# Analysis of Algorithms

## Final Exam : 13 June 2013

1. Show that the unweighted longest simple path problem doesn't have the *optimal substructure* property.

2. Describe two representations of a directed graph $G = (V, E)$ and their space usage.

3. Describe Johnson's algorithm for the all-pairs shortest-paths problem. What is the time complexity of the algorithm?

4. Describe the algorithm that solves the maximum bipartite matching problem by finding a maximum flow. What is the time complexity of the algorithm?

5. Given a graph $G$ and two vertices $u$ and $v$, a *hamiltonian path* from $u$ to $v$ in $G$ is a simple path from $u$ to $v$ that visits every vertex of $G$ exactly once. Show that the problem of finding a hamiltonian path in a *directed acyclic graph* can be solved in polynomial time. Give an efficient algorithm for the problem.

6. Write the definition of NP-completeness (i.e., A language $L$ is NP-complete if ...). Show that if an NP-complete problem $B$ is polynomial-time solvable, then $P = NP$.