Midterm 24:370 Name (print): _____

March 2, 2004 Student Number: _____

Part 1 Ethernet Bits: (value 5 - 1 mark each)

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

2. In wireless 802.11, how does a station know that a message is received?

3. Is bus based Ethernet full duplex? Is wireless 802.11 full duplex?

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 an Ethernet LAN, how does the transmitting station know the frame was received?

Part 2 Telephony and Modulation Bits (value 5 - 1 mark each)

6. Is a call set up phase required when making a traditional telephone call?

7. Is a traditional telephone network packet switched?

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

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

10. 24 voice channels are multiplexed onto a T1. What is the data rate of 24 voice channels?

Part 3 Code Division Multiplexing (value 6 - 2 marks each)

Table 1:

User	Code
1	1 0 1 0 1 0 1 0
2	1 1 0 0 1 1 0 0

11. Are these codes correlated, that is, what is the dot product of these codes, assuming a value of -1 for a logical zero and 1 for a logical 1? (Dot product is a component-wise multiply followed by adding the terms)

If you are User 2 and you received the following signal,

```
0 -2 2 0 0 -2 2 0
```

12. What is your estimate of the data bit transmitted? That is multiply your code with the received signal, integrate the result and decide if the original bit was a 1 or 0. Use (+1,-1 values for the code binary values).

If you are User 2 and you received the following signal (corrupted by noise).

```
0 -2 2 2 2 -2 2 0
```

13. What is your estimate of the data bit transmitted?

Part 4 Acronyms and stuff: (value 5 - 1 mark each)

For questions 14 to 18:
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.

14. FDMA:

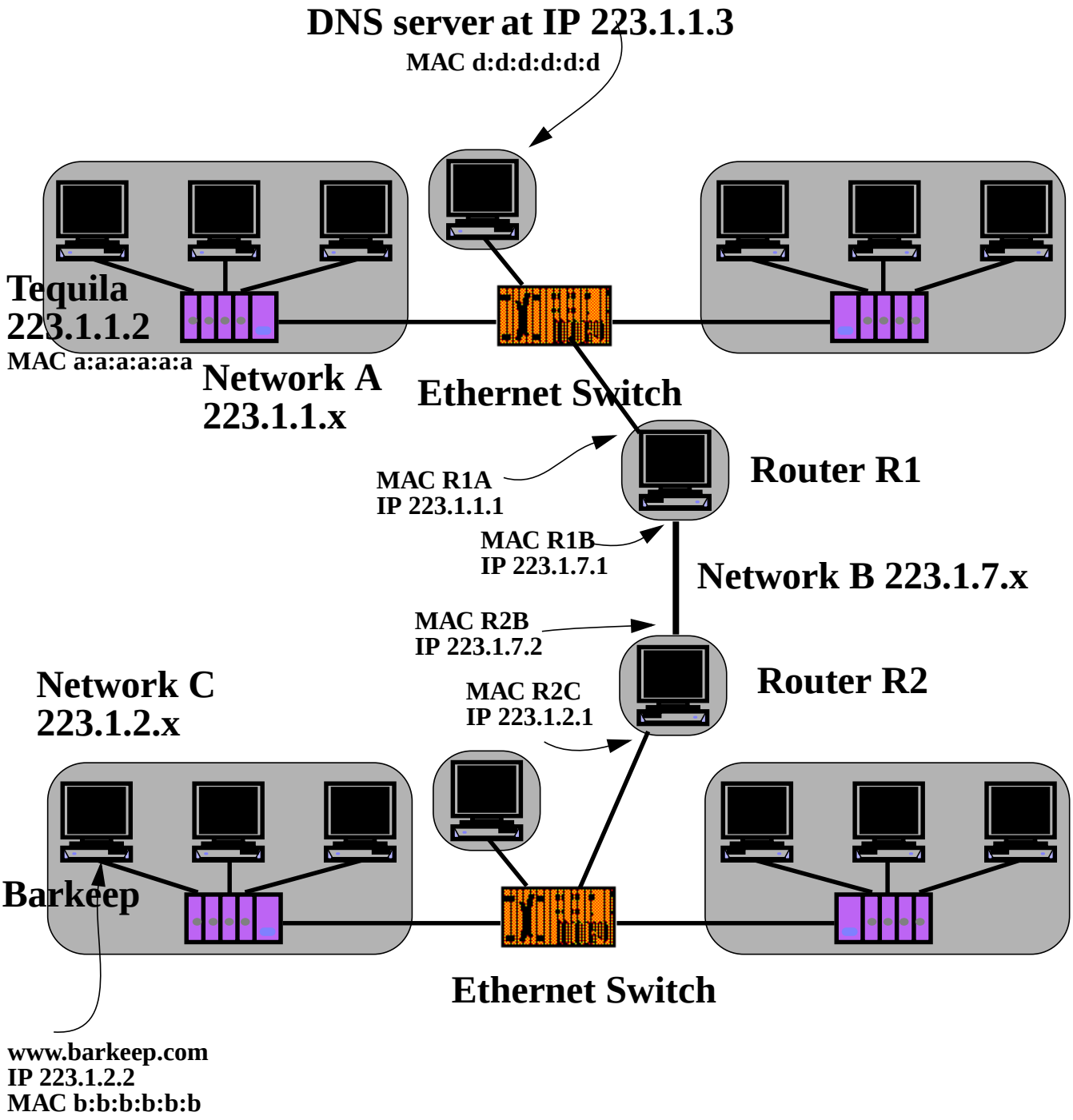
15. CRC:

16. ARP:

17. DNS:

18. DHCP:

This illustration is to be used with the questions in Part 5.
This page may be ripped out of the test, and does not need to be returned.



Part 5 IP: (value 18 - {3, 3, 1, 1, 10})

19. Fill in the routing table in Router 1.

Table 2: Routing Table for Router 1

Network Entry	Next Router	Number of Hops	Output Port MAC
Network A:			
Network B:			
Network C:			

20. An IP packet is transmitted from host Tequila to host Barkeep. Fill in the following table with the IP packet's source and destination IP and encapsulating ethernet frame's MAC addresses for each network leg that the packet takes.

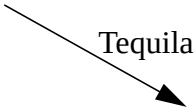
Network Leg		Source	Destination
First Leg	IP address		
	MAC address		
Second Leg	IP address		
	MAC address		
Third Leg	IP address		
	MAC address		

21. What is the network part of the IP address for **Network A**? What does the network address mask look like?

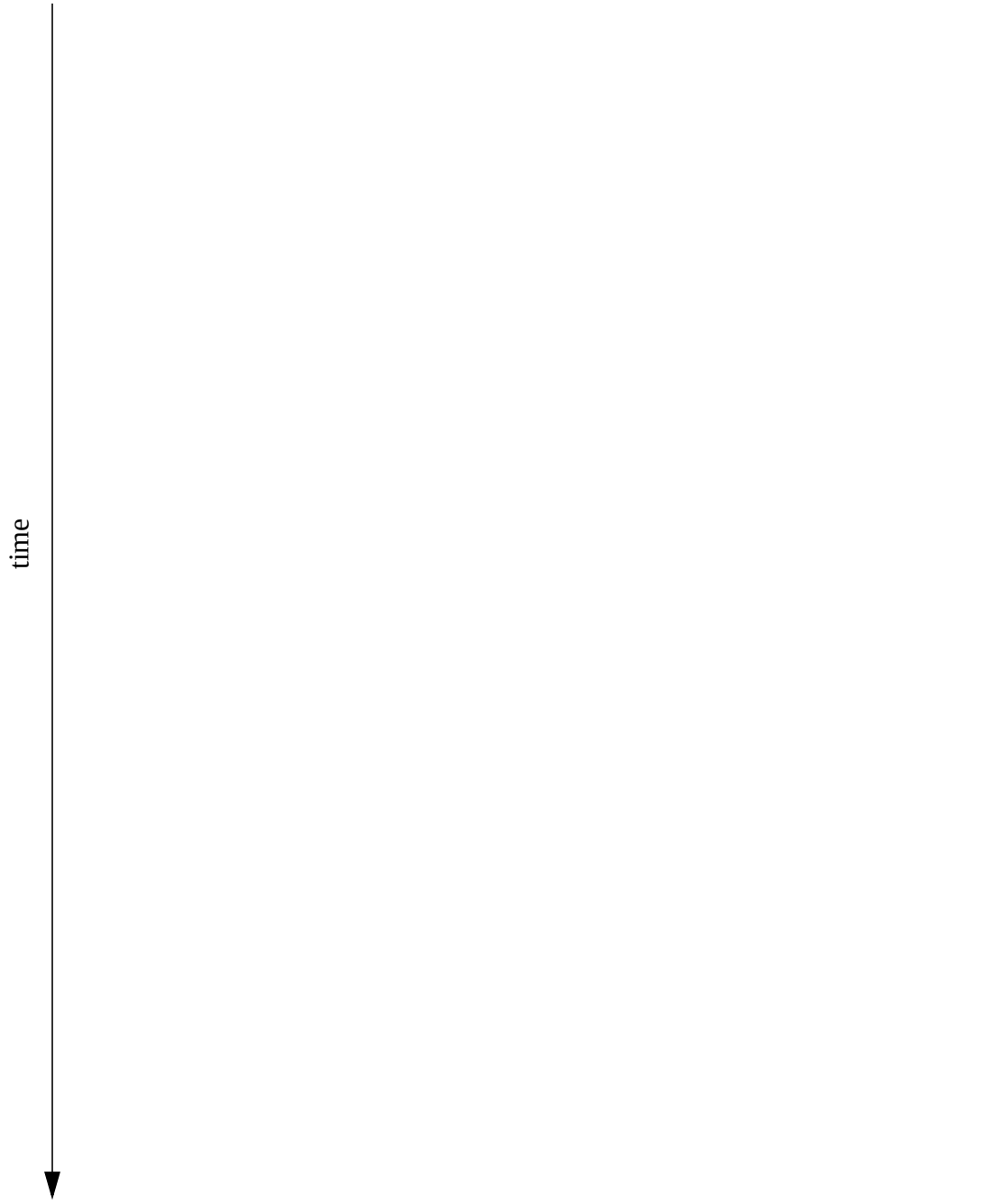
22. If **tequila** wants to send a packet to IP 223.1.2.3, how does it know it is to route it to R1.

23. Assuming that all ARP tables are initially empty, the routing tables are stable, and the DNS server can resolve any request, the IP address of the DNS server is known. Show the sequence of packets that will occur for **Tequila** to send a single packet to **www.barkeep.com.** Provide sufficiently detail comments with each transaction.

e.g. Tequila DNSserver

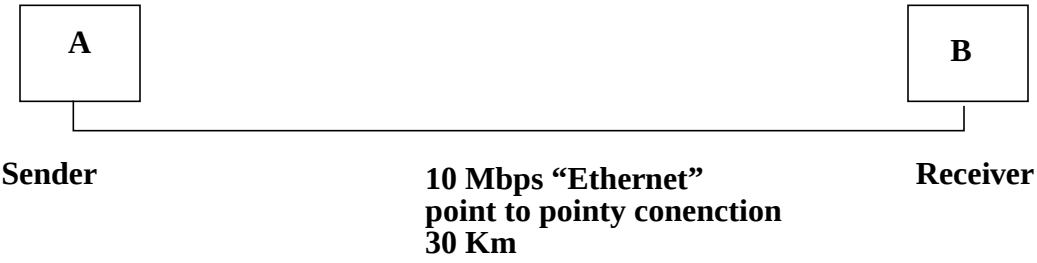


Tequila Arps for MAC address of the DNSserver



Part 6 General Packet Question :(value 15 - {1,2,3,4,5})

Given the following network.



The sender wants to send a 150,000 Byte file to the receiver. The protocol will be stop and wait. Assume if the ack was not received when expected the packet is lost and immediately retransmitted.

24. What is a "stop and wait protocol?

Given: The sender will break the file into 1500 Byte DATA packets. While the receiver will reply with 100 Byte ACK packets. Strong CRC codes are used to check the data and acks.

25. What is the transmission time for the DATA packet? What is the propagation time assuming the velocity of the electromagnetic signal is $c=3x10^8$ m/sec? What is the total time to send the entire packet reliably (i.e. with knowledge that it was received).

Assume now that the channel has a BER (Bit Error Rate) of $1*10^{-5}$.

26. What is the equation for the packet error rate and what is the packet error rates for the DATA and ACK packets?

Given the BER of $1*10^{-5}$.

27. What is the expected time required to transfer the file? The expected value of a distribution of a number of trials before success is E[#trials]=1/(prob. of success).

28. Given a BER of $1*10^{-5}$. What is the optimal packet size for minimum transmission time of the file?

You can do this one of two ways either derive an equation for the transfer time of a file of 150,000 Bytes given that the number of packets required to be transfered is a function of the packet size, times the expected number of trials before a successful packet transfer occurs which in turn is a function of the packet size, times the time it takes to send and receive a packet which is also a function of the packet size. Differentiate this equation with respect to packect size, set the derivative equal to zero and solve. **Or** plot the time required to transfer the file from the equation for file transfer in the presence of bit errors, for packet sizes of 500, 1000, 2000, and 10,000 Bytes and estimate an optimal packet size. You may ignore ACK packet errors.