

# CS 118

## Computer Networking Fundamentals

Final Exam  
Fall 2011

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Question	Points	Score
1	20	
2	10	
3	15	
4	10	
5	20	
6	25	
Total:	100	

Name: \_\_\_\_\_

Student ID #: \_\_\_\_\_

### Instructions:

- Open book, notes, and laptop without Internet connectivity
- Calculators are also allowed
- This exam has 9 pages, including this cover page
- 3 hour duration

**Problem 1 (2 points each, total 20 points)**

Determine if each of the following statements is *true* or *false*. Circle your answer.

- a. The primary criticism of IPv6 is that the address size may be too small for long-term scalability.

TRUE                      FALSE

- b. Public key based encryption is computationally more expensive than symmetric key based encryption.

TRUE                      FALSE

- c. In the case of multicast routing using group-shared trees, packets are always forwarded along optimal paths from sources to subscribers.

TRUE                      FALSE

- d. Frame collisions are completely eliminated in TDM based media access protocols.

TRUE                      FALSE

- e. CSMA/CD is less efficient than pure CSMA because of the overhead associated with the collision detection mechanism.

TRUE                      FALSE

- f. The IEEE 802.11 wireless protocol is based on the CSMA/CA and uses a signaling mechanism (RTS/CTS) in order to reduce collision probability.

TRUE                      FALSE

- g. OSPF is used as an External Gateway Protocol for the Internet since it is based on a link-state algorithm and does not suffer from instability problems.

TRUE                      FALSE

- h. The query ARP message is sent within a broadcast frame, whereas the response ARP message is sent in a standard frame.

TRUE                      FALSE

- i. Interleaving schemes used in Internet phone applications mitigate the effect of packet losses, but they increase the bandwidth requirement of the audio streams.

TRUE                      FALSE

- j. A repeater repeats an incoming bit on all interfaces even if there is signal energy on some of the interfaces.

TRUE                      FALSE

**Problem 2 (5 points each, total 10 points)**

Answer the following questions. Be brief and concise.

- a) Describe the classful IP addressing hierarchy. What is CIDR, and why is it used? What are subnet masks and broadcast addresses, and what are they used for?

In classful IP addressing, address blocks can be assigned in either class A, B, C, or D chunks. Class A blocks have 8 bits for the network portion, 24 for the host portion. Class B is 16/16, Class C is 24/8, and Class D is 32/0. Class D addresses are reserved for multicast addresses, since there are no host addresses available in a Class D block.

CIDR addressing allows address blocks to be assigned in which the network portion can be any number of bits. Addresses are expressed in a.b.c.d/x notation, where x refers to the number of bits in the network portion of the addresses for that block. CIDR is used in order to obtain a more efficient allocation of IP address blocks, since the classful addressing scheme has large gaps between the number of hosts allowed in a class C vs. a class B address (or class B vs. class A). For example, a company wishing to obtain 2000 addresses would need either 8 class C blocks or a single class B block where ~63,000 addresses would be wasted. CIDR would allow for 2048 addresses to be assigned by allocating a block with 21 bits for the network portion.

Subnet masks are another method of notation for describing the number of network bits in addresses. The number of 1's at the most-significant end of the subnet mask identifies the number of bits in the network portion, and the number of zeros at the least-significant end identifies the number of bits in the host portion. Subnet masks can be used to extract the network address from a destination address on a packet, to allow for route-table lookups.

Broadcast addresses are used for broadcasting packets to every host on a subnet. They are obtained by setting all of the host bits in the address to 1's. Every subnet has an address reserved for the broadcast address.

- b) Describe how OSPF works. Explain the concept of hierarchical routing in the Internet, and why it is necessary to help solve scalability issues.

OSPF (Open Shortest Path First) is an intra-AS routing protocol based on the link-state algorithm. Each node sends out periodic link-state updates to every node on the network in order to propagate global topological knowledge to every node. Each node then creates a directed graph (topological map) of the entire network using this global knowledge, and runs Dijkstra's shortest path algorithm to determine a shortest-path tree to all networks with itself as the root node. Link costs are configured by the network administrator. OSPF also allows an autonomous system to be divided into "areas," and can therefore support hierarchical routing within an AS.

In hierarchical routing, the Internet is divided up into several Autonomous Systems (AS's), each with a unique identifier (ASN) assigned by ICANN. Inside each AS, network administrators have administrative autonomy and can choose to run any local routing algorithm they please, with any configuration of link cost metrics, etc. This is part of the