Homework 8 (Posted 2nd April, Due during or before class 9th April (**programming assignment due by 11th April,** 11.59 **p.m.**))

Policy for Programming Assignment: Problem 1 has a programming assignment. The design for this one will be posted 9th April. **The programming assignment is due by 11th March 11.59 p.m..** If your name is John Smith, then name your program as JohnSmith.c and email it to yjkim78@gradient.cis.upenn.edu.

Problem 1: 10+15 Design an algorithm to detect whether an undirected graph has an odd cycle or not. Analyze its complexity. Program your algorithm.

Problem 2: 10 pts Give an algorithm to detect whether an undirected graph has a cycle or not. Your algorithm must be an O(V) algorithm independent of the number of edges.

Problem 3: 10 pts There exists a path from a vertex u to a vertex v in a digraph. Also, $d[u] < d[v]$ in DFS. Does it always hold that v is a descendant of u? Justify your answer. (Prove or give a counter example).

Problem 4: 5 pts Consider the tree structure of BFS (same definitions as those for DFS). Consider an undirected graph. Show that all edges in the graph are either tree or cross edges, i.e., there is no forward or backward edge.