN−FORMULA, then φ has a smaller equivalent formula. A NTM can verify that φ ∈ MIN−FORMULA by guessing that formula.

4. An undirected graph is bipartite if its nodes may be divided into two sets so that all edges go from a node in one set to a node in the other set. Show that a graph is bipartite if and only if it doesn’t contain a cycle that has an odd number of nodes. Let BIPARTITE = {⟨G⟩ : G is a bipartite graph}. Show that BIPARTITE ∈ NL.

5. Recall that a directed graph is strongly connected if every two nodes are connected by a directed path in each direction. Let

   STRONGLY−CONNECTED = {⟨G⟩ : G is a strongly connected graph}.

   Show that STRONGLY−CONNECTED is NL-complete.