Assignment 1

Due Thursday, February 26. Show your work. Submit your assignment using the appropriate dropbox on the course web site. Assignments submitted after the solutions are made available will be given a mark of zero.

Question 1

Consider the contents of this PDF file.

(a) What are the values of the first 8 bytes in hex-adecimal (you can find the values using a hex editor such as hexedit, or Notepad++ using the Plugins/Converter/ASCII-> Hex menu).

(b) What are the values of the first 4 16-bit values assuming little-endian byte order?

(c) what are the values of the first two 32-bit values, assuming big-endian byte order?

(d) What are the first 8 characters, assuming UTF-8 encoding?

Question 2

Consider a temperature sensor that generates one message per minute. This message gives the air temperature, quantized into the ranges shown in the table below. Statistics of the air temperature indicate that the likelihood of the temperature being within each range is as follows:

Temperature	Probability
less than -20	1%
-19 to -10	3%
-9 to 0	10 %
1 to 10	25 %
11 to 20	25 %
21 to 30	25 %
31 to 40	10 %
more than 40	1 %

(a) How many bits of information are contained in each of the eight messages?

(b) What is the entropy of this source in bits/message?

(c) What is the information rate of this source in bits/second?

(d) What would be the data rate if we transmitted 3 bits per message?

Hint: $\log_a(b) = \log(b)/\log(a)$.

Question 3

What character has the Unicode code point U+1234? How would this be encoded in UTF-8?

Question 4

Three bytes with the following values (shown in hex) appear in a UTF-8 encoded document:

    e5   93   b2

What is the Unicode code point and name of this character?

Question 5

You are monitoring a communication system that uses 128-bit frames, each having a CRC[1] that allows you detect which frames contain errors.

You examine 750,000 frames and find that 23 had errors.

(a) What was the FER?

(b) Assuming that each frame with errors had only one bit in error (a reasonable assumption for random errors and low bit error rates), what was the BER?

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[1]To be described later.