Ad Hoc And Sensor Networks
Exercise 9

Assigned: November 16, 2008
Due: November 23, 2008

1 Tree-based Clock Synchronization

Common clock synchronization algorithms (e.g. TPSN, FTSP) rely on a spanning tree to perform clock synchronization. In the TPSN protocol sender-receiver synchronization is performed along the edges of the tree while FTSP is flooding synchronization messages along a tree rooted at the reference node. Finding a good spanning tree for clock synchronization is not trivial. Nodes which are neighbors in the network graph should also be close-by in the resulting tree. Show that in a grid of $n = m \times m$ nodes the stretch of the spanning tree is at least m. The stretch is defined as the hop distance in the tree divided by the distance in the grid.

2 Gradient Clock Synchronization

The A^{max} clock synchronization algorithm was introduced in the lecture. In this exercise, we use a slightly modified version of this algorithm. Instead of adjusting only the clock value of a node, we also set the rate of the logical clock to the maximum clock rate of any neighbor (if faster than the local clock rate). Can you see a problem that arises when this algorithm is used in a real-world sensor node deployment? (Hint: What happens to the logical clock rate when the environmental temperature is varying?)