# Computer Engineering Department
# King Fahd University of Petroleum and Minerals

## COE 441: Local Area Networks

Major Exam # 1
Date: July 13, 2003

Time: 4:30-6:00PM

Instructor: Uthman Baroudi

Student Name:---------------
Student ID:------------------

|  | Max | Earned |
|---|---|---|
| Problem 1 | 150 | |
| Problem 2 | 40 | |
| Problem 3 | 40 | |
| Total | 230 | |

**Please Read These Notes:**

*Trust in Allah*
*Be a smart exam taker:*
*If you get stuck on one problem go on to another problem.*
*Don't waste your time giving irrelevant (or not requested) details.*
*Go over all questions and start with what you know first.*
***SHOW ALL YOUR WORK.***

# Problem #1 (100 marks)

**II.** (25 points; one point each) **Fill in blanks in the following sentences:**

1) The _____ is the device that determines the most efficient path to transmit messages in a network and then sends the data along that path. This device must accommodate a number of differences among networks, such as: a) _____, b) _____, c) _____, and d) _____.

2) Consider the bus/tree topology; signal balancing is a very critical design issue. A common solution is to _____ the medium into _____ segments within which pairwise balancing is possible, using _____ between segments.

3) Circuit switching is a method of communicating in which a _____ communications path is established between two devices through one or more intermediate _____ nodes. Unlike packet switching, digital data is sent a _____ stream of bits. _____ is guaranteed, and delay is essentially limited to _____.

4) The condition when two or more stations attempt to use the same channel at the same time is called _____.

5) There are several key distinctions between LANs and WANs: the LAN geographical scope is _____, the internal data rate of LAN is much _____ than those of WAN, and LAN usually is owned by _____ organization(s) that own(s) the attached devices.

6) Backend networks are used to interconnect large systems such as mainframes, supercomputers, and mass storage devices. Typical characteristics of such networks include the following: a) _____ b)_____, c) _____, d) _____ and e) _____.

7) In general, all of the MAC frames have the following fields: a) MAC control, b) _____, and c) _____ d) LLC data and e) _____.

**II.** (17 points) **True or False**

1) In RING topology, the frame is not transmitted in one shot. It is transferred serially bit by bit.

2) Each connected station to the RING is acting as a repeater.

3) A self-acknowledgment is a feature of the basic RING where the transmitted frame is removed from the RING by the transmitted station.

4) Response delay is fairly predicted in the RING topology.

5) The STAR topology is the dominant topology in today's LANs, because STAR topology is scalable, flexible and relatively inexpensive.

6) The cut-through technique used in a STAR LAN switch may cause high error rate and low delay.

7) Hub in the STAR provides a central point of failure.

8) In the packet switching technique, the flow of data is segmented into frames where an overhead must be appended to each frame. This extra 'overhead' means a part of the available bandwidth isn't used in transmitting the original intended data. This is considered as a wasting of bandwidth and it precludes the other benefits of packet switching.

9) The IP address is composed of two parts: Network and process addresses

10) Class A - supports 16 million hosts on each of 130 possible networks

11) Each process with a host must have a unique address within the host

12) Assignment of network numbers must be coordinated globally; assignment of host addresses can be managed locally

13) The logical link layer (LLC) can offers three services: connection-oriented, connectionless and multiplexing services

14) The TCP layer instruct the IP layer to deliver the TCP data segment to the destination host

15) TCP layer uses checksum for error detection

16) Each host want to access the INTERNET must have a unique global address

17) LLC sublayer is responsible for multiplexing and demultiplexing of frames

**III.** (12 points; 4 points each) Define the three main types of Asynchronous medium access control protocols and give one example of each.

**IV.** (6 points) Define what **Tiered Network** is and justify the need for such networks. Illustrate your answer with a graph.

**V.** (24 points) List and describe **SIX** different hardware devices used for internetworking. Be sure to indicate in which layer of the OSI model each device is used.

| Device Name | Layer in operation | Function |
|---|---|---|
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|  |  |  |
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**VI.** (10 points) Put the appropriate letter in the [ ] to show the type of network connection **necessary** for the use of a computer described.

**N** - No network needed.
**L** - LAN, local connectivity (office) needed.
**G** - Global connectivity over the Internet needed.

[   ] Printing on the office laser printer.
[   ] Gathering research information on the latest healthcare advances.
[   ] Composing a letter.
[   ] Downloading the most recent software patch for Windows 98.
[   ] Sharing a common data base with fellow office workers.
[   ] Using a software application to do your taxes.
[   ] Being able to exchange email with people all over the world.
[   ] Being able to share email with fellow office workers.
[   ] Using a shared electronic meeting and appointment calendar for the office.
[   ] Accessing the work in progress on standards of the IEEE, IETF, ATM Forum, ...

**VII.** (18 points; 6 points each) State the characteristics of the 3 LLC service types and state where each might be used.

| LLC service type | Characteristics | Application |
|---|---|---|
|  |  |  |
|  |  |  |
|  |  |  |

**VIII.** (12 points; 3 points each) Identify four wireline LAN topologies. Illustrate your answer with a graph.

# Problem # 2 (40 marks)

Assume a 100-Mbps link of 10000-meters in length with 5 nanoseconds per meter propagation delay. Assume also constant 400-byte data frames, negligible length ACK frames, and negligible processing delay at both the sender and receiver. The sender always has data to send.

    i)  Is stop-and-wait flow control a good choice for this network as a flow control scheme? To show why, or why not, solve for link utilization (U) between a sender and a receiver.

    ii)  How would the link utilization be affected if "sliding-window" flow control is used instead with a window size of 6? Motivate your answer.

# Problem # 3 (40 marks)

Consider two end systems (i.e. A & B) communicating with each other over a local area network. The call-setup phase is done and now the two systems enter the data-exchange phase. Assume the sliding-window flow control protocol is used with a window size of 5 packets. Show ***IN DETAIL (e.g. show the information and supervisory control information in each PDU)*** the interaction between the two systems for the following succession of events:

i)   A sends PDUs 0,1,2 and receives acknowledgment from B for 0 and 1
ii)  A sends PDUs 3,4 and receives acknowledgment for B for 4 and an instruction to A to stop transmitting
iii) B sends to A informing it that it can resume transmission.
iv)  A sends PDUs 5, 6, 7. Assume an error occurred in transmitting PDU 5 from system A. System A knew about it after it had already sent PDU 6. Show all interaction until the error is corrected.