Problem Set 3—Due Friday, Nov. 10, noon

(20) Problem 1. Problem 23.5-7 (p. 494). Hints: linear time is possible; start by constructing the component graph (as described in 23.5-4), then consider how to test if an acyclic graph is semiconnected.

(20) Problem 2. Problem 26-1 (p. 576). Note that in the problem n is NOT the number of vertices in the graph, but could be as large as $|E|$.

(20) Problem 3. Suppose we have a 2D range tree where the main (X) tree is a balanced Ternary Search Tree, TST, (as was described on the midterm). As in a normal 2D range tree, each internal node in the TST has a pointer to a Y tree which contains all the points in the subtree rooted at that node.

- **A** What is the the space requred for this 2D range tree (in particular is it more or less than a standard 2D range tree).
- **B** Describe how to do a range search in this ternary 2D range tree (given $x_1 < x_2$ and $y_1 < y_2$ return all points in this rectangle). What is the cost of this range search? Again, is it more or less than with a binary 2D range tree.

(20) Problem 4.

Suppose we have an undirected bipartite graph G=(L,R,E) (so all edges in E are between L and R), and a matching $M \subset E$. Prove:

If a search for an augmenting path fails to find one with respect to M, than

1) the unlabeled vertices in L and the labeled vertices in R form a cover of size $|M|$.

2) M is a maximum size matching.