

ECE 3656 Mobile and Wireless Networks
Winter 2003

Homework 1: Due in class Wed February 5 2003

- This test contains 1 problem. It allow you to earn 100 points.
- The solution to this problem should be a *program* (both code and executable) that produces required results obtained by simulating wireless connected topologies, and a short **paper** describing the results obtained by the program.

Show your work, as partial credit can be given. You will be graded not only on the correctness of your program, but also on the clarity with which you express the results in the paper. **Be neat.**

- **No late submissions will be accepted.**
- Only homework returned in a letter size envelope will be accepted. Please, write your group member names, the class name (ECE 3656) and the term (Winter 2003) on the envelope (write clearly, please). The program code and the executable should be sent via e-mail to the instructor (basagni@ece.neu.edu).

Write your name(s) here: _____

Problem # 1 [100 points]. You are supposed to write a program that simulates the generation of wireless networks. These networks should be connected, namely, there has to be possible to find a multi-hop route between any pair of nodes.

Generating a wireless network means that you have to place n nodes in 3D *randomly and uniformly* (for the generation of the nodes' coordinates you can use the C++ class `rstream` that provides a pseudo-random number generator. It is available from the class web page).

As customary in wireless networks, two nodes are *neighbors* if their (Euclidean) distance is less than the smaller of their transmission radii. In this homework and for the project we consider all nodes to have the same transmission radius r . The number of neighbors of a node is called its *degree*. The *network degree* is the maximum among the degree of its nodes.

The resulting graph is called a *topology*. You should only consider *connected* topologies (this will affect the size of the geographic area you are disseminating your nodes on). Once the topology is generated you should write code for checking whether that topology is connected or not.

The sides on the geographic area and the transmission radius of a node should be expressed in meters. We consider cubes (3D) of side L . Also, consider to choose the transmission radius r of a node between the following two: 250m (IEEE 802.11) and 10m (Bluetooth).

For each of the generated topologies that are connected the following are the metrics that we are interesting to have an average of:

- average degree;
- maximum degree;
- number of links;
- network diameter;
- route length.

The choice of the simulation parameters (number of nodes n , transmission range r , side of the cube L) and the number of connected topologies generated on which the average is computed is part of the homework and it must be justified in the paper. The paper should also show graphs about the obtained results rather than tables with numbers.