Analysis of Algorithms

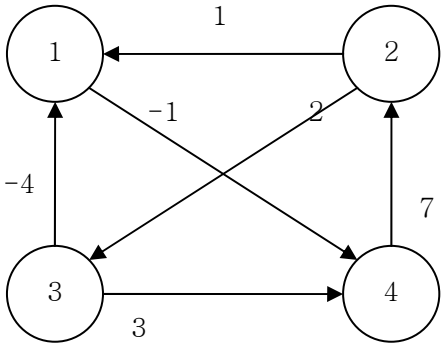
Final Exam: 9 June 2003

1. Suppose that B-Tree-Search is implemented to use binary search rather than linear search within each node. Show that this change makes the CPU time required $O(\log n)$, independently of how t might be chosen as a function of n.

2. Write a nonrecursive version of Find-Set(x) with path compression. (The parent of x is denoted by $p[x]$.

3. Give a counterexample to the conjecture that if there is a path from u to v in a directed graph G, then any depth-first search must result in $d[v] \le f[u]$. ($d[v]$ and $f[v]$ denote the discovery time and finish time of v, respectively.)

4. Run the Floyd-Warshall algorithm on the following graph. Show the matrix $D^{(k)}$ (i.e., $D^{(0)}$, ..., $D^{(4)}$).



5. Give an efficient push-relabel algorithm to find a maximum matching in a bipartite graph. Analyze your algorithm.

6. Write the definition of NP-completeness and explain how to prove that a problem is NP-complete.

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