

CS31006: Computer Networks

Long Test 1, Part - 2

February 22, 2022

Duration: 1 Hour (45 minutes for answering questions + 15 minutes for submission)

Answer ALL questions

All your answers MUST BE HANDWRITTEN on paper. Scan all papers with your answer in a SINGLE pdf and upload in the course page in Moodle in the appropriate link. The size of the final pdf must be less than 10MB. You must upload the pdf strictly by 9-50 am Moodle server time.

1. (a) Show the encoding of the bit stream 1100110010101100 using Pseudoternary encoding scheme assuming that the last signal level before the start of this bit stream has been positive. What is the total number of signals transitions? (3 marks)

(b) Suppose you want to send the bit stream 011110111010. Show the final bit stream transmitted if checksum is used for adding error detecting bits with 4-bit word size. (3 marks)

(c) Suppose a sender S is sending 12 frames (numbered 0 to 11) to a receiver R using sliding window flow control protocol. The window size used is 4. Consider a time at which the sender has sent frames 0 to 7, and has received acknowledgements for the frames 0 to 4. The receiver has received frames 0 to 5. Draw a diagram to clearly show the position of the sender and receiver windows at this time with brief (1-2 sentences max for each window) justification. Also show on the diagram which frames are in transit. Assume that there is no error or loss in transmitting any frame. (4 marks)
2. (a) Consider a sender S sending 7 frames (numbered 0 to 6) to a receiver R. Go-back-N is used as the error control method with 3-bit sequence number and window size of 4. Processing time at the receiver is negligible, ACKs are sent immediately on receive (no piggybacked ACK), the time for any frame to travel over the link (either from S to R or from R to S) is 1 time unit (constant for all frames), and the timeout duration is 2 time units. Assume that when frame 2 and frame 4 are sent **for the first time**, the frames are lost. No other frames are lost. Show clearly with a diagram (as shown in class for describing ARQ protocols) the flow of the frames between S and R, clearly showing the data frame numbers, type of frame, and sequence numbers in each frame. No explanation is needed, just show the diagram. (7 marks)

(b) Suppose you want to do error control between a sender S and a receiver R. If the probability of frame loss/corruption is low and the total delay for a frame to reach from S to R is high, which of Go-back-N and Selective-Repeat ARQ methods would you use? Briefly justify your answer. (3 marks)
3. (a) Consider a transmitter T sending a frame to a receiver R at 10 Mbps over a shared medium using 1-persistent CSMA/CD. The propagation speed is 2×10^8 m/sec, and the

maximum distance between two stations is 200 m. Processing delays at receiving nodes are negligible and can be ignored. Suppose that 4 microseconds have passed from the start of transmission and T is still transmitting the frame. Do you think it will be able to complete the transmission of the frame successfully? Justify your answer showing all calculations you use. (5 marks)

(b) Show with an example why the RTS/CTS scheme may not fully solve the exposed terminal problem. (5 marks)

4. (a) In a packet switched network, suppose that a total of 10000 bytes of data is to be transferred from a node A to a node B at distance of 2 hops away (i.e., one router in between A and B) using datagram packet switching over 200 kbps links. Each packet has a size of 500 bytes (not including header) and requires a header of size 50 bytes. The time for one packet (including header) to be completely received over one hop (i.e., the time from the transmitter transmitting the first bit till the time the receiver receives the last bit of the packet) is 50 milliseconds. What would be the total time for B to receive all 5000 bytes? Show all your calculations. (5 marks)

(b) Consider that an Ethernet frame is received at the data link layer of a machine in a LAN. Draw the frame format and list step-by-step how is the frame processed in the data link layer. (5 marks)