Tutorial 9: Error Detection and Correction

1. Describe two types of errors that you are familiar with and how these errors become introduced into a communications channel.

2. For the above two concepts that you have described, describe the methods that you would use in reducing these types of errors in the communications system.

3. Describe the concept of Hamming Distance in relation to error detection and recovery coding.

4. Describe the concept of these methods of error control
    a. Automatic repeat request (ARQ)
    b. Forward error correction (FEC)

5. A CRC code is specified with CRC divisor given as 10011
    a. Write this CRC divisor as in the form of a generating polynomial.
    b. Calculate the CRC of the following message: 1101011011

                                                    [Checksum = 1110]

6. Draw a simple diagram of an encryption system aimed at encrypting telemetry readings from a military aircraft. Use should consider three principal stages, the data encryption stage, data transmission stage and the data reception and decryption stage. Describe an encryption algorithm and a block cipher mode that you would use in this system. For each of the stages, describe how you would ensure that errors in the system are minimized, detected and corrected for. How does the encryption scheme you have chosen achieve this and how does the hardware infrastructure you have chosen achieve this? Describe these and any other aspects that you think are important in terms of error detection and correction in the system.

7. Do an internet search in the following:
    a. Block Coding FEC
    b. Convolutional Coding FEC
    c. Reed-Solomon Coding is a block coding FEC scheme that is used in CD's and DVD's. How does this work
    d. Quantum error correction in quantum information systems.