

Exercises of lecture  
**Mobile Ad Hoc Networks**  
Summer 2007  
Sheet 2

**SECTION 1:**  
Topology Control

1. Consider following topology where virtual links showing distances between nodes in meters. Each node can vary its transmission power such that it can transmit from 2 meters to maximum of 8 meters. By default each node transmits at maximum radio range.
  - We wish to apply *topology control*. Topology control is the process of altering the wireless topology by configuring the signal transmission power of the nodes, with the goal to minimize energy usage while maintaining connectivity<sup>1</sup>. You are asked to create a simple topology control (central or distributed) algorithm. Your algorithm is only required to keep the topology connected while reducing transmission ranges on each node<sup>2</sup>.

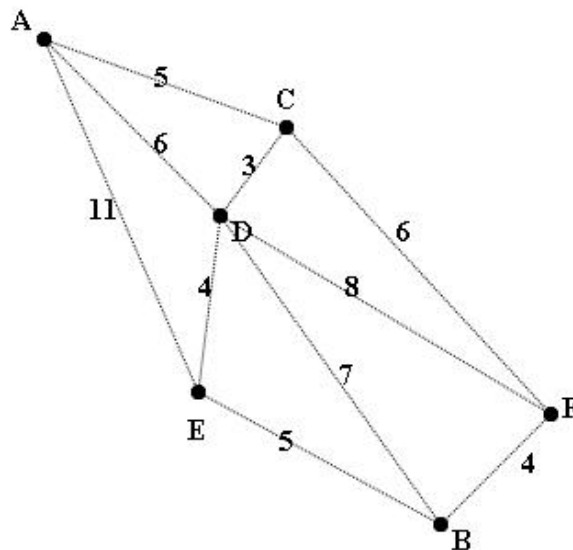


Figure 1: A wireless network where virtual connections showing distances between nodes in meters.

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<sup>1</sup>Connected implies that each node can send message to other node directly or using intermediate hops

<sup>2</sup>We will discuss this topic in more detail in future lectures. Hence your algorithm do not have to be perfect.

- Now assume that a 10 packets of equal size, has to be send from node-A to node-B using minimum number of intermediate nodes. Each node consumes  $(x \times R^2)$  units of energy in sending a packet, where R is transmission range. Furthermore,  $y$  unit of energy used is receiving a packet. How much energy is used in transmission of 10 packets, when they are send in original topology and how much energy is used when send in topology after applying yours topology control algorithm.
- Based on the results of above part what you think could be problems (if any) in your algorithm and how those problem could be solved?

## **SECTION 2:**

### Modulation

1. Distinguish the analogue modulation and digital modulation, and explain why we need digital modulation.
2. Identify the digital modulation format used in such radio system as IEEE 802.11, Bluetooth, Cellular networks like GSM and CDMA, and so on.