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## **CMPUT 313, Winter 2001, Midterm Examination (B2)**

**February 15th, 2001**

This is an closed book exam. All questions have equal weights and must be answered in whatever space is available on this form. No additional sheets are allowed. To receive full marks present all intermediate steps. If necessary, state any additional assumptions that you made. The exam is marked out of 22 which is the percentage of its contribution to the final mark. All questions carry an equal weight. If you disagree with the mark received in this exam, you have two weeks from the day you are notified about your mark to contact the instructor and discuss your objection. Notification about your mark will be performed via e-mail to your `ugrad.cs.ualberta.ca` account.

[1] Assume a CRC polynomial can detect all single bit errors, all two bit errors and all odd number of errors. Assume that you know that if the frame you received contains an error, then it is either a single bit or a two bit error (although you cannot tell which one). Can you correct a received frame? If yes, describe a process by which you can correct the received frame. If no, describe why such a process does not exist.

[2] How would you modify the Go-Back-N ARQ scheme if (for reasons of reducing the overhead due to ACK transmissions) one ACK is sent for every two correctly received frames. In your answer consider both the version of Go-Back-N that uses NAKs as well as the version of Go-Back-N that does not use NAKs.

[3] Assume a slotted ALOHA system which, from measurements, exhibits a throughput of 25%. What is the fraction of slots that contain collisions in this system. Slotted ALOHA throughput:  $S = G e^{-G}$

[4] Ethernet is a CSMA/CD 1-Persistent Truncated Binary Exponential Backoff medium access protocol. Assume we came up with a device, which when a collision occurs, it can indicate (to each station that attempted to transmit) *which* stations collided (e.g., by indicating the IDs of the stations involved in the collision). How could you modify the Ethernet protocol to take advantage of this device, and what problems would it solve?

**[5]** Present the traversal of the tree according to the Adaptive Tree Walk protocol for a set of 16 nodes. The leaf nodes are indexed from 1 to 16 inclusive (from left to right). In the particular traversal, only stations 7, 8, 15 and 16 have a frame to send. Present the exact sequence of collision, idle and successful transmission slots.

[6] We have studied restrictions imposed on the maximum window size in Go-Back-N and Selective Reject protocols. Assume that *instead* of obeying these rules, we introduce a bit in the header which the sender uses to indicate whether a frame is retransmitted or not (0 for new frame transmission and 1 for frame retransmission). Other than the introduced bit, the sequence number field is used as before (i.e., it wraps around). Now that we have introduced this special bit, can we indeed remove the rules pertaining to the maximum window size relative to the sequence numbers, or not and why?