

# Ad Hoc And Sensor Networks

## Exercise 5

Assigned: October 29, 2007

Due: November 9, 2007

### 1 Degree of Euclidean Graphs

In the lecture the four Euclidean graphs Minimum Spanning Tree (w.r.t. the Euclidean length of edges) MST, Relative Neighborhood Graph RNG, Gabriel Graph GG, and Delaunay Triangulation DT have been introduced. Which of these four graphs has degree bounded by a constant? Give a reasoning if you think a graph has bounded degree, or draw a counterexample if you believe a graph can have unbounded degree.

### 2 Gabriel Graph Spanner Property

You have seen in the lecture that the Gabriel Graph GG contains the energy-minimal paths (and is therefore an energy-spanner with spanning factor 1). Do you think the GG is also a Euclidean spanner, i.e. with respect to the Euclidean length of edges? If you think so, give a reasoning; if not, provide a counterexample.

### 3 XTC in Practical Settings

The XTC Algorithm was described in the lecture. It was stated, that the algorithm produces a topology with maximal node degree of at most 6 if the underlying network graph is a UDG. Why does XTC result in a bounded degree topology if the given graph is a UDG? Give a formal prove. Now consider a more practical environment including non-ideal radio propagation and obstacles. Does XTC still produce bounded degree topologies?

### 4 Benefit of Topology Control

In the lecture, you have seen multiple attempts to conserve energy by managing a node's neighborhood. Discuss in which circumstances topology control is useful and when it may be inappropriate. For example, does it make sense to have topology control in dense networks or is it more suitable in a sparse topologies? Does the actual traffic pattern influence your decision for or against topology control?