# CMPUT 313 Final Exam [Harms]
April 26, 2000 B2
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!

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**(6 marks) Question 1.**

Define synchronous time division multiplexing and asynchronous time division multiplexing (also known as statistical multiplexing). For each of these multiplexing schemes, name a protocol that uses it. Also explain how the multiplexing scheme is used within the protocol.

**(9 marks) Question 2.**

(a) Suppose that a protocol uses a block check sum error detection schemed with 4 rows (including the parity bits) and 3 columns (including the parity bits). What is the probability that a message that contains at least ONE error will be accepted (that is, pass through the error detection without an error detected)? Assume a bit error occurs with probability p. Show your work.

(b) If a CRC uses a generator $x^4 + x^3 + 1$, and a node receives the following message: 1100111101101111110, will an error be detected? Show your work.

**[7 marks] Question 3.**

Discuss the advantages and disadvantages of providing reliability only at the data link layer versus providing the reliability only at the transport layer. What are the advantages and disadvantages of having the reliability provided at both layers?

**(4 marks) Question 4.**

Suppose that there is a contention-based MAC layer protocol where, when a collision occurs, it is always possible to distinguish (recover) ONE of the frames (the other frame or frames involved in the collision are destroyed). What kind of backoff algorithm would you recommend to recover from collisions for this protocol? Justify your choice.

**(6 marks) Question 5.**

Different protocols have different maximum payload sizes. Discuss the advantages and disadvantages of having large versus small payloads at each of the data link layer, network layer and transport layer.

**(10 marks) Question 6.**

The error checking mechanism in IP (and TCP) is not as strong as the CRC mechanism used in the MAC layer protocols. In Assignment 3, we saw that problems can arise if bit errors are not detected in the IP headers.

(a) Describe what problems can occur with reassembling fragments of a packet if one of the fragments has an undetected error in the following IP header field (consider each separately):

(i) the fragment offset or

(ii) the more fragments flag or

(iii) the id or

(iv) the time to live (TTL)

(b) Despite these problems, the TCP protocol does provide very reliable transmission of data. Explain why.

**(6 marks) Question 7.**

(a) One of the underlying assumptions for the TCP protocol is that the bit error rates are low. Why is this necessary for the protocol to work well?

(b) A host wants to transmit 400 Kbytes of data using the TCP protocol. Consider the slow start portion of the TCP protocol. Suppose the maximum segment size is 10 Kbytes. Assuming the receiver window is 80 Kbytes and the congestion window is 100 Kbytes, how many packets will be sent if no timeouts occur? Also show the successive window sizes.

**[4 marks) Question 8.**

Choose TWO of the project presentation topics, briefly describe the area and the current research or development issues. The project this term were:

- Video distribution,
- Networking within the home,
- Mobile Networking,
- Satellite Networking,
- Wireless ATM,
- Fibre Optic transmission,
- Quality of Service over the Internet,
- Network security,
- Electronic commerce

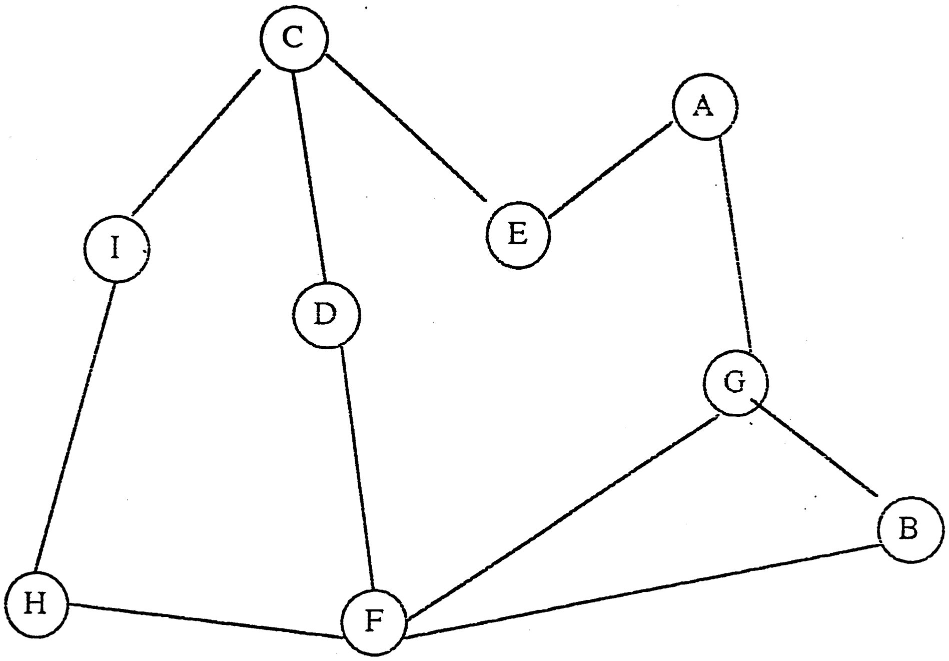
**(8 marks) Question 9.**

Consider the network below.

a) In order to update routing paths, routing protocols will periodically receive packets from other nodes containing routing information. Suppose that routing is done based on delay, what information (be as specific as possible) will node C receive from the other nodes for

i) distance vector routing?

ii) link state routing?

b) If flooding is used to broadcast data packets from node F, how many packets would node C expect to receive? Assume that the flooding is stopped using a hopcount of 4.