1. Consider the generator function for cyclic codes as g(x) = $x^3 + x + 1$. Consider the information sequence 1001.
   (a) Find the codeword corresponding to the preceding information sequence.
   (b) Suppose the codeword has a transmission error in the first bit. What does the receiver obtain when it does its error-checking?

2. Consider the generator function for cyclic codes as $g_1(x) = x + 1$ and $g_2(x) = x^3 + x^2 + 1$. Consider the information bits 110110.
   (a) Find the codeword corresponding to these information bits if $g_1(x)$ is used codeword as the generating polynomial
   (b) Find the codeword corresponding to these information bits if $g_2(x)$ is used as the generating polynomial.
   (c) Can $g_2(x)$ detect single errors? double errors? triple errors? If not, give an example of an error pattern that cannot be detected.
   (d) Find the codeword corresponding to these information bits if $g(x) = g_1(x) \times g_2(x)$ is used as the generating polynomial. Comment on the error-detecting capabilities of g(x).

3. Suppose a header consists of four 16-bit words: (11111111 11111111, 11111111 00000000, 11110000 11110000, 11000000 11000000). Find the Internet checksum for this code.

4. An upper-layer packet is split into 10 frames, each of which has an 80% chance of arriving undamaged. If no error control is done by the data link protocol, how many times must the message be sent on average to get the entire thing through?

5. A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$.
   (a) Find the actual bit string transmitted.
   (b) Suppose that the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.