Name: _____ Roll No: _____

Computer Networks - Subjective

Total Points: 60 Time Allowed: 2 hours 20 minutes

Instructions:

- **Subjective exam should only be given to students once they return the Objective exam**
- **Extra sheet may be given for rough work, however, it must NOT be collected**

Question1: (2+2+2+4+6)

What should be the sampling rate for reconstructing a filtered signal of bandwidth B?

Answer:

_____

Using Nyquist theorem, which signal property can be used to achieve higher data rates on a channel with bandwidth B?

Answer:

_____

Is there any channel property that Nyquist overlooked while deriving equation for Maximum data rate of a channel? If yes, state property name. If No then state reason why Nyquist theorem is perfect for data rate calculations?

Answer:

_____

Why 35kbps is the maximum Shannon limit for the data rate of the telephone systems (PSTN)?

_____ _____

_____

Signal to noise ratio in a typical telephone system is 30db and the channel bandwidth is 4kHz.

a. What is the maximum bit rate possible?

_____

b. What is the number of voltage levels to achieve this bit rate?

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Question2: (2+3+3)

Following character encoding is used in a data link protocol

A: 01010111

B: 11101011

ESC: 11100111

FLAG: 11101111

Show the bit sequence transmitted for the following data with each of the following framing schemes

Data: A ESC FLAG ESC FLAG B

1. Character Count

_____

2. FLAG Bytes with byte stuffing

_____

3. Starting and ending flag bytes with bit stuffing (hint: the flag mentioned here is different than the data FLAG given above, remember bit stuffing flag?)

_____

Question3: (4)

The generator polynomial **11101** is agreed between sender and receiver. Assume that the receiver receives the bits **1101010100110**. Is the data received same as the data sent? Show your working.

Answer: _____

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Question 4: (3+3)

Fill in the following table by writing names of two network devices (devices that are used for inter connections) that are used at each layer

Layer	Device1	Device2
Physical Layer		
Data Link Layer		
Network Layer		

Give one line description of each of these devices. Your description should explicitly state the use of the device at a particular layer of the OSI reference model

Bridge or
Hub:_____

Router:_____
__

Switch:
_____

Question 5: (1+1+2)

Suppose there is a 10 Mbps microwave link between a geostationary satellite and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of 2.4×10^8 meters/sec. (remember that Satellites are 36000 km away from earth)

a. What is the propagation delay of the link?

_____

b. What is the bandwidth-delay product, $R \cdot d_{prop}$?

_____

c. Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting?

_____

_____

_____

_____

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Question 6: (4+6)

a. Do you think the distance vector routing protocol is scalable? Please describe the reason to support your answer (Scalable means that a protocol performance does not degrade as the network size increases).

Your Answer: _____

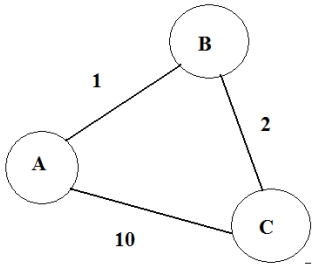
Reason:

_____

_____

_____

b. Calculate the shortest paths using DV algorithm for the following 3 node network. Show all the tables and your working through iterations.



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Question 7: (2+2+1+2+3+2) Consider the figure given below. Assuming TCP Reno is the protocol experiencing the behavior shown below, answer the following questions

a. Identify the intervals of time when TCP congestion avoidance is operating. Explain.

_____

_____

b. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? Explain

_____

_____

c. What is the initial value of ssthresh at the first transmission round?

_____

d. What is the value of ssthresh at the 18th transmission round? Why?

_____

_____ _____

e. Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of ssthresh? Explain

_____

_____

f. Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16th round. What are the ssthresh and the congestion window size at the 17th round?

_____

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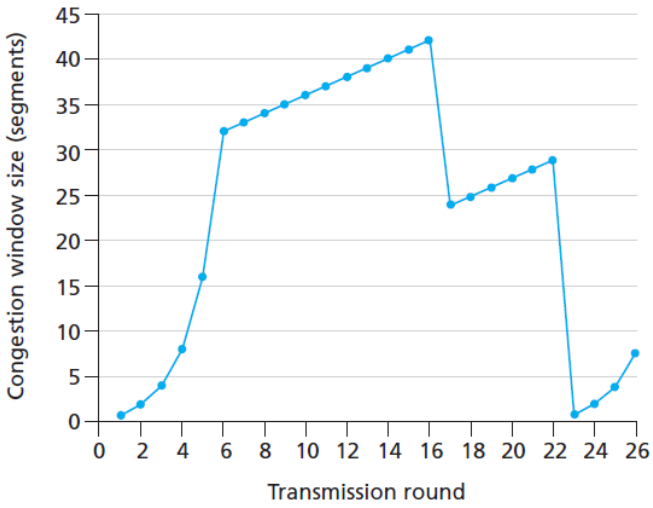
Congestion window size (segments)
45
40
35
30
25
20
15
10
5
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Transmission round