HW #3: Networking Questions

Submit electronically as a PDF file called `hw3_netID.pdf` on Gradescope
(see course website for due date)

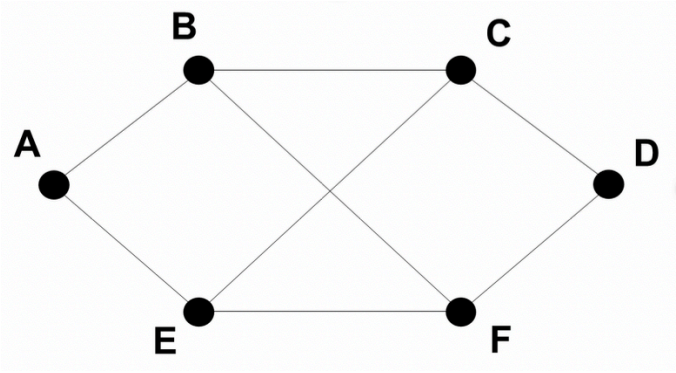
Note: This assignment includes a written portion (this document) and a programming portion (separate document). Be sure to submit both!

1. **Bit Stuffing.**
   (a) A bit string, 1001111110010111110011, needs to be transmitted at the data link layer. What is the string transmitted across the Link after bit stuffing by the sender, assuming the bit stuffing scheme shown in the lecture slides?

   (b) A frame is received by the data link layer, which was transmitted using bit stuffing: 011111100011111011001111100110111111 0. What is the bit string that the link layer passes up the stack to the network layer after bit de-stuffing, assuming the bit stuffing scheme shown in the lecture slides?

2. **Link Layer Protocols.** A channel has a bit rate of 4 kilobits per second and a propagation delay of 20 milliseconds. For what range of frame sizes does stop-and-wait give a link utilization efficiency of at least 50%?

3. **Distance Vector Routing.** Consider the subnet shown below. Distance vector routing is used, and the following vectors (showing the cost from each node) have just come in to router C: from **B**: (5, 0, 9, 12, 6, 2); from **D**: (16, 12, 6, 0, 9, 10); and from **E**: (7, 6, 3, 9, 0, 4). The measured delays from C to **B**, **D**, and **E** are 6, 6, and 3, respectively. What will C's new routing table be after this update? Show both the outgoing line to use and the expected delay.



Routing Table Format:

Destination	Cost	Next Hop
A		
B		
C		
D		
E		
F		

4. **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 75 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).

5. **DNS.** Using an online whois lookup service like whois.net, 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.

6. **Internet Services.** Using netcat (the 'nc' command) in a terminal, manually display the following URL to the console.
http://rabihyounes.com/awesome.txt