CSCI 3333 Practice Quiz PNP

**Problem 1.** Fill in the blanks:

When reducing 2SAT to 3SAT, replace a clause \((x_1 \lor \neg x_2)\) with a clause \((F \lor x_1 \lor \text{literal})\).

When reducing 2SAT to 4SAT, replace a clause \((\neg x_1 \lor x_2)\) with a clause \((F \lor F \lor \text{literal} \lor \text{literal})\).

When reducing 4SAT to 3SAT, replace a clause \((\neg x_1 \lor \neg x_2 \lor x_3 \lor x_4)\) with two clauses \((\neg x_1 \lor \neg x_2 \lor y)\) and \((\text{literal} \lor x_3 \lor \text{literal})\).

When reducing NAE-SAT to 3SAT, replace a clause \((\neg x_1 \lor \neg x_2 \lor x_3)\) with two clauses \((\neg x_1 \lor \neg x_2 \lor \text{literal})\) and \((\text{literal} \lor \text{literal} \lor \text{literal})\).

**Problem 2.** For each problem, check *all* boxes corresponding to known facts about the problem.

Input: an bipartite undirected graph \(G\).
Output: whether \(G\) has a perfect matching.  
\[ \square \text{In P} \quad \square \text{In NP} \quad \square \text{NP-complete} \]

Input: an undirected graph \(G\).
Output: whether \(G\) is connected.  
\[ \square \text{In P} \quad \square \text{In NP} \quad \square \text{NP-complete} \]

Input: an array of integers \(A\).
Output: whether \(A\) is sorted.  
\[ \square \text{In P} \quad \square \text{In NP} \quad \square \text{NP-complete} \]

Input: a Boolean formula \(\Phi\).
Output: whether \(\Phi\) has a satisfying assignment.  
\[ \square \text{In P} \quad \square \text{In NP} \quad \square \text{NP-complete} \]
Problem 3. Fill in the blanks in the Venn diagram in Figure 1.

Figure 1: The Venn diagram for Problem 3.