ITS 323 – QUIZ 3

First name: _____   Last name: _____

ID: _____   Total Marks: _____

out of 10

In all questions, assume bits are number left to right. That is, for the sequence 010111, the first bit is 0, the second bit is 1, the third bit is 0 and the sixth bit is 1.

Question 1 [2 marks]

Consider a simplified CRC error detection algorithm where there are k bits of data to send, the frame check sequence (which is appended to the end of the data) is f bits in length, and the divisor must be $(f + 1)$ bits in length. If the data to send is 1010 and the divisor is 101:

a) What is the value (in binary) of the frame check sequence? [1 mark]

b) If the first two bits are received in error, can the receiver detect the errors? Show your calculations or explanation. [1 mark]

Question 2 [4 marks]

a) Assume a Hamming distance based forward error correction algorithm is used on a data block of 32 bits, and produces 50-bit codewords. If you instead increase the codeword size to 40 bits, in general, more errors can be detected.

                                                        True   /   False

b) Choosing a very long time-out interval for an ARQ protocol may lead to low throughput because there will be many unnecessary retransmissions (that is, an ACK for original frame is received after original frame is retransmitted).

                                                        True   /   False

c) The highest frequency component of an analog data is 500kHz. If Pulse Code Modulation with each code represented as 8 bits is used, following the sampling theorem, the data rate should be:

  a. 250kb/s

  b. 1Mb/s

  c. 2Mb/s

  d. 4Mb/s

  e. 8Mb/s

  f. 16Mb/s

  g. 32Mb/s

d) If a protocol uses an 6-bit field in the header for sequence numbers of frames (and all frames are the same size), according to the sliding window mechanism, the minimum number of frames a receiver should be able to store in its receive buffer is:

  a. 0 frames (no buffer needed)

  b. 1 frame

  c. 5 frames

  d. 6 frames

  e. 31 frames

  f. 32 frames

  g. 63 frames

  h. 64 frames

Question 3 [3 marks]

What is the maximum throughput of the Stop and Wait Flow Control protocol.

You can assume:

- Data rate is 500kb/s

- Data frame size is 900 bits of data plus 100 bits of header

- ACK size is 100 bits

- Propagation time is 1.2msec

- Processing delay in preparing ACK is 0.05msec

Question 4 [1 mark]

Go-Back-N ARQ with a *k* bit sequence number limits the maximum window size to 2^k-1. Explain a problem that may occur if the maximum window size was *greater than* 2^k (e.g. 2^k+1). (A diagram may help with your explanation).