Model answer

O.K

Fayoum University- Faculty of Engineering- Communications & Electronics Department
Computer Networks 4th year

FINAL EXAM
January 5th 2009
TIME ALLOWED: 3 Hours
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Question 1: Choose the correct answer:

1. **What is the most common type of cabling used in LANs?**
   a) STP
   b) Coax
   c) Fiber
   d) UTP
2. **Refer to the fig.1 how many collision domains exist in the network?**

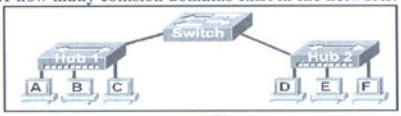


Fig. 1

   a) 7
   b) 6
   c) 4
   d) 1
   e) 2
3. **Which address does a bridge use to make filtering and switching decisions?**
   a) Source MAC
   b) Network IP address
   c) Destination MAC
   d) destination IP
   e) source IP
4. **Refer to the fig.2 host A is communicating with host F. What happens to a frame sent from host A to host F as it travels over the Ethernet segments?**

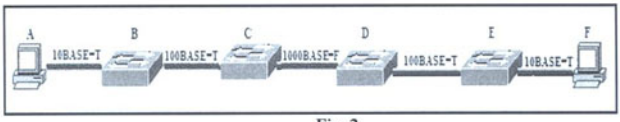


Fig. 2

   a) The frame format is modified as it passes through each switch.
   b) The frame format is modified as the media material changes between copper and fiber at switch C and switch D.
   c) The frame format remains the same across each Ethernet segment.
   d) The frame format is modified as the media speed changed at switch B and switch E.

5. The connector of UTP cable called:-

a) RJ-11.
b) BNC.
c) AUI.
d) RJ-45.

6. The maximum length for UTP is

a) 50 meters.
b) 75 meters.
c) 100 meters.
d) 150 meters.

7. The maximum length for thin coax cable is:

a) 500 meters.
b) 185 meters.
c) 100 meters.
d) 150 meters

8. The maximum length for thick coax cable is:

a) 500 meters.
b) 185 meters.
c) 100 meters.
d) 150 meters.

9. Which of the following are copper UTP based technologies?

a) 10BASE-T
b) 10BASE5
c) 10BASE2
d) 100BASE-FX

Question 2:

a) Answer True or False for the following statements.

1. In CSMA/CD LANs, the amount of time that it takes to detect a collision is never greater than the end-to-end propagation delay. **True / False**
2. When the bit length of the link is greater than the frame length, multiple frames can be in transit at one time. **True / False**
3. The Ethernet data frame preamble is used to synchronize the sender. **True / False**
4. After a collision an exponential back-off algorithm is used to determine when to retransmit. **True / False**
5. A Selective Repeat protocol receiver will ignore any **out-of-ordered** frame arrival, even if it's within the receive window. **True / False**
6. In Selective Repeat protocol ,the arrival of any **out-of-ordered** frame, yet within the receive window, will force the receiver to send NAK_i , where ***i*** being the lost frame sequence number, indicating the loss of such previous frame, and requesting the sender for its retransmission. **True / False**

b) Starting and Ending Flags with Bit Stuffing is used to deal with framing in Data Link Layer.

I. Briefly describe this framing Method. (3 Marks)

- Each Frame begins and ends with a special bit pattern 01111110 (Flag Byte). (1 Mark)
- Bit Stuffing:-Whenever the sender's data link layer encounters five consecutive 1s in the data, it automatically stuffs a 0 bit into the outgoing bit stream. (1Mark)
- When the receiver sees five consecutive incoming 1 bits, followed by a 0 bit, it automatically de-stuffs (i.e., deletes) the 0 bit. (1 Mark)

II. Assuming that framing at the data link layer is achieved by using starting and ending flags with bit stuffing. What is the original data bit-content if the data link frame *received* at the destination station is as shown below? (2 Marks)

0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	0	1	0	1	1	1	1

1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	0	1

c) What are the differences between the two types of Fiber media Multimode and Single-mode? (4 Marks)

Multimode	Single-mode
Large core 50 -62.5 µm	Small core- 8.3-10 µm
Light signals are refracted inside the cable (loss of signal energy)	Light propagates in straight lines- No refraction (no loss of signal energy)
Max. distance 2 Km (greater than copper but less than single-mode)	Suitable for long distance (3-10 Km)
Uses LED as a light source	Uses LASER as a light source
Often with LANs	Often(WANs-backbones)
Subscriber connector (SC)	Straight tip connector (ST)

d) In the Ethernet CSMA/CD protocol, how are retransmission attempts done after a collision is detected? (3 Marks)

1. It will abort transmission, (back-off algorithm is invoked).
2. It will send a jamming signal (32 bit) to inform the other stations when they want to transmit they must run the random timer before starting transmitting.
3. Each device sees the jamming signal, before starting transmitting invokes the back-off algorithm.

- Waiting for a random time interval (back off delay) before trying to send that frame again. = random number x time slot
- The random time is determined by the following algorithm:
- Random number between (0 to 2^i-1).
- Back off = random number (0 to 2^i-1) x time slot)
- If i= 10:don't increase the random no (0 to 2^{10}-1) x time slot.
- If i= 16: Give up after 16 collisions.
- Each device will have a random timer that determines when it can transmit.
- The waiting period is designed to be random so that two stations do not delay for the same amount of time before retransmitting, which would result in more collisions.

4. When the back-off timer expires, devices are free to transmit data again.

Question 3:

a) In fig. 3 frames are generated at node A and sent to node C through node B. Determine transmission rate required between nodes B and C based on the following: (5 Marks)

- The data rate between A and B is 100kbps.
- The propagation delay is 5 μs/Km for both lines (AB channel and BC channel).
- There are full duplex lines between the nodes.
- All data frames are 100 bits long and ACK frames are separate frames of negligible length.
- The average number of frames entering and leaving B must be the same over a long interval.

Fig. 3

b) A 48 KB file is to be transmitted from the source to the destination through the a network link of 10 Km as shown in Fig. 4. The stop-and-wait ARQ protocol is used for communication over each communication link. The size of headers and CRC together is 64 Bytes. The ACK size is also 64 Bytes. Given that it is required for the efficiency of the communication link to be at least 0.7675, calculate the time required to transfer the whole file from the source to the destination. (*5 Marks*)

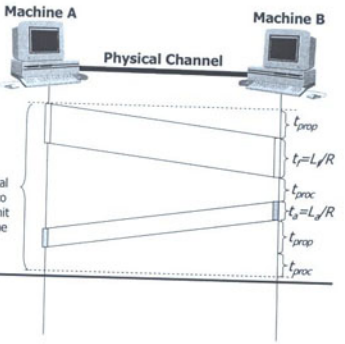
Notes:

--Assume processing time is negligible

--Speed of light is 3×10^8 meters/sec.

Fig. 4

t_{prop}	Propagation Time
t_{proc}	Processing Time
t_f	Frame Transmission Time
t_a	ACK Transmission Time
L_f	No. of Bits/Frame
L_a	No. of Bits/ACK



$$\eta_{\text{No Error}} = \frac{R_{eff}}{R} = \frac{L_f - L_h}{Rt_0} = \frac{1 - \frac{L_h}{L_f}}{1 + \frac{L_a}{L_f} + \frac{2R\left(t_{proc} + t_{prop}\right)}{L_f}}$$

$L_h = 64 \times 8 = 512$ bits

$L_a = 64 \times 8 = 512$ bits

$$t_{prop} = \frac{10000}{3 \times 10^8} = 3.33 \times 10^{-5} \text{ sec}$$

$$\eta = 0.7675 = \frac{L_f - L_h}{L_f + L_a + 2Rt_{prop}}$$

$$\Rightarrow 0.2325L_f = L_h + 0.7675L_a + 1.535Rt_{prop}$$

$$\Rightarrow L_f = 15996 \text{ bits}$$

$$\Rightarrow L_f \approx 2000 \text{ bytes}$$

Therefore the message will be composed of $48 \times 2^{10}/2000 = 24.576 \rightarrow 25$ packets

$t_o = 2Rt_{prop} + t + t_a$
t_f=0.291 ms
t_a=0.0093 ms
t_0=0.3669 ms

Total message delay = $25 * t_o = 25 * 0.3669 =$ 9.1725ms

Question 4:

An application on station **A** was activated to send a file of **6 frames** to station **B** on the same network "**Network 1**". **Go-back-2** protocol was used for flow control between station A and B. **Also, the same** application on station **C** was activated to send the same file of **6 frames** to station **D** on the same network "**Network 2**". **Stop-and-Wait** protocol

was used for flow control between station **C** and **D**. **As shown in Fig. 5. Given that the transmission rate is 1 Mbps, t_t = 10 *msec*, t_{prop}=20 *msec* for both networks. (33 Marks)**

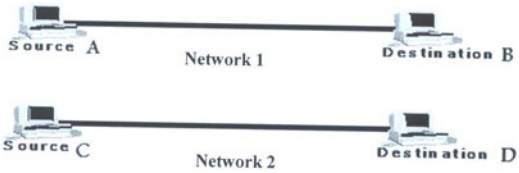


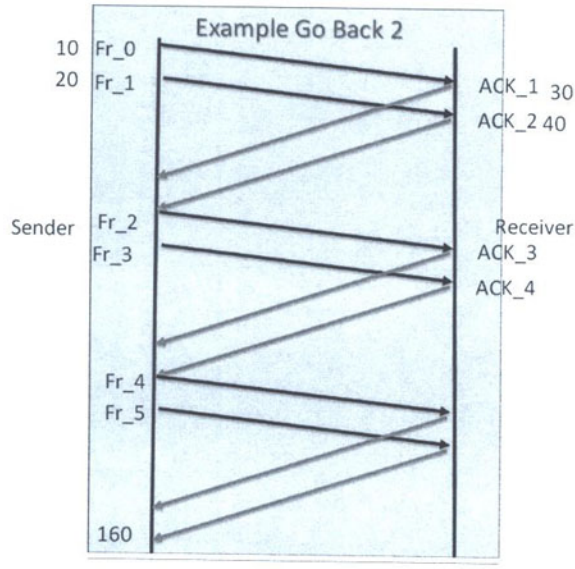
Fig. 5

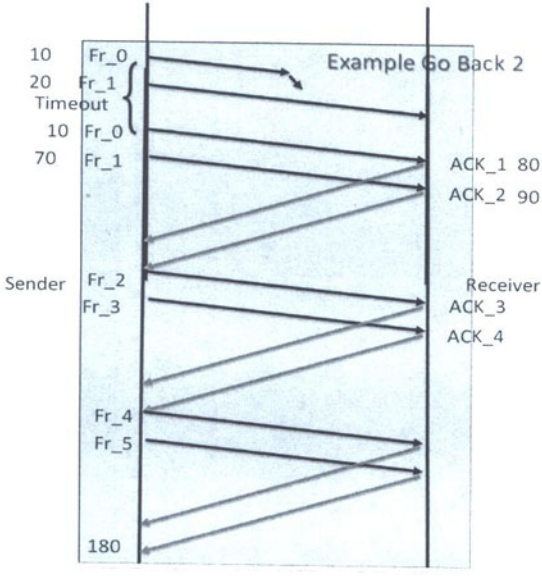
Compare between Networks 1 and 2 by:-

I. Plotting the time-line diagram for each network then find the total time required for each network to deliver all frames assuming error free channel. Comment on the final result. **(7 + 7 = 14 Marks)**
II. Plotting the sliding window within the 6 frames for each network. **(2+ 1= 3 Marks)**
III. Repeat part I and II if the first frame for each network is lost due to channel noise and time out = 50 *msec*. **(7 + 7 + 2 = 16 Marks)**

Network 1 :-

$W_s = 2$, $m = 6$


Example Go Back 2
10
Fr_0
20
Fr_1
ACK_1 30
ACK_2 40
Sender
Fr_2
Fr_3
Receiver
ACK_3
ACK_4
Fr_4
Fr_5
160


Example Go Back 2
10
Fr_0
20
Fr_1
Timeout
10
Fr_0
70
Fr_1
ACK_1 80
ACK_2 90
Sender
Fr_2
Fr_3
Receiver
ACK_3
ACK_4
Fr_4
Fr_5
180

Network 2