CS 170: Problem Set 5
Due: September 30, 2011, 4:00 p.m.

Instructions: Turn this in to the class homework boxes in 283 Soda by 4:00 p.m. on Friday, September 30, 2011. Please begin your answer to each question on a new sheet of paper and make sure each sheet is labeled with your name, SID, section number, GSI name, the assignment number, the question number, and “CS 170 – Fall 2011.”

Because each problem will be graded by a different reader, please turn in each question in a different box in 283 Soda. Question i goes in the box labeled “CS 170 — i.”

Please read the class webpage for rules regarding collaboration (encouraged!) and cheating (forbidden!) on homework.

DPV = Dasgupta, Papadimitriou, and Vazirani.

1. DPV 4.1
2. DPV 4.4
3. DPV 4.5
4. DPV 4.13
5. DPV 4.19
6. A directed graph $G = (V, E)$ is called semiconnected if for every pair of distinct vertices $u$ and $v$ there is either a path from $u$ to $v$ or from $v$ to $u$, or both ($u$ and $v$ may lie on a cycle). Show that $G$ is semiconnected if and only if the DAG formed by $G$’s strongly connected components has a unique topologically sorted order, i.e. there is a unique way to order the DAG vertices $v_1, v_2, \ldots, v_n$ such that any edge $(v_i, v_j)$ satisfies $i < j$. Hint: Let $\tilde{G}$ denote the DAG of strongly connected components of $G$. Show that $G$ is semiconnected if and only if $\tilde{G}$ has the following property: if $v_i$ and $v_{i+1}$ are consecutive vertices in a topological sort of $\tilde{G}$, then the edge $(v_i, v_{i+1})$ exists in $\tilde{G}$. 