CSE/PC/B/S/314   Computer Networks Lab
CO1: Design and implement error detection techniques within a simulated network environment.

Assignment 1: Design and implement an error detection module which has two schemes namely Checksum and Cyclic Redundancy Check(CRC).

Due on: 31 July - 04 August 2023 (in your respective lab classes)
Report submission due on: 6 August 2023

Language: You can write the program in any high level language like C, C++, Java, Python etc.
Please note that you may need to use these schemes separately for other applications (assignments).

Sender Program: The Sender program should accept the name of a test file (contains a sequence of 0,1) from the command line. Then it will prepare the dataword from the input. Based on the schemes, codewords will be prepared. Sender will send the codewords to the Receiver.

Error injection module: Inject error in random positions in the input data frame. Write a separate method for that. Sender program will randomly call this method before sending the codewords to the receiver.

Receiver Program: Receiver will check if there is any error detected. Based on the detection it will accept or reject the dataword.

- **Checksum (16-bit):** Checksum of a block of data is the complement of the one's complement of the 16-bit sum of the block. The message (from the input file) is divided into 16-bit words. The value of the checksum word is set to 0. All words are added using 1's complement addition. The sum is complemented and becomes the checksum. So, if we transmit the block of data including the checksum field, the receiver should see a checksum of 0 if there are no bit errors.
- **CRC:** CRC generator polynomials will be given as input (CRC-8, CRC-10, CRC-16 and CRC-32). Show how good is the selected polynomial to detect single-bit error, two isolated single-bit errors, odd number of errors, and burst errors.
    - CRC-8: $x^8 + x^7 + x^6 + x^4 + x^2 + 1$ (Use: General, Bluetooth wireless communication)
    - CRC-10: $x^{10} + x^9 + x^5 + x^4 + x + 1$ (Use: General, Telecommunication)
    - CRC-16: $x^{16} + x^{15} + x^2 + 1$ (Use: USB)
    - CRC-32: $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$ (Use: Ethernet IEEE802.3)
- **Error types:** single-bit error, two isolated single-bit errors, odd number of errors, and burst errors.

Test the above two schemes for the error types and CRC polynomials mentioned above for the following cases (not limited to).
    - Error is detected by both CRC and Checksum.
    - Error is detected by checksum but not by CRC.
    - Error is detected by CRC but not by Checksum.

Note: Follow the instructions given for report preparation.