EE 706: Communication Networks

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Spring 2011

Code B

Quiz 2 : **20 points** (60 min) February 11, 2011

0. Write down the code of your question paper next to your roll number. [0 points]

1. If m bits are available to store the sequence number of a frame in its header, what is the maximum window size in go-back-N ARQ for correct operation? Give an example illustrating what can go wrong if the window size is larger than your answer for the case of $m = 4$. [4 points]

2. Suppose a source is forced to use the polar NRZ line coding scheme to communicate with a destination. One disadvantage of this scheme is that a long sequence of ones or zeros will result in the presence of a DC component which is undesirable.

   (a) Propose a solution to this problem using a rate $\frac{1}{2}$ encoding scheme which will sit between the FEC encoder and the line code modulator. [2 points]

   (b) Draw the modulated signal waveform corresponding to FEC encoder output of 00011. [2 points]

   (c) How many different rate $\frac{1}{4}$ encoding schemes exist which can solve this problem?. [2 points]

3. Suppose a source transmits frames over a full-duplex link with data rate 50 kbps and a one-way propagation delay of 5 milliseconds. Suppose the frame length is 1000 bits and ACK length is 100 bits. Assume that processing delays of the frame at the receiver and ACK at the source are negligible.

   (a) If stop-and-wait ARQ is used, what is the minimum value of the timeout duration? [2 points]

   (b) For the value of timeout obtained above, what is the percentage of time the link from source to receiver is busy if exactly one timeout occurs during the transfer of a frame? [2 points]

   (c) If go-back-N ARQ is used, what is the minimum value of the window size N so that the link from source to receiver is always occupied? [2 points]

4. (a) Illustrate and explain using a timing diagram what goes wrong in stop-and-wait ARQ when no sequence numbers are present in the ACKs and early timeouts occur. [2 points]

   (b) For the selective repeat ARQ situation shown below, draw the state of the sender sliding window after every ACK/NACK reception. Let window size be 8. [2 points]