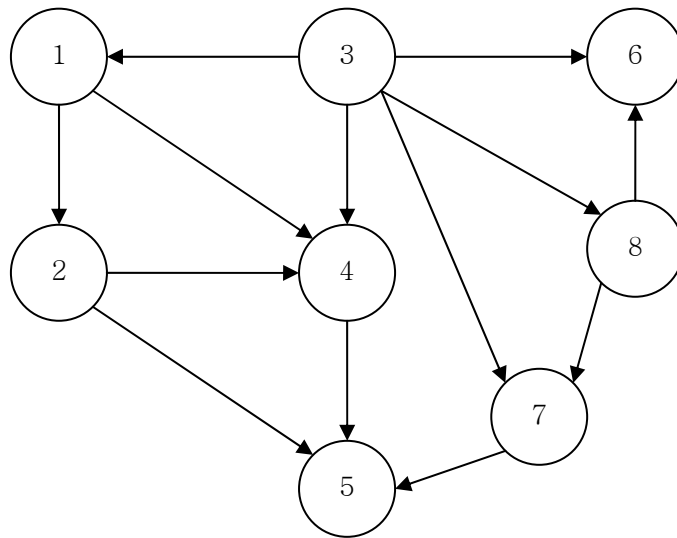# Analysis of Algorithms
Final Exam: 5 December 2006

1. Suppose that in a 0-1 knapsack problem, the order of the items when sorted by increasing weight is the same as their order when sorted by decreasing value. Give an efficient algorithm to find an optimal solution to this variant of the knapsack problem, and argue that your algorithm is correct.

2. Show the discovery time and finishing time for each vertex and the depth-first forest of depth-first search of the following graph when vertices are considered in their increasing order.

3. Describe the Bellman-Ford algorithm for the single-source shortest paths problem (in pseudo code) and its time complexity.

4. Describe the Edmonds-Karp algorithm for the maximum flow problem (in words).

5. The *edge connectivity* of an undirected graph is the minimum number k of edges that must be removed to disconnect the graph. Show how the edge connectivity of an undirected graph $G = (V, E)$ can be determined by running a maximum flow algorithm on at most $|V|$ flow networks, each having $O(V)$ vertices and $O(E)$ edges.

6. Give the definitions of problems CLIQUE and VERTEX-COVER. Assuming that CLIQUE is NP-complete, show that VERTEX-COVER is NP-complete.