CS425: Computer Networks
Homework-1
Due date: Wednesday 11/02/2026

PROCEDURE:

1. **(20 points)** Write a program (in any language) that generates an n-bit frame for transmission from a k-bit data block D and a $(n - k + 1)$ bit CRC pattern P. Compile and run the program with at least two set of inputs to confirm that this program is generating CRC patterns correctly.

   Now, modify the program that performs the following steps:

   (a) Generates a message of $k =10$ bits.

   (b) Uses the previous code with P=110101 to generate the corresponding 15-bit frame T for transmission.

   (c) Generates transmission errors at any bit positions of T.

   (d) Applies CRC to the received frame (i.e. frame T after introducing errors) to determine if the frame should be accepted or discarded.

   Attach your code with your report, and also put comments stating the instructions of how to run it.

2. **(10 points)** In the Go-back-N ARQ mechanism using k-bit sequence numbers, why is the window size limited to $2^k - 1$ and not 2^k?

3. **(10 points)** What is the maximum window size that can be used in the Selective-Reject ARQ mechanism that uses k-bit sequence numbers? Explain your answer.

4. **(10 points)** A channel has a data rate of 4 kbps and a propagation delay of 20 ms. For what range of frame sizes does stop-and-wait give an efficiency of at least 50%?

5. **(20 points)** Consider a frame consists of one character of 4 bits. Assume that the probability of bit error is 10^{-3} and that it is independent in each bit.

   (a) What is the probability that the received frame contains no errors?

   (b) What is the probability that the received frame contains at least one error?

   (c) Now assume that one parity bit is added. What is the probability that the frame is received with errors that are not detected?

6. **(10 points)** For P = 110011 and M = 11100011, find the CRC

7. **(20 points)** (a). In a CRC error-detecting scheme, choose $P(x) = X^4 + X + 1$. Encode the bits 10010011011.

   (b). Suppose the channel introduces an error pattern 100010000000000 (i.e., a flip from 1 to 0 or from 0 to 1 in position 1 and 5). What is received? Can the error be detected?

   (c). Repeat part (b) with error pattern 100110000000000.