1. (5%) (a) What are the advantages of packet switching over circuit switching?
(b) What the advantages of circuit switching over packet switching?

(a)

(1)Packet switching offers better sharing of bandwidth than circuit switching.

(2)Packet switching is simpler, more efficient, and less costly to implement than circuit switching.

(b)

A circuit-switched network can guarantee a certain amount of end-to-end bandwidth for the duration of a call.

2. (10%) Suppose there is exactly one packet switch between a sending host and a receiving host.

The transmission rates between the sending host and the switch and between the switch and

the receiving host are both R. The propagation delays between the sending host and the switch and

between the switch and the receiving host are both D. The processing delays and queueing delays are zero.

(a) Assuming that the switch uses stored-and-forward packet switching, what is the total end-to-end delay to send a packet of length L?

(b) Suppose that the switch does not store-and-forward packets but instead immediately transmit each bit it receives before waiting for the entire packet to arrive.

What is the total end-to-end delay to send a packet of length L?

(a)2L/R + 2D

(b)L/R + 2D

3. (10%) (a) What layers in the Internet protocol stack does a router process?
(b) What layers in the Internet protocol stack does a host process?

(a)Physical layer, link layer, network layer

(b)Physical layer, link layer, network layer, transport layer, application layer.

4. (5%) A packet switch receives a packet and determines the outbound link to which the packet should be forwarded.

When the packet arrives, x bits of the currently-being-transmitted packet

have been transmitted,

and n packets are already in the queue.

Suppose that all packets have length L and the transmission rate is R.

What is the queueing delay for the packet?

[nL+(L-x)]/R

5. (5%) The bandwidth-delay product for a communication link is defined as the product of the bandwidth and

the propagation delay of the communication link. Provide an interpretation of the bandwidth-delay product.

The bandwidth-delay product of a link is the maximum number of bits that can be in the link.

6. (10%) Consider sending a large file of F bits from host A to host B.

There are two links and one switch between A and B, and the links are uncongested (that is, no queueing delays).

Host A segments the file into segments of S bits each and add 64 bits of header to each segment,

forming packets of L=64+S bits. Each link has a transmission rate of R bps.

The propagation delay from A to the switch is X, and the propagation delay from the switch to B is Y.

Find the delay for sending the whole file.

Time at which the 1st packet is received at the destination = ((S+64)/R*2)+X+Y sec. After this, one packet is received at destination every S+64/R sec. Thus delay in sending the whole file =

Delay = 2*(S+64)/R + X + Y (F/S-1)* (S+64)/R

= (S+64)/R*(F/S+1)+X+Y

7. (5%) What are the four components of the cookie technology?

A cookie header in the HTTP response message

A cookie header in the HTTP request message

A cookie file on the user's end system

A back-end database at the Web site

8. (10%) (a) Describe how Web caching can reduce the delay in receiving a requested object.

(b) Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?

(a)Web caching can bring the desired content “closer” to the user, perhaps to the same LAN to which the user’s host is connected.

(b)reduce the delay for all objects.

Web caching can reduce the delay for all objects, even objects that are not cached, since caching reduces the traffic on links.

9. (5%) What are the three major components of the Internet mail system?

User agents, mail servers, Simple Mail Transfer Protocol(SMTP)

10. (15%) Suppose within your Web browser you click on a link to obtain a Web page.

The IP address of the Web server is cached in your local host.

The Web page references N very small objects on the same server.

Let the round trip time between the local host and the Web server be RTT.

Neglecting the transmission time, how much time elapses with

(a) Non-persistent HTTP with no parallel TCP connections?

(b) Non-persistent HTTP with parallel TCP connections?

(c) Persistent HTTP with pipelining, i.e., multiple HTTP requests can be sent one after another

without waiting for replies to previous requests?

(a)2RTT + 2*NRTT = 2*(N+2)RTT

(b)2RTT+2RTT = 4RTT

(c)2RTT + RTT = 3RTT

11. (5%) Describe why an application developer might choose to run an application over UDP rather than TCP.

An application developer may not want its application to use TCP’s congestion control, which can throttle the application’s sending rate at times of congestion. Often, designers of IP telephony and IP videoconference applications choose to run their applications over UDP because they want to avoid TCP’s congestion control. Also, some applications do not need the reliable data transfer provided by TCP.

12. (5%) Suppose a process in Host C has an UDP socket with port number 6789.

Suppose both Host A and Host B each sends an UDP segment to Host C with destination port number 6789.

Will both of these segments be directed to the same socket at Host C?

If so, how will the process at Host C know that these two segments originated from two different hosts?

Yes, bothsegments will be directed to the same socket. For each received segment, at the socket interface, the operating system will provide the process with the IP addresses to determine the origins of the individual segments.

13. (5%) Explain the problems with a centralized design of a DNS system?

(1)single point of failure

(2)traffic volume

(3)distant centralized database

(4)maintenance — The single DNS server would have to keep records for all Internet hosts. Not only would this database be huge, but would have to be updated frequently to account for every new host.

14. (5%) Describe the functions of a local name server.

When a host makes a DNS query, the query is sent to the local DNS server, which acts as a proxy, forwarding the query into the DNS hierarchy.