ELEX 4340 : Data Communications
2015 Fall Session

Assignment 4

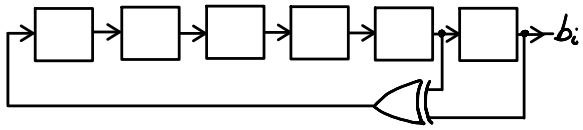
Due Monday, January 4, 2016. Show your work. Submit your assignment using the appropriate dropbox on the course web site. Assignments submitted after the solutions are made available will be given a mark of zero.

Question 1

Assume the taps in the following PRBS generator are set to produce a ML sequence.

(a) What is the period of the sequence b_i?

(b) What is the longest run of ones?



Question 2

The message 11011 is to be protected with a CRC defined by the following generator polynomial: $G(x) = x^3 + 1$. What is the CRC? Assume the CRC is simply the remainder after dividing by $G(x)$.

Question 3

The following hex dump shows the first 16 bytes of of an Ethernet frame starting with the first byte following the preamble.

```
00 1d 7e 2f b5 9b 00 24
1d 73 df ce 08 00 45 00
```

What are:

(a) the OUI of the source address?

(b) the manufacturer of the destination interface?

(c) the protocol used by the payload?

Hints: You can use:http://standards.ieee.org/develop/regauth/oui/public.html and select "All MAC" to search for the owner of an OUI.

See the Wikipedia article on EtherType or the IEEE Ethertype list for a list of values assigned to the type/length field.

Question 4

The following hex dump shows the contents of an IP packet:

```
45 00 00 3c
68 47 40 00
40 11 7b b2
0a 00 00 64
d0 50 7c 02
```

What are:

(a) the destination IP address in "dotted-quad" notation?

(b) the name of the protocol used in the payload portion of the IP frame?

(c) the total length of the IP packet (in decimal)?

(d) the maximum number of times this packet can be forwarded?

(e) the correct value of the header checksum (show your work)?

Hints: If you use a spreadsheet you can format a column as text and use the hex2dec() and dec2hex() functions to convert numbers to/from hex strings. You can use the mod() and floor() functions or the bitrshift() and bitand() functions to extract the MS and LS words a 32-bit value.

The Wikipedia article "List of IP Protocol Numbers" contains, not surprisingly, such a list.

If you want to check your results you can copy the hex digits to a single-line text file, add an initial '0' offset value and use File->Import to read the data into Wireshark using "Raw IP" encapsulation. This will show you the contents of the various fields.

Question 5

What is the netmask for a /11 network?

Question 6

A code contains the following four codewords:

```
0000000
1000011
0111100
1111111
```

(a) What is the minimum distance of this code? How many errors can this code correct? How many errors can it detect?

(b) If the codeword 1011100 is received, was there an error? Can the receiver correct the error? If so, which bit was in error?

(c) If the codeword 1100011 is received, was there an error? Can the receiver correct the error? If so, which bit was in error?

Question 7

(a) You are sending data from NYC to London (a distance of approximately 6000 km) over a 1 Gb/s fiber optic link using a stop-and-wait ARQ protocol and frames of 1250 bytes. Assuming a velocity of propagation of 200 m/μs, what throughput would you expect? Assume an ACK packet is very short. Give your answer in bits per second.

(b) If you were to use go-back-N ARQ instead, how many packets and how many bytes would need to be buffered at the sending side to ensure a throughput of 1 Gb/s?

Hint: the round-trip time is twice the propagation delay.