ELEX 3525: Data Communications
2023 Fall Term

Midterm 1
11:30
Tuesday, October 10, 2023
SW01-3555

This exam has four (4) questions on two (2) pages. The marks for each question are as indicated. There are a total of twelve (12) marks. Answer all questions. Write your answers and all rough work in this paper and nowhere else. Show your work. Underline or 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:

Questions Version 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: _____

0

Question 1 — 2 marks

A communication system uses 3 bits to select a pulse that is at one of 8 possible levels. One of these pulses is transmitted every 250 μs.

(a) What is the symbol rate, in Hz?

(b) What is the bit rate, in bps?

Question 2 — 2 marks

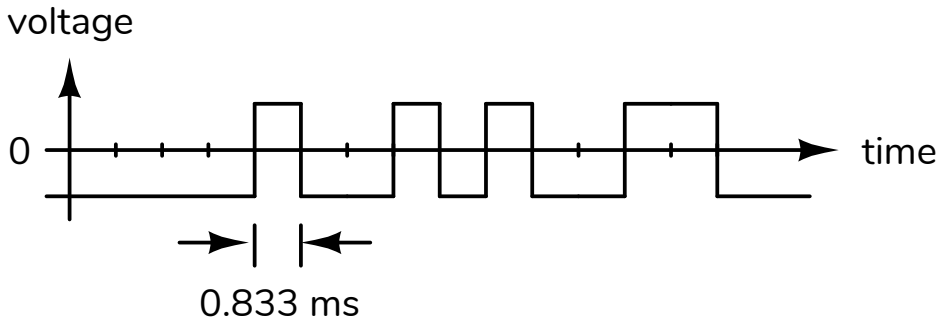
You need to measure the voltage at the output of a transducer that measures the vibration of a motor and have determined that the signal contains significant frequency components up to 30 kHz. The measured voltage ranges from 0 to 1 V at the point where this voltage is sampled.

(a) What is the minimum sampling rate that would ensure you are able to capture all of the features of the measured waveform?

(b) What is the minimum number of bits per sample required to quantize this waveform such that the spacing between the quantized signal levels is 1 mV?

Question 3 — 4 marks

The waveform below is an asynchronous serial interface ("RS-232") waveform used to transmit an 8-bit character:



(a) (i) What are the bit rate in bps and (ii) the baud rate in Hz?

(b) What is the hexadecimal value of the character?

(c) Is parity being used? If so, what type?

Question 4 — 4 marks

The sequence of bytes shown below includes two Unicode characters encoded using UTF-8. The byte values are given in hexadecimal.

```
57 E7 BA BF
```

(a) What were the code points of each character? Give your answer in hexadecimal. Show your work.

(b) If either or both are ASCII characters, what is/are the character(s)? Your answer(s) should be letters or two-letter abbreviations for control codes, not the numerical value(s).

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This exam paper is for:

Questions Version 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: _____

255

Question 1 — 2 marks

A communication system uses 4 bits to select a pulse that is at one of 16 possible levels. One of these pulses is transmitted every 125 μs.

(a) What is the symbol rate, in Hz?

(b) What is the bit rate, in bps?

Question 2 — 2 marks

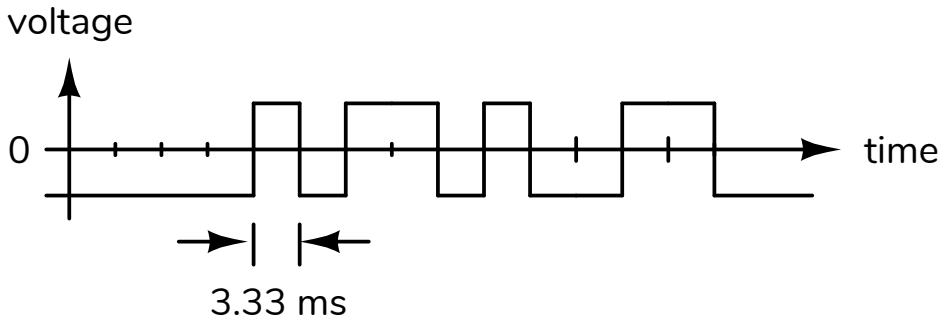
You need to measure the voltage at the output of a transducer that measures the vibration of a motor and have determined that the signal contains significant frequency components up to 60 kHz. The measured voltage ranges from 0 to 100 mV at the point where this voltage is sampled.

(a) What is the minimum sampling rate that would ensure you are able to capture all of the features of the measured waveform?

(b) What is the minimum number of bits per sample required to quantize this waveform such that the spacing between the quantized signal levels is 1 mV?

Question 3 — 4 marks

The waveform below is an asynchronous serial interface ("RS-232") waveform used to transmit an 8-bit character:



(a) (i) What are the bit rate in bps and (ii) the baud rate in Hz?

(b) What is the hexadecimal value of the character?

(c) Is parity being used? If so, what type?

Question 4 — 4 marks

The sequence of bytes shown below includes two Unicode characters encoded using UTF-8. The byte values are given in hexadecimal.

```
E5 AD 97 57
```

(a) What were the code points of each character? Give your answer in hexadecimal. Show your work.

(b) If either or both are ASCII characters, what is/are the character(s)? Your answer(s) should be letters or two-letter abbreviations for control codes, not the numerical value(s).