ELEX 3525 : Data Communications
Term 201810

FINAL EXAMINATION
09:30 AM –12:30 PM
Tuesday, April 17, 2018

This exam has seven (7) questions on ten (10) pages. The marks for each question are as indicated. There are a total of 32 marks. Answer all questions. Write your answers and all rough work in this paper and nowhere else. Show your work. Draw a box around your final answer. Numerical answers must include units. Books and notes are allowed. No electronic devices other than calculators are allowed. Show your work.

This exam paper is for:

Exam 1   A00123456

Each exam is equally difficult.
Answer your own exam.

Do not start until you are told to do so.

Name: _____

BCIT ID: _____

Signature: _____

Question	Mark	Max.
1		5
2		4
3		4
4		4
5		4
6		2
7		9
Total		32

Question 1 (5 marks)

A data source generates one of four messages every 1 ms. The four messages have probabilities 0.25, 0.25, 0.125 and 0.375. What is the information rate of the source? If the best possible compression is used, what bit rate is required to transmit the data?

An RS-232 transmitter generates the following waveform to transmit one byte with no parity:
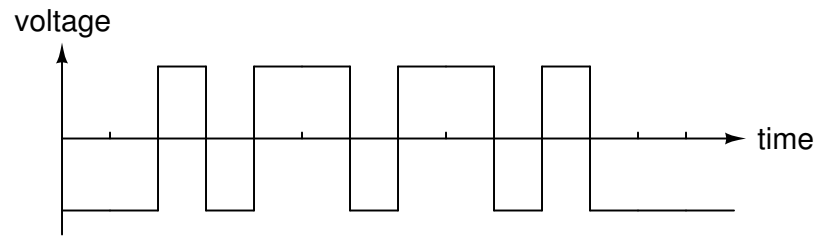
What value was sent? Give your answer in hexadecimal. Does this correspond to a character? If so, which one?

Question 3 (4 marks)

A low-pass channel has a gain of 0.5 (-6 dB) at a frequency of 0.6 MHz and is symmetrical about that frequency. What is the maximum symbol rate that can be transmitted over this channel without ISI? If this symbol rate is used and each symbol is a pulse that has one of 8 possible levels, what is the data rate in bits per second?

Question 4 (4 marks)

You receive a message polynomial $x^5 + x^2 + x + 1$ and are told that the message should be divisible by the generator polynomial $x^2 + 1$ if the message has no errors. Did the channel introduce any errors? Show your work.

Question 5 (4 marks)

What is the minimum Hamming distance of a code with the two codewords 1001 and 0110? How many bit errors could this code detect? How many bit errors could this code correct? How many data (non-parity) bits are transmitted by each codeword?

Question 6 (2 marks)

The bytes below (in hexadecimal notation) are the contents of the initial part of an Ethernet frame following the SFD. What are the source and destination addresses? Give your result as sequence of bytes in hexadecimal notation.

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bc 83 85 f9 7d 7c 00 1d 60 9f 21 94 08 00 ...
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Question 7 (9 marks)

(a) What is the maximum period of a PN sequence generated by a circuit using 12 flip-flops?

(b) Radio receivers are sometimes affected by noise caused by lightning from storms. Is this noise random or pseudo-random? Why?

(c) WiFi systems transmit data in the form of frames that are up to 1500 bytes long. Would a WiFi system be more likely to use a convolutional or multiplicative scrambler? Why?

(d) You are designing a communication link to the moon (2.5 second round-trip propagation delay). The frame duration is 1 ms. You've estimated the error rate to be about one frame error every 10 years. What is the simplest ARQ scheme that would provide high throughput? Why?

(e) RFID tags used for inventory control have a range of about 3 m. Based on their range, would RFID tags be part of a PAN, LAN, or WAN?

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