

Computer Science 72010

Parallel and Distributed Computation and Advanced Operating Systems

Midterm

1. Suppose that the attached diagram of a switched LAN represents a collection of subnets (clouds) connected by Cisco switches, (square boxes) whose MAC addresses are given by the numbers in the boxes. Assume that edges are bidirectional and have weight 1.
 - a) Label the root switch; the root port on each switch; the designated ports; and the blocked ports.
 - b) What would the mac-address-table entries be for switches 1 and 2 after the following messages have been sent:
 - From 4 to 3
 - From 5 to 4Assume that the mac-address-tables are initially null.
 - c) Suppose that messages can be forwarded while the spanning tree is being constructed (i.e., during the listening and learning phases), and that the learning bridge algorithm is run while the spanning tree algorithm is running. Describe a sequence of messages that will cause mac-address-table entries to be set in a way that some switch can never get a message to some other switch.
2. What is the lowest possible message complexity for a leader election algorithm that has only comparison operations for UID's? Use the IOA model to write an algorithm that achieves this complexity, and sketch a proof of its complexity.
3. Consider a collection of networks connected by Cisco switches, running the spanning tree algorithm. Define a root path as a sequence of switches s_1, s_2, \dots, s_n such that the root port of s_i is connected to s_{i+1} . (Note that s_{i+1} is closer to the root than s_i .) Let M be the switch with the smallest MAC address in a network. Prove by induction that after r rounds, if switch s is at distance r from M , that s has its root equal to M and there is a root path from s to M .

What is the message complexity of the above algorithm? What is the communication complexity? Explain each.
4. Construct counter-examples to the following statements:
 - a. The Cisco spanning tree algorithm computes a minimum weight spanning tree.
 - b. The LCR algorithm for leader election needs at least n^2 messages to find a leader.
 - c. Using the learning bridge algorithm (without the spanning tree algorithm) guarantees that messages follow the shortest path from source to destination.

Switched LAN

