National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Data Communication Networks	Course Code:	EE317
	Program:	Electrical Engineering	Semester:	Spring2018
	Duration:	1 Hour	Total Marks:	25
	Exam Date:	26 Feb- 2018	Weight:	15
	Section:	ALL	Page(s):	4
	Exam Type:	Sessional-1 SOLUTION		

Student Name:_____ **Roll No.**_____ **Section:**_____

Instruction/Notes:
1. Do not forget to write your Name and Roll Numbers in above space.
2. Solve on the paper and Return.

Question No. 1 **Marks: 10**

Compute answers to the following questions.

1. A TV picture is to be transmitted over a channel whose spectrum is between 3MHz and 4MHz. The signal-to-noise ratio for this channel is 24dB. Find the appropriate bit rate and signaling levels required.

   Bandwidth B = 1 MHz

   S/N = 24 dB = 251

   Shannon Theorem:

   Channel Capacity (Bit rate) = B $\log_2$ (1+S/N) = 1000000 $\log_2$ (1+251) = 1000000*$\log_2$ (252) = 1000000*7.977= 7.977 Mbps (Shannon's limit on channel bit rate)

   Nyquist Theorem:

   C = 2B$\log_2$L gives L = 16

2. If file size is *L* and transmission rate is *R*, the transmission time is computed as *L*/*R*. An image is 2400 × 1600 pixels with 4 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over a 56-kbps modem channel? Over a 1-Mbps cable modem? 1 bytes = 8 bits

   L = 2400x1600 = 3840000 pixels = 3840000x4 = 15360000 bytes = 15360000x8 = 122880000 bits

   Over 56 kbps modem: time = L/R = 122880000/56000 = 2194 seconds = 36 minutes

   Over 1 Mbps modem: time = L/R = 122880000/1000000 = 122.88 seconds = 2 minutes

3. A modem constellation diagram has data points at the following coordinates: (1, 1), (1, -1), (-1, 1), and (-1, -1). How many bps can a modem with these parameters achieve at 1200 symbols/second?

This constellation diagram represents QPSK with 2^2 = 4 points, which means 2 bits per symbol.

2 bits per symbol means bit rate is double the symbol rate/baud rate.

As baud rate is 1200, bit rate or data rate would be 2400 bps.

4. In a typical mobile phone system with hexagonal cells, it is forbidden to reuse a frequency band in an adjacent cell. If 840 frequencies are available, how many can be used in a given cell? What is the cluster size in this case?

Cluster size = 3

840/3 = 280 frequencies would be used in each cell

This will ensure the condition that frequencies are not reused in adjacent cells.

Flag | Frame-1 payload | Flag | Flag | Frame-2 payload | Flag

Flag 01111110

5. The following bits have been received by the receiver over a link which uses "Flag bits with Bit Stuffing" framing method. Retrieve the data bits at the receiver. How many frames have been received?

01111110011011111101111101111101001001111110011111100110001011100011111011111011011111110

delete the zero in de stuffing after 5 consecutive 11111

Two frames have been received

Data bits after de-stuffing at receiver are: 011011111111110111111001001100010111000111111111011

Question No. 2 **Marks: 10**

Give short answers to the following questions.

1. Suppose the algorithms used to implement the operations at layer *k* is changed. How does this impact operations at layers *k* – 1 and *k* + 1? Suppose there is a change in the service (set of operations) provided by layer *k*. How does this impact services at layers *k* – 1 and *k* + 1?

   No impact on k-1 and k+1 layers if algorithms at layer k are changed.
   If services by k are changed, it would affect the services at layer k+1 but no change on layer k-1.

2. What is the purpose of twisting in case of twisted-pair transmission medium?

   Twisting is done because two parallel wires constitute a fine antenna. When the wires are twisted, the waves from different twists cancel out, so the wire radiates less effectively.

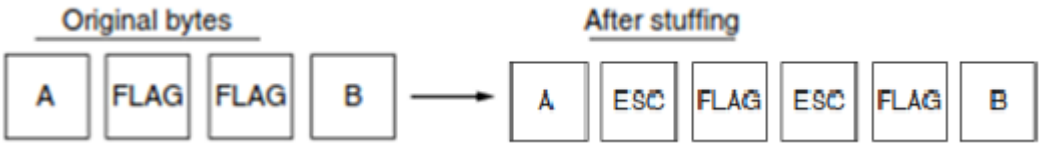
3. What is the role of a MODEM and a CODEC in PSTN?

   MODEM: Bits modulate the carrier, e.g. QAM and transmitted over analog local loop.
   CODEC: Analog carrier is digitized using PCM and TDM the high bandwidth Trunk.

4. The Ethernet frame begins with a 56-bit preamble of alternating 1s and 0s followed by a length count. What is the purpose of this preamble?

   Preamble is for synchronization and also start of frame delimiter.

5. In Byte stuffing scheme of PPP protocol, show bytes after stuffing if two consecutive FLAG bytes appear in the data.



Question No. 3 **Marks: 5**

A CDMA receiver gets the following chips: (-1+1-3+1-1 -3 +1 +1). Assuming the chip sequences defined below, which stations transmitted, and which bits did each one send?

A = (−1 −1 −1 +1 +1 −1 +1 +1)

B = (−1 −1 +1 −1 +1 +1 +1 −1)

C = (−1 +1 −1 +1 +1 +1 −1 −1)

D = (−1 +1 −1 −1 −1 −1 +1 −1)

Solution:

Just compute the four normalized inner products:

$$(-1\ +1\ -3\ +1\ -1\ -3\ +1\ +1) \bullet (-1\ -1\ -1\ +1\ +1\ -1\ +1\ +1)/8 = 1$$
$$(-1\ +1\ -3\ +1\ -1\ -3\ +1\ +1) \bullet (-1\ -1\ +1\ -1\ +1\ +1\ +1\ -1)/8 = -1$$
$$(-1\ +1\ -3\ +1\ -1\ -3\ +1\ +1) \bullet (-1\ +1\ -1\ +1\ +1\ +1\ -1\ -1)/8 = 0$$
$$(-1\ +1\ -3\ +1\ -1\ -3\ +1\ +1) \bullet (-1\ +1\ -1\ -1\ -1\ -1\ +1\ -1)/8 = 1$$

The result is that *A* and *D* sent 1 bits, *B* sent a 0 bit, and *C* was silent.