CS 6543 Computer Networks

Spring 2011 – Midterm2 -- Given on April 27, 2011
MUST be returned in class on **May 2**, 2011, **8:00pm**.
You have 100 min. Good luck.

I do solemnly and sincerely swear that I worked on this exam for 100 minutes by myself, I did NOT discuss or share my solutions with anyone else, and I did NOT use any other materials except the 4-page cheat sheet that I prepared… ***Signature****:……*

Name:…… Score: ……./25

This exam has 7 questions in10 pages. Good luck.

1. (5 points) In this question, you will explain/discuss some concepts briefly.

    a. (1pt) How/why do **routing loops** happen in the IP networks (give an example), and briefly describe how IP **avoids the circulation** of IP datagrams over such loops?

    b. (1pt) Recall the formula $1/(1+t_{prop}/t_{trans})$ given for the efficiency of the Ethernet. Explain the advantages and disadvantages of using **larger frames** in the Ethernet.

Name:……..

c. (1pt) What are the advantages and disadvantages of using a large value for the **playout delay** when streaming some multimedia data?

d. (1pt) Wireless MAC protocols are designed based on **collision avoidance** (CA) rather than **collision detection** (CD). Briefly explain the reasons behind this design choice.

e. (1pt) Describe a realistic situation where a **reactive** routing protocol (e.g., AODV) would be better than a **proactive** routing protocol (e.g., OLSR) in wireless ad hoc networks. Why?

Name:…….

2. (3 points) In general, routing protocols perform two tasks: (a) collect/disseminate network state information and (b) compute paths using this information and fill the routing table at each node. Recall that we have two different yet complementary routing protocols in the Internet, namely intra-domain routing protocol OSPF and inter-domain routing protocol BGP.

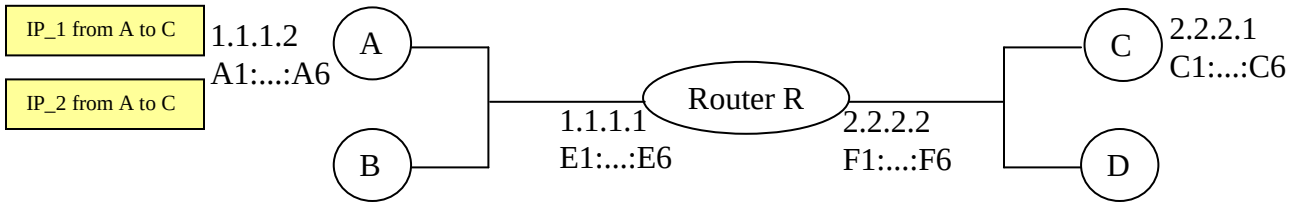
    a. (1 points) Giving an example, explain how OSPF works (i.e., performs the above tasks).

    b. (1 points) Giving an example, explain how BGP works (i.e., performs the above tasks).

    c. (1 points) Briefly explain why we need two different routing protocols in the Internet.

Name:…….

3. (4 points) Consider the below IP network.



a. (1 points) Determine the routing tables at node A, at node C, and router R.

routing table at A

Dest	next	cost

routing table at router R

Dest	next	interface	cost

routing table at node C

Dest	next	cost

Name:…….

b. (3 points) Suppose node A **has two IP packets** (IP_1, and IP_2) to send to node C. List all the steps that are performed at the **network** layer and **data link** layer while transmitting these two packets from node A to node C.

Assume that routing tables are known as determined in part (a). Also node A knows the IP address of node C (so no need for DNS). But, physical addresses are NOT known by any NIC.

Steps:

1. Node A looks up the routing table to identify the next node for 2.2.2.1 and determines that the next node is ……
2. …..

If you need more space use the next page…

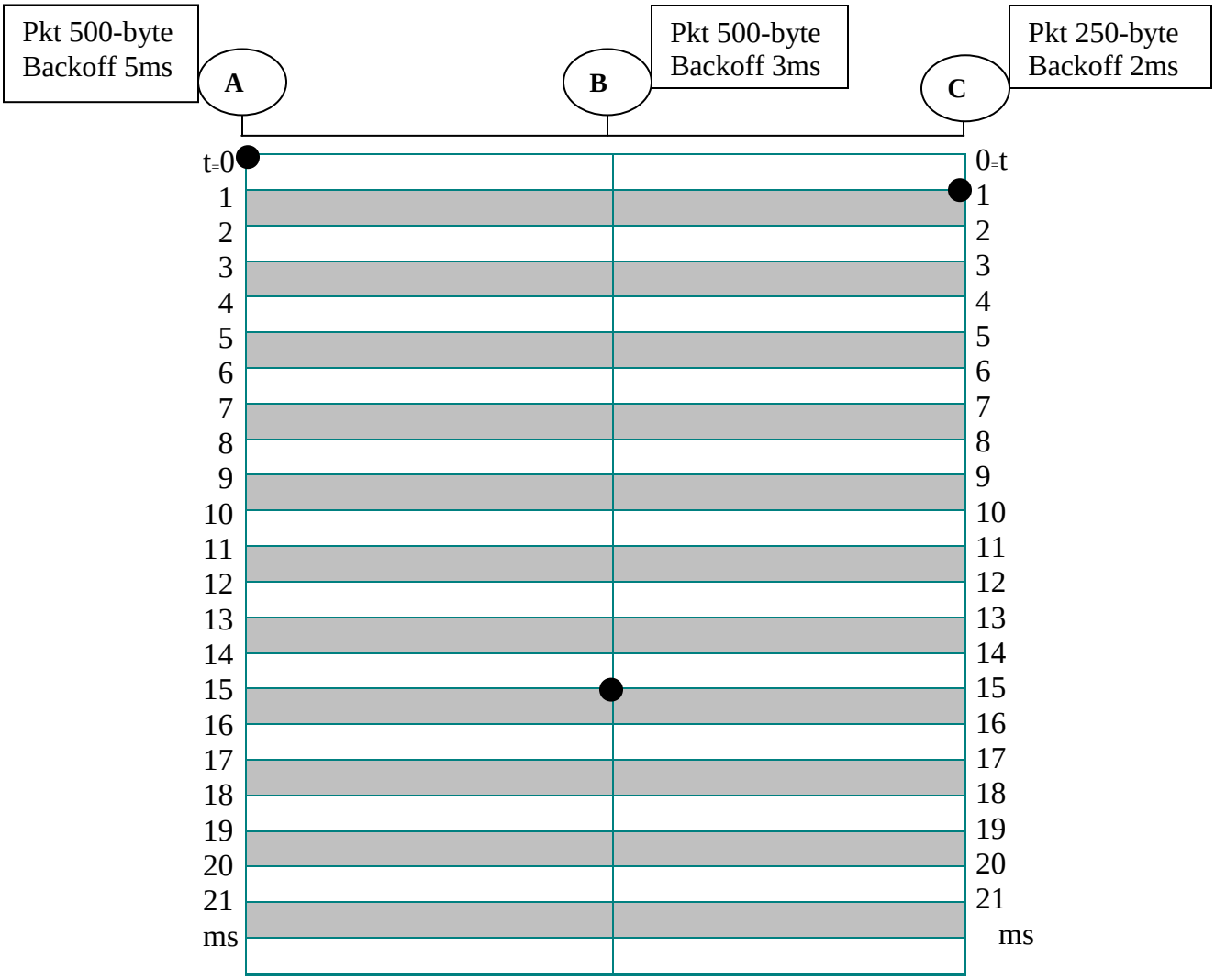
Name:…….. ------- continue answering the question 3.(b) on this page ------

Name:……

4. (3 points) Suppose A, B, and C connected via Ethernet bus, as shown below.

- The capacity of the bus is 1Mbps (Mega bit per second).
- The propagation delay for A-B is 1 ms, B-C is 1ms, so A-C is 2ms.
- At time t=0ms, node A creates a 500-byte frame to send to B.
- At time t=1ms, node C creates a 250-byte frame to send to A.
- At time t=15ms, node B creates a 500-byte frame to send to C.
- Whenever A, B, and C detect collision, they respectively backoff for 5ms, 3ms, 2ms.
- You can ignore the transmission time for jam signal.
- Nodes can send their frames as soon as the channel becomes idle unless they wait for backup timer to expire.

Using the below time diagram, show the important events (first bit arrived (FBA), last bit arrived (LBA), Collision detected (CD), Backoff Xms, channel idle, etc) and their times until A, B and C get the frames correctly.



Name:……..

5. (3 points) Suppose we have three types of users A, B, and C. Each user can run applications that generate high priority (H) or low priority (L) packets. To implement the following policies, just draw figures showing how you use/integrate various mechanisms (e.g., classifier, priority queuing (PQ), WFQ, token bucket (TB)) and set their parameters.

    a. (1pt) High priority packets will be served in a FIFO manner before low priority packets. But when it is time to transmit low priority (L) packets, we want A, B, C to share the link with the ratio of 2:3:1 for their low priority (L) packets.

    b. (2pt) Suppose we want to limit the high priority (H) packets sent from A such that user A should not send more than 20 high priority (H) packets back to back (as a burst) while the average is less than 10 high priority (H) packets per second. How would you implement that policy in addition to the policy in part (a).

Name:…….

6. (3 points) Suppose three users have the following codes and use CDMA to communicate with a base station:

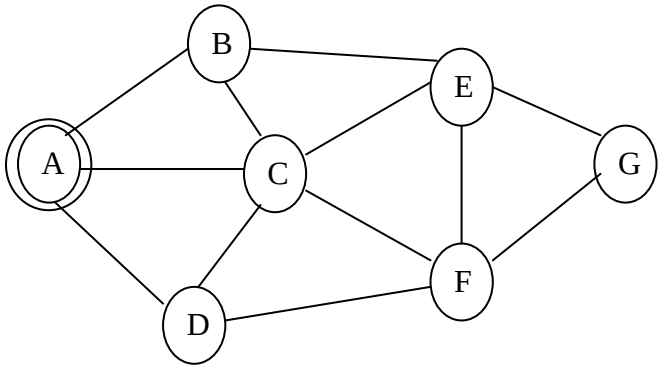
```
A has    1    1   1   1
B has    1   -1   1  -1
C has   -1    1  -1   1
```

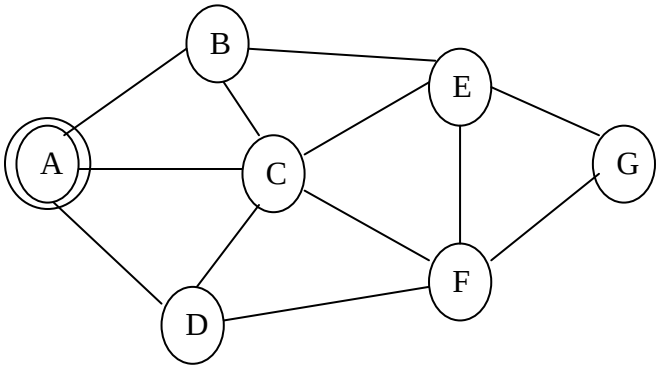
   a. **(1pt)** Which nodes (AB, AC, or ABC) can communicate with the base station at the same time? (Justify your answer)

   b. **(2pt)** Suppose all nodes send data bit 0 to base station at the same time. Given the above codes, what data bit the base station will actually receive from A, B, and C? Base station know the code for each node.

Name:…….

7. (4points) Recall the operation of OLSR and consider the below wireless network (same copy is provided in case you need it for part (b)).





a. (2pt) By visually inspecting the above graph (i.e., without running HELLO protocol or exchanging neighbor list etc.), determine the minimum set of multi point relays (MPR) and the set of multipoint relay selectors (MS) for every node.

MPR list		**MS list**	
A ={	}	A ={	}
B ={	}	B ={	}
C ={	}	C ={	}
D ={	}	D ={	}
E ={	}	E ={	}
F ={	}	F ={	}
G ={	}	G ={	}

b. (1pt) Based on your answer in (a), show how a link state advertisement (LSA) packet created by node A is delivered to all other nodes. Just draw an arrow along the link on which the LSA is sent on the **above graph** and double circle the nodes that forward the LSA. In case you need, another copy of the same graph is provided above.

c. (1pt) Briefly explain the key differences between the flooding in OLSR and OSPF.