1. Dynamic DNS is a protocol that enables a host to inform a DNS name server of its IP address change in real-time. Thus, servers without static IPs (e.g., server connected to residential DSL) prefer this service.

   (a) Explain how dynamic DNS prevents returning a stale IP-host name mapping even if the host’s IP address frequently changes.

   (b) Given the answer to the previous question (1a), what’s the potential disadvantage of dynamic DNS in terms of lookup latency performance?

   (c) What could dynamic DNS service provider do to compensate the problem in question (1b) still not allowing stale entries?

   (d) Suppose a web server behind NAT with a dynamic public IP address. Explain what the DNS entry should look like and how to configure NAT in order to make the server publicly accessible. (assume the web server uses the port 80.)

2. (a) What is the process of loading a web page: http://www-inst.eecs.berkeley.edu/~ee122/fa09/class.html? Specify the first line of each HTTP header. (assume the IP address is unknown, we use
HTTP 1.1, and the web page is available.

(b) Explain how stateless HTTP can implement user session such as a shopping cart application at Amazon.com, which is stateful. What’s a security vulnerability with respect to the answered approach?

(c) Your web site prospers but your ISP starts to complain about your web traffic. Where would you put a web cache to handle this problem?

(d) Can any web content be cached? If so, justify it. Otherwise, describe what kind of content cannot be cached.

3. (a) What’s the expected backoff time in 10Mbps Ethernet when a host experienced 3 collisions in a row?

(b) Suppose two hosts connected in a CSMA/CD network, where the medium transmits 1Gbps. If the minimum frame length is fixed to 1,000 bits and the propagation speed is $2 \times 10^8$ m/s, how far can the hosts be apart?

(c) If the network mentioned in Question (3b) is Ethernet, what’s an approximate efficiency when the hosts are apart maximum? And what about if the distance is reduced to 1m?

(d) Suppose hosts sharing a broadcast link. Each host has a frame to send with a probability $p$. Which multiple access protocol would you use if $p$ is low? What about if $p$ is high?

4. Assume the topology in Figure 1 where A, B, and C are end hosts which had never sent a packet and whose network interfaces are in promiscuous mode. Initially, the link between U and V is disabled.

(a) What is the process of sending a request message from A to B and getting a reply back from B to A, if the squares (i.e., U, V, X, and Y) are hubs? Can C see any messages? If so, which messages?
Figure 1: A, B, and C represent end hosts. The U-V link is initially disabled.

(b) Repeat the same question assuming the squares are now switches.

(c) The U-V link is now enabled. Can we always guarantee communication between A and B, if the squares are hubs? What about if they are switches?

(d) If any case in question (4c) prevents communication, how to solve the problem?

(e) Suppose we disabled the U-V link again. And B is moved and now connected to U. Can A and B communicate, if the squares are hubs? What about if they are switches?

(f) If any case in question (4e) prevents communication, how would you solve the problem?

5. (a) Why are DHCP messages broadcast?

(b) If there are multiple DHCP clients want to obtain IP addresses, how does DHCP prevent interference among the hosts?