Last name _____

First name _____

LARSON—MATH 556—CLASSROOM WORKSHEET 09
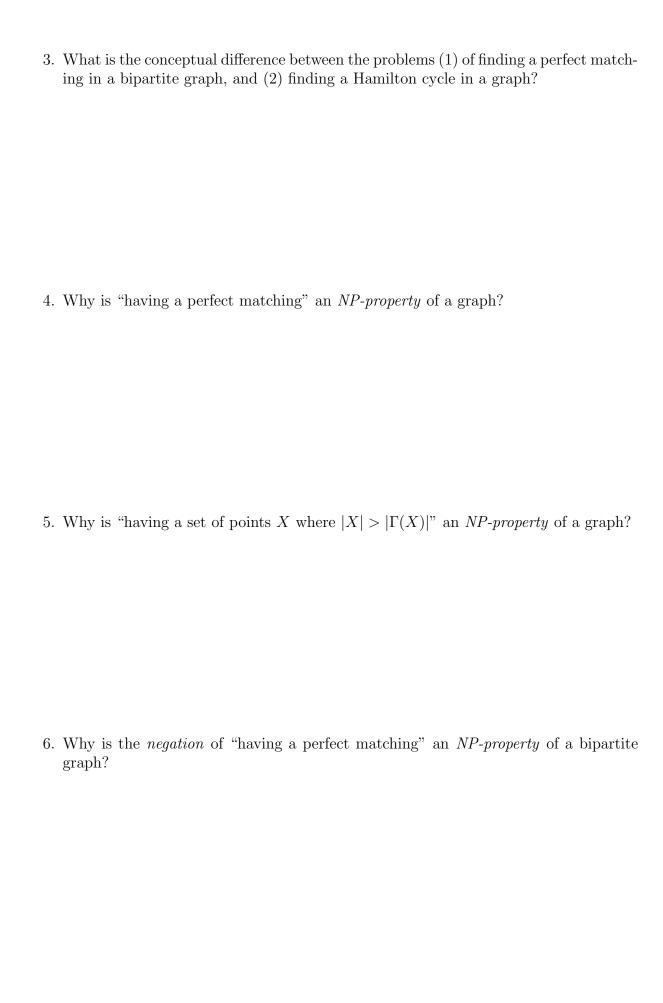### Algorithms and NP-properties

Concepts & Notation

- *assignment problem, graph G, points $V(G)$, lines $E(G)$, adjacent, incident.*

- *line covering, line covering number ρ, matching, matching number ν, point covering, point covering number τ, independent set, independence number α.*

Review

- **König's Theorem:** For any bipartite graph, $\tau = \nu$.

- A **perfect matching** (or **1-factor**) is a matching which covers all points of G.

- What is *Hall's Theorem*?

- What is *Frobenius's (Marriage) Theorem*?

1. What is a *Hamilton cycle* in a graph?

2. What's an algorithm for finding a Hamilton cycle in a graph?

3. What is the conceptual difference between the problems (1) of finding a perfect matching in a bipartite graph, and (2) finding a Hamilton cycle in a graph?

4. Why is "having a perfect matching" an *NP-property* of a graph?

5. Why is "having a set of points X where $|X| > |\Gamma(X)|$" an *NP-property* of a graph?

6. Why is the *negation* of "having a perfect matching" an *NP-property* of a bipartite graph?

7. Why is the property of "having a perfect matching" in a bipartite graph *well-characterized*?

8. What does it mean for *a class of graphs to be in NP*?

9. What does it mean for *a class of graphs to be in co-NP*?

10. How do we extend the concept of "a *property* being well-characterized" to that of "an *invariant* being well-characterized"?

11. What is a *minimax theorem*?

12. What is the **importance** of minimax theorems?