CMPUT 313 Final Exam [Harms]
December 14, 2000
Closed Book

Comments:

- This exam is worth 38% of your final grade. There are 9 questions and 4 pages. The mark distribution is given beside the questions. The total number of marks is 60.
- This is closed book exam. Calculators are allowed but not necessary. For mathematical results, it is sufficient to just set up the equations.
- If you are concerned about an interpretation of an exam question, state your assumptions and then answer the question.
- Be sure to show your work! Good Luck!

[8 marks] Question 1.

In this course we have discussed the different requirements of voice versus data traffic. What are these requirements? For the following protocols, discuss their ability to support a mixture of both voice and data traffic:

a) ATM

b) TCP/IP

c) Ethernet

d) Token Ring

e) Time Division Multiplexing (TDM)

(4 marks) Question 2.

Suppose we have a 10 km (10,000 m) FDDI ring. If the propagation rate is 200 m / µsec and the ring has 100 stations, what is the length of the ring in bits (that is, the number of bits that can be on the ring simultaneously)? Note that there is a 10 bit delay at each station. FDDI has bit rate 100 mbps;

[4 marks) Question 3.

Choose TWO of the project presentation topics, briefly describe the area and the current research or development issues. The projects this term were: security, intelligent networks, ADSL, ATM-LANs, Wireless Application Protocol, Bluetooth, Ad Hoc networks, CDMA, cellular telephony, satellites, Internet telephony, home automation, virtual private networks, e-commerce, multimedia.

(6 marks) Question 4.

Consider the following three backoff algorithms: after the ith collision, the frame is transmitted in a slot

a) uniformly distributed over range $(0, 2^n-1)$ where n=min (i,10).

b) uniformly distributed over range $(0, 2^5)$

c) uniformly distributed over range $(0, 2^{10})$

Compare the expected performance of these backoff algorithms when used with a 1-persistent CSMA protocol

(6 marks) Question 5.

Suppose that an application wants to send 1024 bytes of data over the Internet using TCP/IP. Recall that the TCP header is 20 bytes and the IP header is also 20 bytes. The maximum transfer unit, MTU, of a network (such as Ethernet) is the maximum size of IP packets that can pass through that network (this includes the IP header and the IP data).

For Ethernet, the MTU is 5000 bytes and the Ethernet header is 18 bytes. Suppose another network, N, has a MTU of 220 bytes and a header of 8 bytes.

Answer the following questions (and justify your answers):

a) How many bytes is the IP packet (include the IP header)? Assume no fragmentation.

b) If the first network the information passes through is the Ethernet, how big is the Ethernet frame?

c) There is a lot of confusion over IP fragmentation in the textbook and assignment so, here is a clarification which may help you do the following question. The offset field of the IP header has 13 bits; while the length field has 16 bits. Thus, the offset cannot represent each byte. Therefore, the fragments must be multiples of 8 bytes (except for the last fragment) and the offset counts 8 byte portions of the data. So, in the example above, if the information must pass through network N,

(i) how many frames will be carried by N?

(ii) how large will the N frames be?

(iii) what will the offset field be for each of the IP fragments?

(8 marks) Question 6.

Discuss the difficulty of setting timeouts for flow control in the Transport layer (as compared to setting them in the data link layer). Explain briefly how TCP sets its timeout value (exact formulae are not required). What would happen in the TCP protocol if the timeout was much too short?

(10 marks) Question 7.

Consider the following set of activities at the sender host and receiver host. Describe what segments are transmitted if TCP is used to transport the data. Also, indicate the sender window and receiver buffer sizes.

Make the following assumptions to simplify the answer:

-- no timeouts occur and the congestion window is larger than the receiver window.

-- the receiver always sends a "response" (ACK) to the sender whenever it receives a segment or has more room in its buffer.

-- the round trip time is always 2 time units (1 time unit for the segment to reach the receiving host and 1 time unit for the ACK to reach the sender). The time to transmit a frame is small compared to the round trip time.

-- the maximum segment size (data portion) is 20 Kbytes.

Initially (at time 0), the receiver has a 60 Kbyte buffer which is empty; the sender has a window of size 60 Kbytes and the next sequence number will be 0.

(i) Time 0: the application does a 20 Kbyte write (that is, the sender receives 20Kbytes of data from the application to send to the receiving host)

(ii) Time 3: the sender application does another 20 Kbyte write

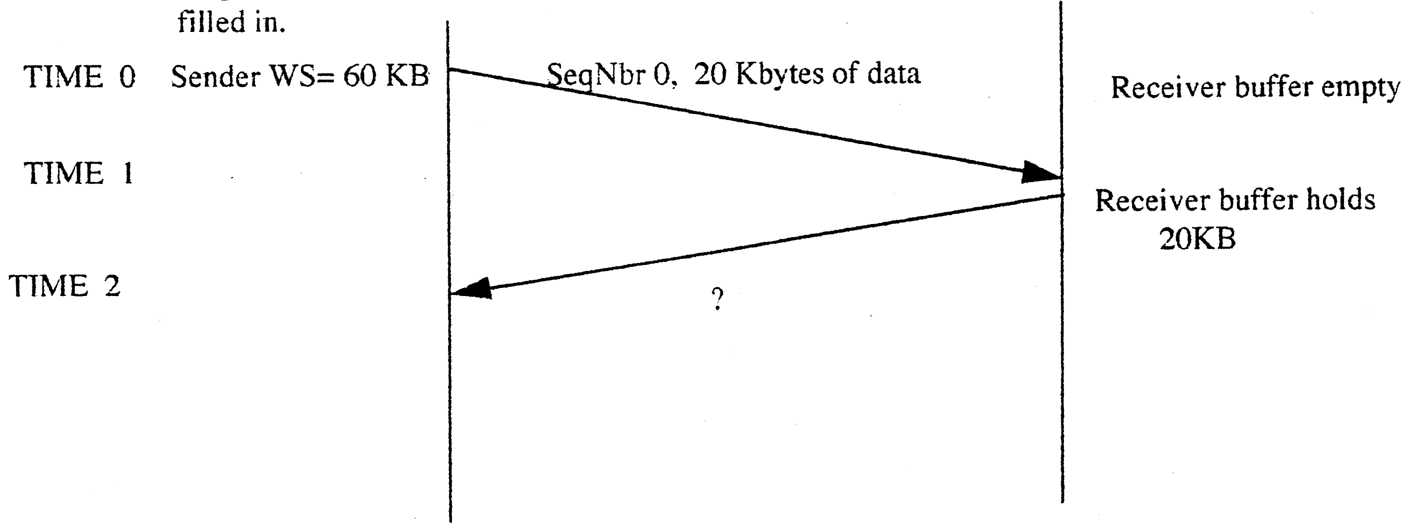
(iii) Time 5: the sender application does a 10 Kbyte write

(iv) Time 6: the sender application does another 10 Kbyte write

(v) Time 7: the sender application does a 40 Kbyte write

(vi) Time 8: the receiver reads (clears out) the buffer(leaving 60 Kbytes available)

To describe the protocol, use a diagram similar to the one below. To start you off, the diagram already has the first transmission and the response from the receiver partially filled in.



(4 marks) Question 8.

Having the receiver always respond with a window advertisement as soon as there is some buffer space, can result in poor performance. Describe a scenario where this is the case. What is a possible solution to this problem?

(10 marks) Question 9.

In the following network, if C wants to send a packet to F and the criteria for shortest path is hopcount, the packet would normally take the links C-D and then D-F. Suppose that link D-F goes down. Describe in some detail how C discovers where to route a packet destined for ~~D~~ F for the following 3 routing algorithms:

(a) link state routing. Also, indicate what the new path would be.

(b) distance vector routing. Also, explain whether there would be a "count to infinity" problem here (with respect to node C).

(c) flooding with hopcount limit of 4. Also, show how many packet transmissions are required to send a packet from C to F on the new network.