Assignment 4

Due Tuesday, December 6. 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

Compute a modulo-256 checksum for the following sequence of bytes. The result of adding your one-byte checksum to the values given (modulo-256) should be zero. Give your answer in hexadecimal.

```
82 e8 5b bd 17 16 b2 bb
```

Hint: Use a calculator with hexadecimal mode or a spreadsheet and the hex2dec() and mod() functions.

Question 2

A block FEC code uses values from GF(4). The 4 possible elements are represented using the letters A through D. The valid code words are:

element in	codeword out
A	ABC
B	DAB
C	CDA
D	BCD

(a) What is the code rate[1]?

(b) What is the minimum distance of this code[2]? How many errors can be detected? Corrected?

(c) If the codeword ADA is received, was an error made? Can it be corrected? If so, what codeword should the decoder decide was transmitted? Show your work.

(d) Repeat if the codeword received was AAA.

Question 3

The rate-1/2 convolutional encoder shown in the lecture notes is initialized so all the shift-register outputs

[1]You can compute this as a ratio of input GF(4) elements to output GF(4) elements.

[2]Hamming distance is defined as the number of differing elements in the two codewords.

are zero and the three bits 1, 1, 1 are input to it. For example the first two outputs are A=1 and B=1.

(a) What are the next two outputs?

(b) If the puncturing pattern AB, A, AB was applied, what is the code rate?

(c) What is the punctured encoder output if the three input bits are as above?

Question 4

Assuming a generator polynomial $G(x) = x^4 + x^3 + 1$ and a message to be protected "1101", compute the transmitted message (data plus CRC) using the basic method described in the lecture notes. As always, show your work.

Question 5

Look up the appropriate procedure for displaying the 48-bit MAC (or "hardware") address for a network interface on one of your communication devices (cell phone, tablet, computer, router, etc). This address can usually be found under a user interface such as Properties→About Phone→Status, Network Connections→Status→Details or can be displayed by a command-line utility such as `ifconfig`, `ip link`, or `ipconfig /all`. Select a network interface that has a 48-bit MAC/hardware address and answer the following questions:

(a) What device, interface and command did you use?

(b) What is the MAC address? What is the OUI?

(c) Look up the OUI using an on-line database (e.g. https://regauth.standards.ieee.org/standards-ra-web/pub/view.html) or https://www.wireshark.org/tools/

`oui-lookup.html`. What company manufactured the network interface?

Show how you obtained your answers.

Question 6

An Ethernet packet contains the following bytes:

```
00 1d 7e 2f b5 9b 00 24 1d 73 df ce 08 06 00 01
08 00 06 04 00 01 00 24 1d 73 df ce 0a 00 00 64
00 00 00 00 00 00 0a 00 00 01
```

The preamble (including SFD) and CRC are not included.

(a) What are the values of the three Ethernet header fields?

(b) What is the meaning of the type/length field (length or type; if type what is the Ethertype)?

(c) What is the length of the Ethernet frame payload?