ELEX 3525 : Data Communications
Term 201730

FINAL EXAMINATION
9:00 AM – 12:00 PM
December 14, 2017

This exam has six (6) questions on eight (8) pages. The marks for each question are as indicated. There are a total of 22 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		3
2		5
3		4
4		2
5		5
6		3
Total		22

Question 1 (3 marks)

The following chart shows the Unicode code points (in hexadecimal) for a few characters:

μ 00B5	Å 00C5
¶ 00B6	Æ 00C6

(a) How many byte(s) are required for the UTF-8 encoding of the character Æ ?

(b) What are the values of these byte(s)? Give you answer in hexadecimal.

(c) Write the values of the bits of the first byte in l.s.b.-first order.

Question 2 (5 marks)

Draw the waveform that would be used to transmit the bits in the byte 0x53, in m.s.b.-first bit order using a differential unipolar NRZ (NRZI) line code at a rate of 2 Mb/s. Assume the line level before the first bit is transmitted was zero, voltage levels of 0 and 5 V and the differential encoding rule given in the lecture notes. Label the axes. *Note: this is* **not** *an asynchrous serial interface.*

Question 3 (4 marks)

A signal with a power of 200 μW is received along with additive white Gaussian noise that has a power of 66 μW. What is the minimum bandwidth that would allow error-free transfer of information at a rate of 2 Mb/s?

Question 4 (2 marks)

The following sequence of bytes includes a frame that is framed using PPP-style framing. What is the sequence of bytes contained within the frame? Ignore bytes appearing before or after the frame.

```
0xaa 0x7e 0x7d 0x7e 0xe7 0x27 0x00 0x7e 0x1b
```

Question 5 (5 marks)

A code contains the following three codewords:

```
101100
010110
001011
```

(a) what is the minimum distance of this code?

(b) what is the maximum number of errors the code is guaranteed to detect?

(c) what is the maximum number of errors the code is guaranteed to correct?

(d) if the codeword 110110 is received, was there an error? If so, what codeword was most likely transmitted and which bit(s) were/was most likely in error?

Question 6 (3 marks)

The following bytes follow the SFD of an Ethernet frame. The CRC is not shown.

```
08 00 27 da fa 8f 00 1d 7e 2f b5 9b 08 00 45 00
```

Answer the following questions:

(a) what is the destination address?

(b) what is the OUI of the source address?

(c) what is the length of the payload portion of the frame (in bytes)?

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This exam paper is for:

Exam 2   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		3
2		5
3		4
4		2
5		5
6		3
Total		22

Question 1 (3 marks)

The following chart shows the Unicode code points (in hexadecimal) for a few characters:

μ	Å
00B5	00C5
¶	Æ
00B6	00C6

   (a) How many byte(s) are required for the UTF-8 encoding of the character μ ?

   (b) What are the values of these byte(s)? Give you answer in hexadecimal.

   (c) Write the values of the bits of the first byte in l.s.b.-first order.

Question 2 (5 marks)

Draw the waveform that would be used to transmit the bits in the byte 0x35, in m.s.b.-first bit order using a differential unipolar NRZ (NRZI) line code at a rate of 1 Mb/s. Assume the line level before the first bit is transmitted was zero, voltage levels of 0 and 5 V and the differential encoding rule given in the lecture notes. Label the axes. *Note: this is **not** an asynchrous serial interface.*

Question 3 (4 marks)

A signal with a power of 100 μW is received along with additive white Gaussian noise that has a power of 33 μW. What is the minimum bandwidth that would allow error-free transfer of information at a rate of 1 Mb/s?

Question 4 (2 marks)

The following sequence of bytes includes a frame that is framed using PPP-style framing. What is the sequence of bytes contained within the frame? Ignore bytes appearing before or after the frame.

`0xaa 0x7e 0x7d 0x7e 0xe7 0x27 0x00 0x7e 0x1b`

Question 5 (5 marks)

A code contains the following three codewords:

```
101100
010110
001011
```

(a) what is the minimum distance of this code?

(b) what is the maximum number of errors the code is guaranteed to detect?

(c) what is the maximum number of errors the code is guaranteed to correct?

(d) if the codeword 010111 is received, was there an error? If so, what codeword was most likely transmitted and which bit(s) were/was most likely in error?

Question 6 (3 marks)

The following bytes follow the SFD of an Ethernet frame. The CRC is not shown.

```
08 00 27 da fa 8f 00 1d 7e 2f b5 9b 08 00 45 00
```

Answer the following questions:

(a) what is the destination address?

(b) what is the OUI of the source address?

(c) what is the length of the payload portion of the frame (in bytes)?