CISC450/CPEG419: Computer Networks I
Makeup Midterm Exam
April 9, 2019 13:00-14:15

Name: **UD ID:** **Grade in Points:**

Note: transmission rate: Kbps= 10^3 bits per second, Mbps= 10^6 bits per second; **data size:** KB=2^{10} bytes, Kb=2^{10} bits, MB=2^{20} bytes, GB=2^{30} bytes; **time:** ms=10^{-3} second, μs=10^{-6} second

True or False (3 points each)

1. Queueing delay increases as the traffic intensity increases. ( )

2. A user requests a Web page that consists of some text and five images. For this page, the client will send one request message and receive six response messages. ( )

3. Unlike the client-server architecture, the time needed to distribute a file to all peers decreases as the number of peers increases under the P2P architecture. ( )

4. Every socket is identified by the four tuples: source IP address, source port number, destination IP address, and destination port number. ( )

5. There are cases in which bits errors cannot be detected by checksum. ( )

Multiple Choices Single Answer (5 points each)

6. Which of the following does not belong to the DNS hierarchy? ( )

- (A) Local DNS server
- (B) Root DNS server
- (C) TLD DNS server
- (D) Authoritative DNS server

7. Host A needs to transmit a sequence of packets to host B, and each packet needs to travel over three links with bandwidth 1 Mbps, 2 Mbps, 3 Mbps, respectively. What is the end-to-end throughput between A and B? ( )

- (A) 1 Mbps
- (B) 2 Mbps
- (C) 3 Mbps
- (D) 6 Mbps

8. Suppose within your Web browser you click on a link to obtain a Web page. The HTML file reference 7 very small objects on the same server. Also suppose that your Web browser is configured with non-persistent HTTP and 5 parallel connections. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that it takes 20 ms for your browser to receive the IP address from DNS. Also assume that the round trip time between your local host and the server containing the webpage and objects is 10 ms. Neglecting transmission times, how much time elapses when the client clicks on the link until the client receives all the objects? ( )

- (A) 40 ms

- (B) 60 ms
- (C) 80 ms
- (D) 180 ms

9. Which of the following statement about the mechanisms for reliable data transfer protocols is NOT correct? ( )

- (A) With the Selective Repeat protocol, it is possible for the sender to receive an ACK for a packet that outside of its current window.
- (B) With the Go-Back-N protocol, it is impossible for the sender to receive an ACK for a packet that outside of its current window.
- (C) The alternating-bit protocol is the same as the Selective Repeat protocol with a sender and receiver window size of 1.
- (D) The alternating-bit protocol is the same as the Go-Back-N protocol with a sender and receiver window size of 1.

Problem 10 [20 Points]: Suppose two hosts, A and B, are separated by 50,000 kilometers and are connected by a direct link of transmission rate $R = 6$ Mbps. Suppose that the propagation speed over the link is 2.5×10^8 meters/sec. Consider sending a file of 800,000 bits from Host A to Host B.

- (a) Suppose that the file is sent continuously as one big message. What is the maximum number of bits that will be in the link at any given time? [10 Points]

- (b) Suppose now the file is broken up into 20 packets with each packet containing 40,000 bits. Suppose that each packet is acknowledged by the receiver and the transmission time of an acknowledgment packet is negligible. Finally, assume that the sender cannot send a packet until the preceding one is acknowledged. How much time elapses from the sender starting to send the first packet to receiving the acknowledgment of the last packet? [10 Points]

Problem 11 [20 Points]: Suppose that 20 users share a 1 Mbps link where packet switching is used. Also suppose that each user alternates between periods of activity, when a user generates data at a constant rate of 250 kbps, and periods of inactivity, where a user generates no data. Suppose further that a user is active only 20 percent of the time.

- (a) What is the probability that at any given time, exactly 4 users are transmitting? [10 Points]

- (b) Find the probability that there are 5 or more users transmitting simultaneously. [10 Points]

Problem 12 [25 Points]: A 2-Mbps satellite link with 498 ms one-way propagation delay is used to transmit data packets of 8000 bits. Both the header of the data packets and the acknowledgment packets are of negligible size. Using 8-bit sequence numbers, what is the maximum achievable link utilization for

- (a) a stop-and-wait protocol (e.g., rdt 3.0) [5 Points]

- (b) a go-back-N protocol [10 Points]

- (c) a selective repeat protocol [10 Points]

Bonus Problem [10 Points]: Consider sending a large file of F bits from Host A to Host B. There are three links (and two switches) between A and B, and the links are uncongested, i.e., no queueing delays. Host A segements the file into segments of S bits and adds 80 bits of header to each segment, forming packets of $L = S + 80$ bits. Each link has a transmission rate of R bps. Find the value of S that minimizes the delay of moving file from Host A to Host B. Disregard propagation delay.