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**COMPUTER ENGINEERING**

**CE 51: Data Communication Computer Networks,**

**B. Tech III yr. (Sem. V)**

**Mid Semester Exam**

**Dt:16/09/2019@10hr.** **Total: 20 Marks**

<u>**Instruction**: *Keep your answers clear and concise, and state all of your assumptions carefully. Note there is no fractional marks for partly correct answer.*</u>

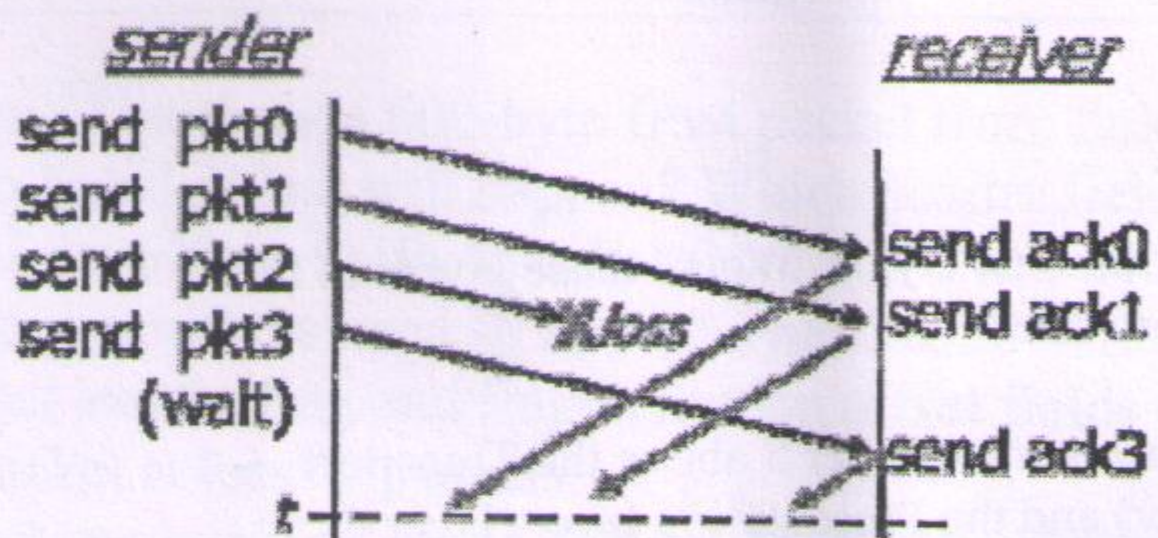
| | Answer Following Questions | Mrks | CO BL |
|---|---|---|---|
| Q.1 (a) | The OSI Reference Model has two additional layers. Where these layers in the stack are and what services do they provide? | 4 | CO1, 3 BL3 |
| A.1 (a) | The two additional layers are the Session layer (layer 5 above the Transport layer and below the Presentation layer) and the Presentation layer (layer 6 above the Session layer and below the Application layer. "The role of the presentation layer is tò provide services that allow communicating applications to interpret the meaning of data exchanged." And, "The session layer provide for delimiting and synchronization of data exchange, including the means to build a check pointing and recovery scheme." | | |
| Q.1 (b) | A noiseless 4-kHz channel is sampled every 1 msec. What is the maximum data rate? How does the maximum data rate change if the channel is noisy, with a signal-to-noise ratio of 30 dB? | 2 | |
| A.1 (b) | A noiseless channel can carry an arbitrarily large amount of information, no matter how often it is sampled. Just send a lot of data per sample. For the 4-kHz channel, make 8000 samples/sec. If each sample is 16 bits, the channel can send 128 kbps. If each sample is 1024 bits, the channel can send 8.2 Mbps. The key word here is "noiseless." With a normal 4 kHz channel, the Shannon limit would not allow this. A signal-to-noise ratio of 30 dB means S/N = 1000. So, the Shannon limit is about 39.86 kbps. | | |
| Q.2 (a) | The following character encoding is used in a data link protocol:<br>A: 01000111 B: 11100011 FLAG: 01111110 ESC: 11100000<br>Show the bit sequence transmitted (in binary) for the four-character frame A B ESC FLAG when each of the following framing methods is used:<br>(a) Byte count.<br>(b) Flag bytes with byte stuffing.<br>(c) Starting and ending flag bytes with bit stuffing.<br>(d) One of your classmates has pointed out that it is wasteful to end each frame with a flag byte and then begin the next one with a second flag byte. One flag byte could do the job as well, and a byte saved is a byte earned. Do you agree? | 4 | CO1 BL3 |
| A.2 (a) | (a) 00000100 01000111 11100011 11100000 01111110<br>(b) 01111110 01000111 11100011 11100000 11100000 11100000 | | |

01111110 01111110

(c) 01111110 01000111 110100011 111000000 011111010 01111110

(d) If you could always count on an endless stream of frames, one flag byte might be enough. But what if a frame ends (with a flag byte) and there are no new frames for 15 minutes? How will the receiver know that the next byte is actually the start of a new frame and not just noise on the line? The protocol is much simpler with starting and ending flag bytes.

Q.2 (b) Consider following in Figure. Does this figure indicate that Go-Back -N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain your answer briefly with suitable justification.




A.2 (b) Answer: This must be the SR protocol since pkt 3 is acked even though pkt 2 was lost. GBN uses cumulative ACKs and so would not generate an ACK 3 if pkt 2 was missing.

OR

| | | | |
|---|---|---|---|
| Q.2 (a) | What is the minimum bandwidth needed to achieve a data rate of *B* bits/sec if the signal is transmitted using NRZ, MLT-3, and Manchester encoding? Explain your answer. | 3 | CO1 BL3 |
| A. 2 (a) | In NRZ, the signal completes a cycle at most every 2 bits (alternating 1s and 0s). So, the minimum bandwidth need to achieve *B* bits/sec data rate is B/2 Hz. In MLT-3, the signal completes a cycle at most every 4 bits (a sequence of 1s), thus requiring at least *B*/4 Hz to achieve B bits/sec data rate. Finally, in Manchester encoding, the signal completes a cycle in every bit, thus requiring at least *B* Hz to achieve *B* bits/sec data rate. | | |
| Q.2 (b) | Why we need line coding? Suppose you are asked to choose line coding scheme mechanisms, so what different types of signaling elements you will consider? Explain. | 3 | CO1 BL3 |
| A.2 (b) | Explain Baseline wandering, DC component, error detection/Correction, noise component etc. | | |
| Q. 3 (a) | After you finish the router prototype, you need to test it with different packet switching technologies, which may have different MTU. In a test, your router has 3 links with MTU as below: | 4 | CO4 BL1 BL3 |

| Link | MTU(bytes) |
|---|---|
| 1 | 60 |
| 2 | 120 |
| 3 | 1000 |

Now the router receives a 600-byte IPv4 packet from link 3, and it needs to send it to link 2. What will happen? Which header fields need to be updated? If the 600-byte IPv4 packet from link 3 has 20 bytes header, at least how many packets need to be sent over link 2? Write down the value of total length, flag and fragmentation offset fields of each outgoing packet.at least 2 packets.

A.3 (a) The router needs to split the packet into smaller ones. Total length, flag, fragmented offset, TTL and checksum.

Total length flag offset
packet 1: 420 1 0
packet 2: 200 0 50
Note: other answers are also right if
1. the sum of total length is 580+20*number of packets
2. packet i+1 offset = (packet i length - 20)/8 + packet i offset
3. packet 1 has offset 0
4. flag is 1 except the last packet, which has 0

Q.3 (b) The Ethernet protocol is called CSMA/CD because it supports carrier sense, collision detection and backoff. For each of these three capabilities, give a brief explanation of what it is and why it offers an improvement over Slotted Aloha. 4

A.3 (b) Carrier sense refers to a node listening before it begins to transmit to see whether the medium is already in use. It prevents easily avoided collisions (but can't prevent all collisions). With Slotted Aloha, nodes simply start transmitting at the beginning of a slot if they have new data, and so can immediately collide. In addition, carrier sense allows Ethernet to avoid requiring fixed slots, so nodes can both transmit whenever they have new data to send, and also needn't transmit for an entire slot's duration.

Collision detection refers to how Ethernet nodes can quickly determine that they have transmitted at the same time as another node, rendering both transmissions ineffective. Note that Slotted Aloha also detects collisions,but at the cost of an entire lost slot. With Ethernet, only the time occupied by a minimum-sized frame is lost.

Backoff refers to Ethernet's behavior upon detecting a collision, which is to select a random amount of time to wait before trying again. A key difference between Ethernet and Slotted Aloha is that in addition Ethernet exponentially backs off. This means that the load caused by colliding senders will eventually diminish as the senders wait longer and longer to resolve their collisions. Slotted Aloha, on the other hand, back off geometrically, trying each new slot with probability , and not adapting to be lower if collisions persist.