ENEL 573: Assignment 2

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Question 1

You have been asked to determine whether the length of a packet affects the performance of a simple parity check bit. Assume we have two different types of packets containing 7 bits and 15 bits of data, respectively. Both packets also have a single parity bit capable of detecting only odd bit error patterns. If the probability of bit error is 0.0001, determine the probability that the parity check fails to detect an error for the two different packet lengths. Does parity bit performance improve or get worse as a packet gets longer?

Question 2

Determine the answer to the equation `89-103` using ones complement arithmetic. This means you should transform `98` and `-103` to ones complement numbers, add them and then transform the result back to binary.

Question 3

Consider an 8 bit version of the Internet Checksum where the packet consists of the following three bytes: `0x13, 0xaa, 0xf2`.

a) Determine the 8 bit checksum for this three byte packet.

b) Now, assume that you've transmitted the packet and some errors have occured. Your checksum is uncorrupted but the information bytes have changed to the following: `0x13, 0xac, 0xf0`. Use your checksum to perform an error detection operation on the packet.

c) In part b), you should have found that the checksum failed to detect the errors. Based on the received data, can you figure out what kind of errors will cause the Internet checksum to fail?

Question 4

Write the polynomial for the following 16 bits: `0011010111000101`. What is the degree of the polynomial?

Question 5

Consider the following two polynomials

$$p(x) = x^4 + x^2 + x \quad g(x) = x^3 + x + 1$$

a) Calculate the sum of the two polynomials.

b) Calculate the product of the two polynomials.

c) Calculate $p(x)/g(x)$. Write the long division both in terms of polynomials and in binary form.

d) If $q(x)$ and $r(x)$ are the quotient and remainder of $p(x)/g(x)$, check your answer to the previous question by verifying that $p(x) = q(x)g(x) + r(x)$.

Question 6

Consider the following 11 bit packet:
`11010101011`

a) Using the 5 bit 0x25 USB cyclical redundancy check generator polynomial, $g(x) = x^5 + x^2 + 1$ determine the checksum for this two byte packet.

b) Add the checksum to $x^5 i(x)$ and then divide the whole thing by the CRC generator polynomial. You should get a remainder of 0 since you've just created a packet that's error free.

c) Now, assume that your checksum is received error free but the information bits have experienced some errors and are now:

`00010101001`

Verify that your checksum will detect this error pattern.