Project #3: Networking Questions
Spring 2023

Please answer each question in the corresponding answer area on Gradescope.
Due: Thursday, Feb 27, 2025 at 11:59 pm

Note: This assignment includes a written portion (this document) and a programming portion (separate document). Be sure to submit both!

1. **Bit Stuffing.**

a. A bit string, 1000111111010001111101l, needs to be transmitted at the data link layer. What is the string transmitted across the Link after bit stuffing by the sender? Assume the same start/end flags as the ones used in class. (Hint: Apply 5 consecutive 1s to your frame and append 01111110 to both the start and end of your frame).

b. A frame is received by the data link layer, which was transmitted using bit stuffing: 011111101111101100011111101101111110. What is the bit string that the link layer passes up the stack to the network layer after bit de-stuffing?

2. **Hamming Code.**

a. Encode the message 10011011 to send.

b. What can be said about the correctness of the following received messages (Hint: Check for Hamming Code correctness using parity)?

i. 111000101011

ii. 01110011011

3. **CRC Code.** Assume the $C(x) = x^4 + x^2 + 1$.

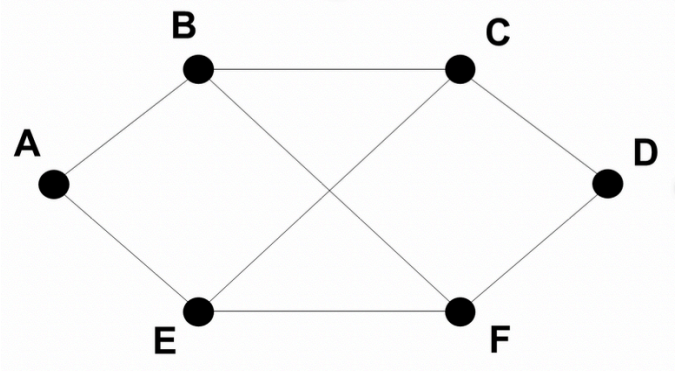
a. Encode the message 10110 with CRC.

b. What can be said about the correctness of the following received messages?

i. 110101110

ii. 110101100

4. **Distance Vector Routing. Distance Vector Routing.** Consider the subnet shown below. Distance vector routing is used, and the following distance vectors have just come in to router C: **B**: (6, 0, 8, 10, 5, 5); from **D**: (4, 9, 7, 0, 8, 6); and from **E**: (7, 7, 4, 8, 0, 5). The measured distances/costs from C to **B**, **D**, and **E** are 5, 5, and 4, respectively. What will C's new routing table be after this update? Show both the outgoing router to use and the cost.



Routing Table Format:

Destination	Cost	Next Hop
A		
B		
C		
D		
E		
F		

5. **TCP Sequence Numbers.** To get around the problem of sequence numbers wrapping around while old TCP packets still exist, TCP could use 64-bit sequence numbers instead of 32 bits. However, theoretically, an optical fiber can run at 100 Terabits per second. What maximum packet lifetime would be required to prevent sequence number wrap-around even with 64-bit sequence numbers? Assume that each byte of a packet has its own sequence number (as TCP does).

6. **DNS.** Using an online whois lookup service like whois.com, look up duke.edu. On what date was the domain registered? When does it expire? What are the DNS servers for this domain? Include a screenshot of your source.