CS 6543 Computer Networks

Spring 2007 – Midterm II

April 19, 2007

Name:…… Score: ……./20

This exam has 6 questions in 10 pages. You have 75 minutes. Good luck.

1. (6 points) In this question, you will explain/discuss some concepts briefly. (1pt bonus)

    a. (1pt) Why do we use very high frequencies in wireless communications (like 2.4Ghz in 802.11)? What are the advantages/disadvantages of using high frequencies?

    b. (1pt) Why do we use ACKs in 802.11 (Wi-Fi) but not in wired Ethernet?

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c. (1pt) What are the key differences between WiMAX and Wireless LAN (WLAN) regarding medium access, performance, and offered services?

d. (2pt) Solutions to TCP in wireless are classified as: link-layer, split-connection, end-to-end protocols. Give at least one advantage and disadvantage for each class.

link-layer

+

-

split-connection

+

-

end-to-end

+

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e. (1pt bonus) Briefly explain one of the wireless-related concepts/topics that you learned best or found interesting in the second part of this course?

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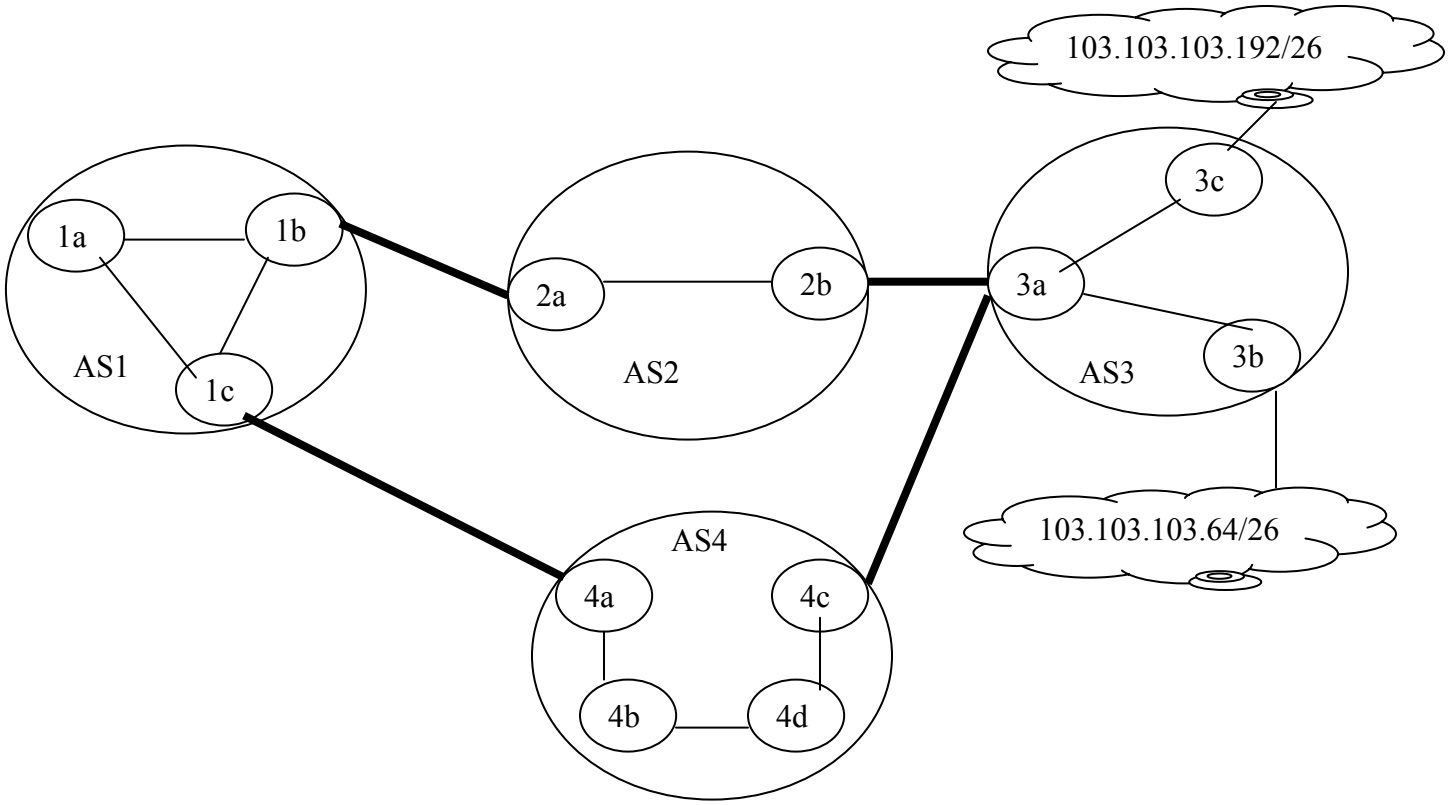
2. (3pt) Consider the network shown below. Suppose all ASes are running OSPF as their intra-AS routing protocol and BGP as their inter-AS routing protocol.



In this question you are asked to show/explain how/what Router **1a** in AS1 learns/knows about the two networks served by AS3. When answering this question, give the key steps until the information regarding the two networks reaches Router 1a and what Router 1a stores in its routing table (e.g., which nodes uses OSPF or BGP (eBGP or iBGP) and what kind of information they send, which node does address aggregation if necessary, which path is selected etc.)

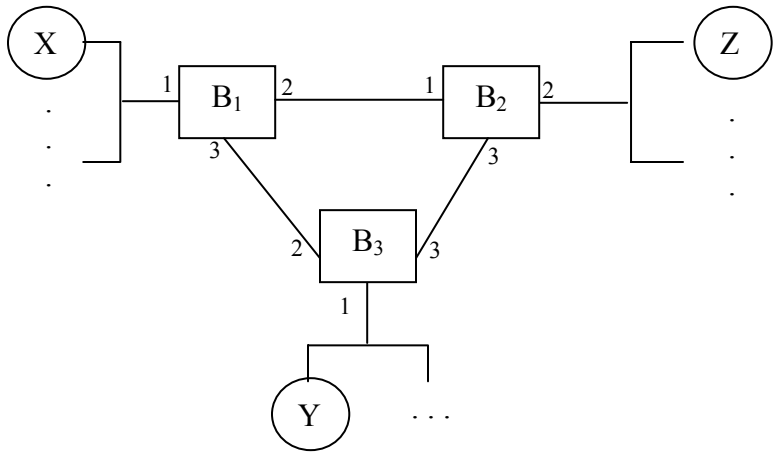
1. Router 3c uses OPSF and sends a link state advertisement (LSA) indicating that it has a link to 103.103.103.192.0/26 network.
2. ….

More space is available in the next page →→→→

Extra page for question 2.

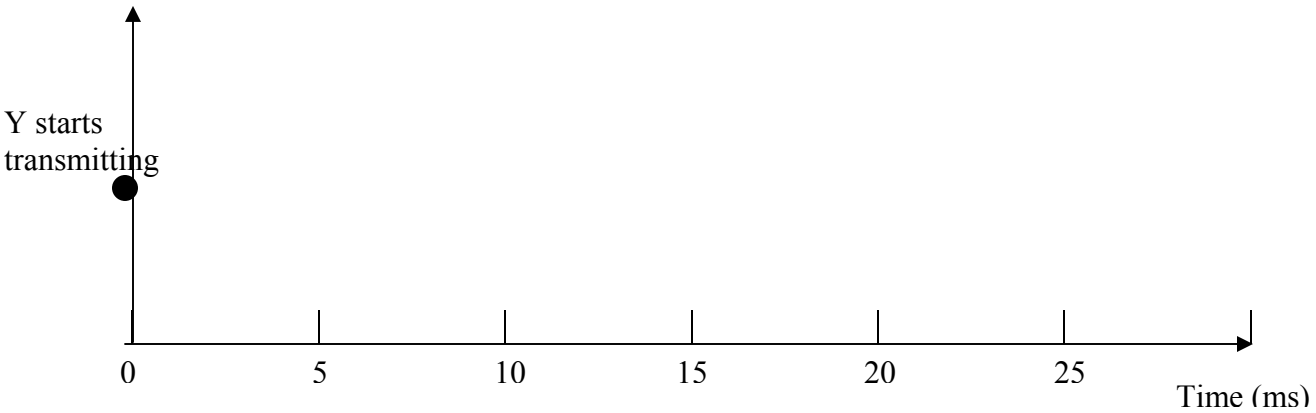
Name :……

3. (3pt) Three local area networks (LANs) are connected via three learning switches (bridges) B_1, B_2 and B_3, as shown in the below figure.



Initially, switches have empty forwarding tables. But assume that every node knows the physical addresses of all other nodes in the network (i.e., no need for ARP). Also assume that it takes 5ms to send a packet over one segment (link). If needed you can also make assumptions.

a. (2 pt) If Y sends a packet to Z at t=0ms, what will happen in the above network? Drawing a diagram show the important events until t=25ms.



b. (1pt) Explain what the problem is in part (a) and how we can avoid it.

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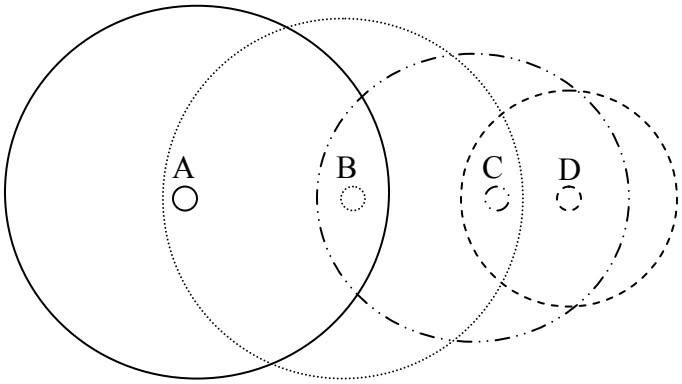
4. (3pt) Suppose that four mobile nodes are located as shown below. The circles around each node shows the transmission range of that node (since they use different powers their transmission ranges are different). Ignore sensing and inference ranges.



a. When B is transmitting to A, explain which nodes will be hidden or exposed. Would using RTS/CTS help to avoid the hidden node problem in this case (why, why not)?

b. Suppose every node uses CSMA/CA without RTS/CTS and has the same transmission capacity of 2Mbps. Also assume that

   A wants to continuously send data to B and

   C wants to continuously send data to D.

   At the high level discuss what would be the performance (e.g, throughput) for A-B, and for C-D? How would the performance change if we enable RTS/CTS feature?

Use the next page →→→→

Extra page for question 4.

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5. (3pt) Suppose 3 nodes using CDMA have the following codes

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A:  1,  1,  1, -1, -1,  1, -1, 1
B: -1,  1,  1,  1, -1, -1,  1, 1
C: -1, -1,  1,  1,  1, -1, -1, 1
```

And try to send data to A', B', and C', respectively.

a. (1pt) Suppose A is sending data bit 1, C is sending data bit 0, and B is silent. What will be the received signal at A', B' and C'.

b. (1pt) Using the received signal in part (a), show that what will be the data bit received by A', B' and C'. Is there any noise because of CDMA (assume there is no other noise)?

c. (1pt) Would there be any noise as in part (b) if only A and B were sending while C was silent? Why or why not?

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6. (3pt) Consider a wireless ad hoc network where nodes are randomly distributed in an area and each node monitors the environment for two types of events (Ev_A and Ev_B). Each monitoring node sends the information regarding Ev_A to a special node called A, and the information regarding Ev_B to another special node called B. Assume that all the monitoring nodes and the special node A are fixed while the special node B is randomly moving around in the area where monitoring nodes are deployed.

a. (1pt) Suppose the probability of observing Ev_A is much higher (e.g. 0.8) than that of Ev_B (e.g., 0.1) and you are asked to select **only one** routing protocol for the above network. In this case, which routing protocol (proactive OLSR, or reactive DSR or AODV) would you use? **Please justify your answer.**

b. (2pt) Suppose Ev_A and Ev_B happen with equal but relatively high probabilities (e.g., 0.7). Can you design a better routing approach if you are allowed to use different routing protocols at the same time and/or their modifications? Discuss a new routing protocol (which can use some ideas from proactive OLSR, or reactive DSR or AODV) that would better perform in the above network when Ev_A and Ev_B happen with equal probability.

Use the next page →→→→

Extra page for question 6.