Midterm 24:370 Name (print): _____

Feb. 25, 2003 Student Number: _____

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**Part 1 Ethernet Bits: (value 8 - 1 mark each)**

1. What does the term **full duplex** mean?

2. Is common bus based Ethernet full duplex? Why not :)

3. With the Ethernet protocol CSMA/CD, what is the role of Carrier Sense (CS)?

4. With the Ethernet protocol, what occurs when there is a positive Collision Detection (CD)? That is, if a transmitting station detects a collision, what happens?

5. Having sent a frame on a wired Ethernet LAN, how does the transmitting station know the frame was received?

6. For CSMA/CD when a collision is detected what do the stations involved in the collision do next as a means of contending for the medium?

7. If two stations detect a collision (for the first time with their respective frames), what is the probability the two stations will experience another collision (with the same frames)?

8. Two stations are 100 m apart, and one station starts transmitting a frame. Within what period of time will a collision be detected if one is to occur. Bonus: Why would a collision not be detected after that period.

**Part 2 Telephony and Modulation Bits (value 13 - 1 mark each, 4 for #6)**

1. Is a traditional telephone call packet switched or circuit switched? (circle one)

2. If the nominal bandwidth of voice is less than 4KHz, why is voice sampled at 8000 times/sec?

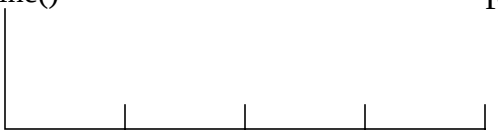
3. Voice is sampled with a resolution of 8 bits. What is the data rate for a telephone channel?

4. 24 voice channels are multiplexed onto a T1. What is the data rate of 24 voice channels?

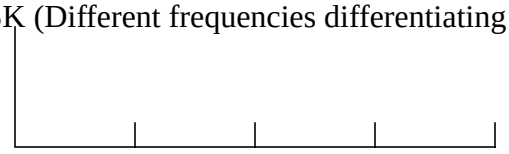
5. The raw data rate of a T1 is 1.544 Mbps. Why is this different than for 24 voice channels?

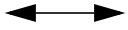
6. Draw a sinusoidal carrier with 2 cycles per data symbol period. Given a data stream 1 0 1 0, draw a ASK, FSK, and a PSK representation.

Sine()



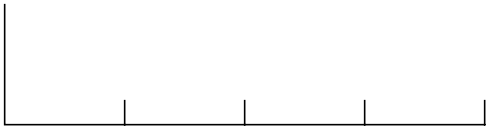
FSK (Different frequencies differentiating 1s and 0s)





Data Period

PSK(Different phases differentiating 1s and 0s)



ASK (Different amplitudes differentiating 1s and 0s)

7. The decibel system is typically used when measuring a signal in terms of power. If a transmitter on a cell phone has a requirement not to exceed 3dBm, what is the actual power that is not to be exceeded? Power in dBm is defined as $10\log_{10}$(Power in mW/ 1mW)

8. If the maximum power of the signal from the question above undergoes a 30 dB attenuation while propagating from the sender to the receiver, what is the actual power level at the receiver?

9. For a CDMA system, if a spreading code or chip sequence is 1010111000. What does a data bit of 1 followed by a data bit of zero look like?. What is the spreading gain, i.e. how much more bandwidth is required for the spread signal??

10. If a second CDMA channel was to be created for another user, would the spreading code 0101000111 be a good choice for the second user's code. Why or why not?

**Part 3 Acronyms and stuff: (value 6 - 1 mark each)**

What do the following terms or acronyms stand for and mean?

e.g. Question and answer: WDM: WDM stands for wavelength division multiplexing. WDM associates a channel with a given wavelength.

1. FDMA:

2. CDMA:

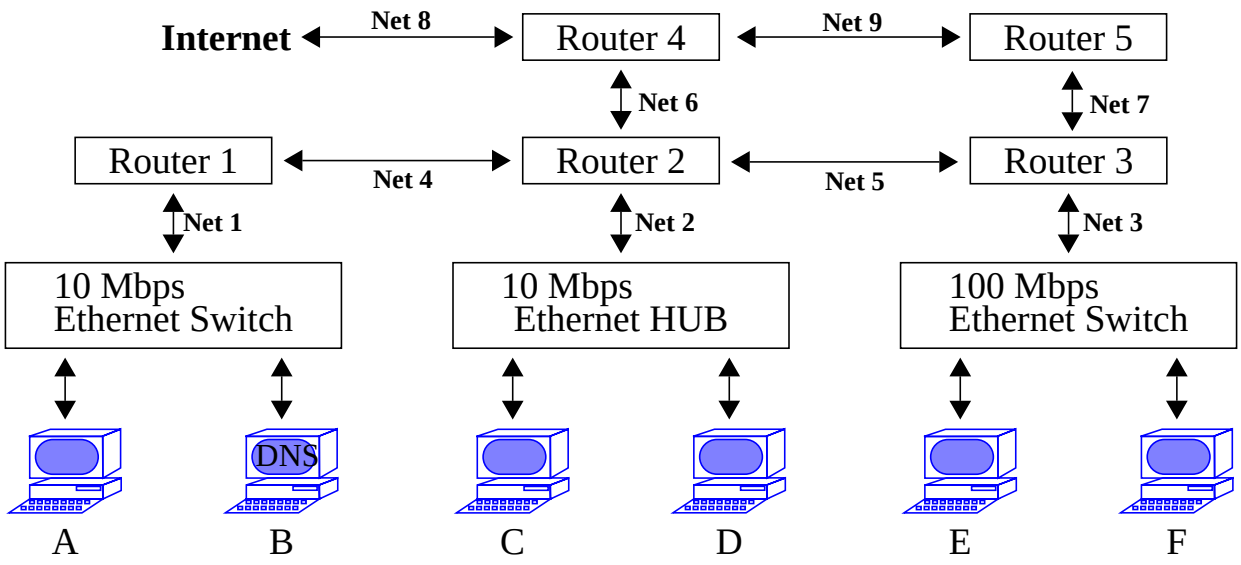
3. Baseband Signal:

4. CRC:

5. ARP:

6. DNS:

**This illustration is to be used with the questions in Part 4.**
**This page may be ripped out of the test, and does not need to be returned.**




| | | | |
|---|---|---|---|
| **A** | (a.deptx.company.com) | 129.1.10.1 | (MAC-A) |
| **B** | (b.deptx.company.com) | 129.1.10.2 | (MAC-B) |
| | - **DNS server for *.company.com**) | | |
| **C** | (c.depty.company.com) | 129.1.20.1 | (MAC-C) |
| **D** | (d.depty.company.com) | 129.1.20.2 | (MAC-D) |
| **E** | (e.deptz.company.com) | 129.1.30.1 | (MAC-E) |
| **F** | (f.deptz.company.com) | 129.1.30.2 | (MAC-F) |
| **R1** (router 1) | | | |
| | r1.deptx.company.com | 129.1.10.3 | (MAC-R1) |
| | r1.net1-2.company.com | 129.1.40.3 | (MAC-R1net4) |
| **R2** (router 2) | | | |
| | r2.depty.company.com | 129.1.20.4 | (MAC-R2) |
| | r2.net1-2.company.com | 129.1.40.4 | (MAC-R2net4) |
| | r2.net2-3.company.com | 129.1.50.4 | |
| | r2.net2-4.company.com | 129.1.60.4 | |
| **R3** (router 3) | | | |
| | r3.deptz.company.com | 129.1.30.5 | (MAC-R3) |
| | r3.net2-3.company.com | 129.1.50.5 | |
| | r3.net3-5.company.com | 129.1.70.5 | |
| **R4** (router 4) | | | |
| | r4.net2-4.company.com | 129.1.60.6 | (MAC-R4) |
| | r4.net4-5.company.com | 129.1.80.6 | |
| | r4.net-ext.company.com | 129.1.90.6 | |
| **R5** (router 3) | | | |
| | r5.net3-5.compnay.com | 129.1.70.7 | (MAC-R5) |
| | r5.net4-5.company.com | 129.1.80.7 | |

**Part 4 IP: (value 17 - { 6,  1, 10})**

1. An IP packet is transmitted from host **A** to host **D**. Fill in the following table with the packet's source and destination IP and MAC addresses for each network leg that the packet takes.

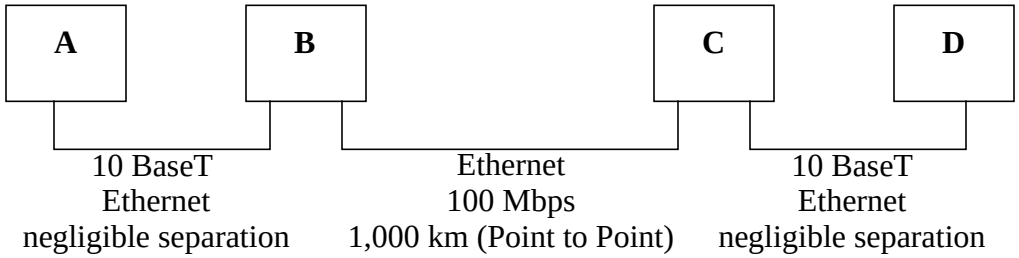
| Network Leg | | Source | Destination |
|---|---|---|---|
| First Leg | IP address | | |
| | MAC address | | |
| Second Leg | IP address | | |
| | MAC address | | |
| Third Leg | IP address | | |
| | MAC address | | |

2. What is most likely the network part of the IP address for **company.com**?

3. Assuming that all host ARP tables are initially empty, the routing tables are stable and the ARP tables between routers are up to date, and the DNS server can resolve any request: Show the sequence of packets that will occur for **A** to send a single packet to d.depty.company.com.

**Part 5 LANs: (value 8 - 2 marks each)**

1. Given the following network configuration:




Host **A** wants to send 14,800 bytes of IP data to host **D**. In addition to the data, the IP header is 20 bytes and the Ethernet header is 26 bytes. The maximum payload of an Ethernet frame is 1500 bytes. Note: The hosts are smart enough not to fragment IP packets.

a) What is the minimum number of Ethernet frames possible, and what is the percentage of overhead transmitted?

b) What is the number of Ethernet frames that would be required if the Ethernet payload size were 168Bytes, and what is the percentage of overhead transmitted in that case?

c) In the best case scenario, and assuming the transmission gets 25% of the available bandwidth on the first LAN (and as much as it needs over the remaining links), how long would the transfer take?

d) Given a bit error probability of $10^{-7}$, what is the probability that the data would arrive arrived error free.

**Part 6 General: (value 12 - 1 mark each)**

1. Is there any need for a network layer (OSI layer 3 or IP in TCP/IP) in a broadcast network?

2. Suppose a user has two browser applications active at the same time and suppose that the two applications are accessing the same server to retrieve HTTP documents at the same time. How does the server tell the difference between the two applications?

3. What is the difference between a physical address, a network address, and a domain name?

4. Suppose a computer is moved from one IP network to another. Does the physical address change? Does the IP address need to change?

5. A 10 KHz baseband channel is used by a digital transmission system. Ideal pulses are sent at the Nyquist rate, and the pulses can take 16 levels. What is the bit rate of the system?

6. What is the maximum capacity of a 3 KHz telephone channel with a SNR of 30dB?

7. A telephone modem is used to connect a personal computer to a host computer. The speed of the modem is 56 Kbps and the one-way propagation delay is 100 ms. Find the efficiency of the stop-and-wait flow control protocol if the frame size is 256 bytes. Also, find the efficiency of a sliding window flow control protocol if 3-bit sequence numbering is used.

8. What is the difference between an infrastructure wireless LAN and an ad hoc wireless LAN?

9. In a broadcast LAN, which MAC protocol has a higher efficiency: ALOHA or CSMA-CD? ALOHA is the “protocol” where if a station wants to talk it does, whether another station is talking or not, much like a typical lecture :)

10. What is DHCP and what is the role of DHCP?

11. What is the MAC address?

12. How many bytes in an Ethernet MAC address?

Equations of potential use:

Nyquist $C = 2B\log_2(m)$

Shannon $C = B\log_2(1+SNR)$

SNR in dB = $10 \log_{10}$(signal power / noise power)

$U = T_{frame} / (T_{frame} + 2T_{prop})$ Stop and Wait

$U = WT_{frame} / (T_{frame} + 2T_{prop})$, if $WT_{frame} < (T_{frame} + 2T_{prop})$ Window