Homework 9 – Due Friday, October 30, 2009 in class

Reminders   Collaboration is permitted, but you must write the solutions by yourself without assistance, and be ready to explain them orally to a member of the course staff if asked. You must also identify your collaborators. Getting solutions from outside sources such as the Web or students not enrolled in the class is strictly forbidden.

Reading     As a reminder, you should read over the material on BFS/DFS in Chapter 22. The non-starred exercises in those sections are good exercises to check your understanding of the material.

Problems to be handed in. Please submit each problem on a separate sheet of paper.

1. Consider exercise 22.2-6 in CLRS 2e (22.2-7 in CLRS 3e), which deals with professional wrestling.
   (a) Show how you would encode the problem as a graph $G = (V, E)$: what would be the vertices $V$, and what would be the edges $E$? What are the sizes of the sets $V$ and $E$?
   (b) Consider the following algorithm for the problem of finding a rivalry-respecting designation: run BFS, and if a cross edge is found that connects two vertices at the same level of the BFS tree, return “no designation exists”; otherwise, designate all vertices at odd levels of the tree to be “babyfaces” and all vertices at even levels of the tree to be “heels.”
   What is the running time of this algorithm in terms of $n$ and $r$?
   (c) Show that if the algorithm outputs a designation (i.e. if there are no cross edges between vertices at the same level of the tree), then every rivalry is between a babyface and a heel.
   (d) Show that if $G$ contains a cycle of odd length, then no rivalry-respecting designation is possible.
   (e) Show that if the algorithm from part (b) outputs “no designation exists”, then it is really true that no rivalry-respecting designation is possible.

2. (Depth-first Search)
   (a) (Rewriting DFS to use a stack) CLRS Exercise 22.3-6 (2e) / 22.3-7 (3e)
   (b) (Articulation points) CLRS Problem 22-2, parts a through d. (This is a “problem” from the end of the chapter, not an “exercise”. Also note that you are only asked to hand in the suquestions about articulation points, though the remaining parts make good exercise/review material).

3. Programming problem: details to be posted online.