# EE122 Spring 2001 Final

## 1: True or False [20%]

1. Light in a fiber travels faster than signals in copper.

2. Block coding can achieve a higher compression than Huffman codes.

3. Layer 2 switching cannot be used for a large network because CSMA/CD is inefficient.

4. IP routers implement Go Back N to retransmit erroneous or missing packets.

5. DHCP improves the utilization of the IP address space.

6. In public key cryptography, the encryption and decryption are numerically simpler than in private key cryptography.

7. In the Internet, routers do not modify the IP source address and the IP destination address (unless they implement a tunnel).

8. DVMRP routers multicast packet along the shortest tree from the source to the destinations.

9. ADSL transports IP packets as ATM frames from the DSL modem to the IP router.

10. RED attempts to improve TCP by reducing the synchronization of connections.

## 2: Multiple Choice [20%]

1. [2%] The capacity of a telephone line with a bandwidth of 1MHz is

    a. 0.5 Mbps
    b. 2 Mbps
    c. 1 Mbps
    d. an increasing function of the SNR.

2. [3%] The transmission control protocol TCP performs the following tasks:

    a. Flow control
    b. Congestion control
    c. Error control
    d. Routing optimization
    e. ARP
    f. DNS lookup

3. [2%] Packets with an average length of 1000 bits arrive at an average rate of 800 packets per second at a queue served by a 1-Mbps link. The M/M/1 model predicts an average delay per packet through the queue equal to

   a. 10 ms
   b. 1 ms
   c. 5 ms
   d. 8 ms
   e. None of the above

4. [3%] Consider two queues served in the proportions 20% and 80% (respectively) using deficit round robin by a 10-Mbps link. Assume that the arrival rates at the two queues are 6Mbps and 18Mbps, respectively. The average service rates of the two queues are as follows:

   a. 2Mbps and 8Mbps
   b. 2.5Mbps and 7.5Mbps
   c. 5Mbps and 5Mbps
   d. None of the above.

5. [2%] The address resolution protocol performs the following task(s):

   a. Translate Name into IP address
   b. Translate MAC address into IP address
   c. Translate IP address into Name
   d. Translate IP address into MAC address
   e. Look up the port that corresponds to a given destination address

6. [2%] When using CIDR, the router performs the next-hop lookup using

   a. OSPF
   b. BGP
   c. A longest matching prefix search
   d. Huffman coding algorithm

7. [2%] In an Ethernet with a hub,

   a. the nodes share a collision domain
   b. collisions are avoided by a reservation protocol
   c. collisions are avoided by a learning algorithm
   d. collisions are resolved by delayed retransmissions
   e. the hub prevents collisions by granting slots

8. [2%] When Alice sends a message to Bob, a possible digital signature scheme is as follows:

   a. Using public key cryptography, Alice can encrypt using her decryption rule
   b. Using public key cryptography, Alice can encrypt using Bob's encryption rule
   c. Using public key cryptography, Alice can encrypt using bob's decryption rule
   d. Using public key cryptography, Alice can encrypt using her encryption rule

9. [2%] The objective of the additive-increase, multiplicative-decrease algorithm of TCP is to

     a. Make sure that every packet is received exactly once
     b. Share the network links fairly among the TCP connections
     c. Avoiding packet losses in routers
     d. Avoiding packet losses in the host

---

## 3. Problem [20%]

Consider the network below
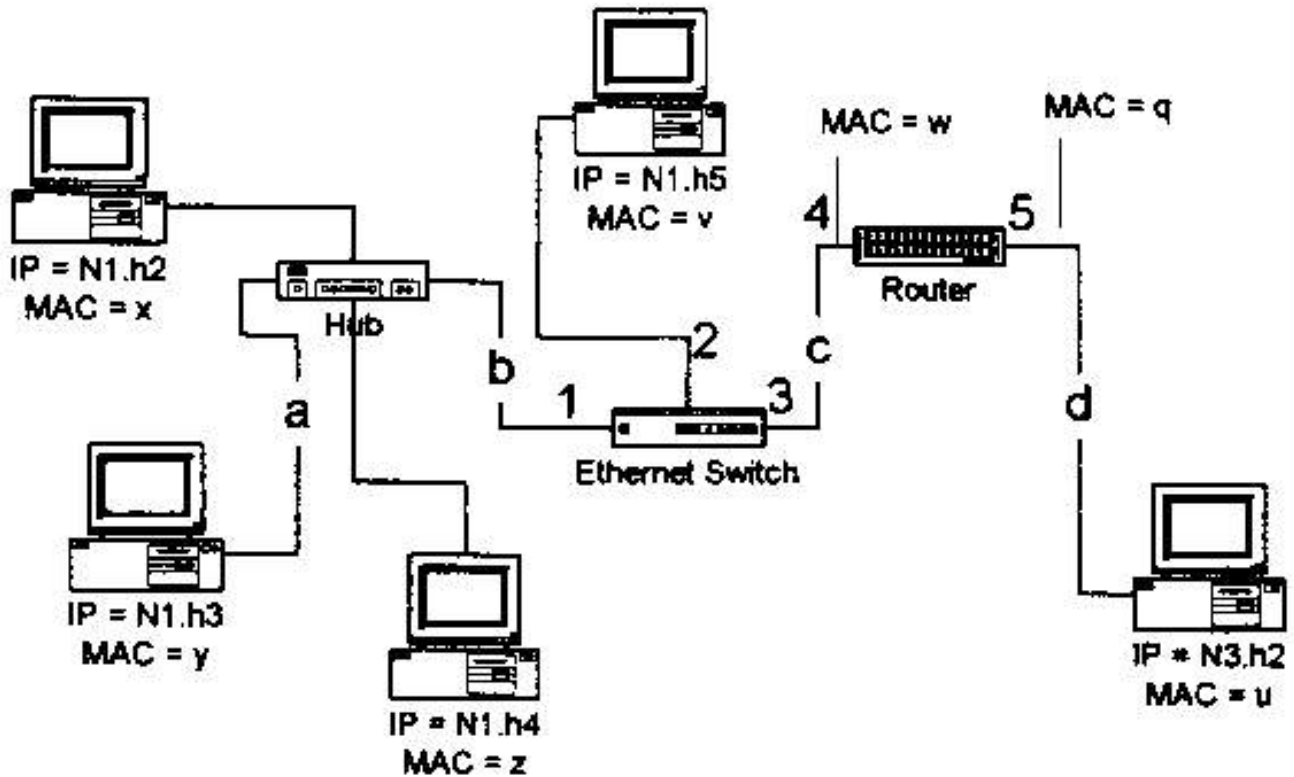


a. [3%] Fill in the following table:

| Port Number | Learned Addresses for that Port |
|:---:|:---:|
| 1 | |
| 2 | |
| | |

| 3 | |
|---|---|

b. [2%] Specify the routing table of the router.

c. [5%] consider a packet that goes from N1.h3 to N3.h2. Indicate the headers [EDA|ESA|IPSA|IPDA] of the packet on the four links a, b, c, d:

| Link | [EDA\|ESA\|IPSA\|IPDA] |
|---|---|
| a | |
| b | |
| c | |
| d | |

d. [10%] Assume that all the links are 10Mbps and are full-duplex at the switch. Assume also that each node wants to send R Mbps to every other node. Thus, N1.h2 wants to send R Mbps to N1.h3, and R Mbps to N1.h4, and R Mbps to N1.h5, and R Mbps to N3.h2. Similarly, N1.h3 wants to send R Mbps to each of N1.h2, N1.h4, N1.h5, and N3. h2, and similarly for all the nodes. Assuem that the shared Ethernet (with the hub) is 60% efficient and that the switched Ethernet is 100% efficient. Find the maximum possible value of R. (Show your work.)

---

## 4. Problem [15%]

In the network below, all the links are bi-directional 10-Mbps links. The circles represent MPLS routers and the squares are hosts. We use MPLS to set up a normal and backup paths between pairs of hosts. The objective of these paths is to enable every pair of hosts to exchange information at R Mbps, even in the event of a single failure of a link between the MPLS routers. Describe a choice of normal and backup paths that corespond to the largest possible value of R and determine that value. Show your work.



---
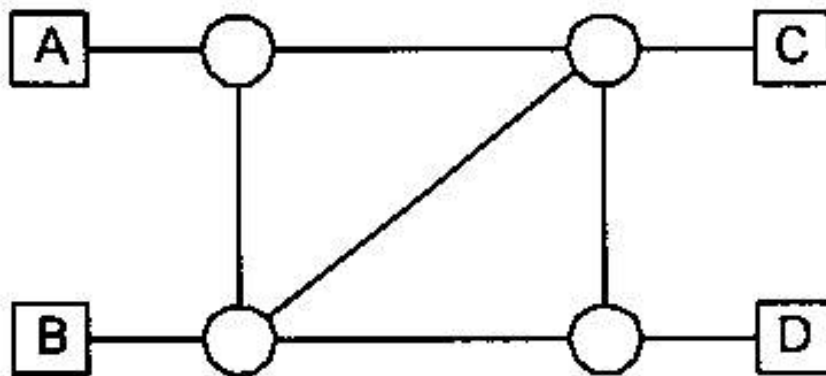
# 5. Problem [15%]

Consider a connection from host A to host B that goes through a single router R. The link from B to A is lossless and infinitely fast and has a propagation time of 50ms. the link from R to B is lossless, infinitely fast, and has zero propagation time. the link from A to R transmits at 1Gbps, is lossless, and has a propagation time of 50ms. The packets all are 1000-bits long. The connection uses Go Back N with a window of a fixed size equal to N . Determine the average rate of packet transmissions from A to B as a function of N. Give the values of that average rate for N=1, N=10, and N=1000. show your work. [Hint: Draw a timing diagram.]

---

# 6. Problem [10%]

The optical network below uses burst switching. Assume that the switching time of the optical switch is 1ms. The system operates by connecting the switch to a queue 1 for S seconds, then switching it over to queue 2 for S seconds, and so on. While a queue is not attached to the outgoing link, it stores the incoming bits. Assume that the two links a and b have constant bit rate streams of R Mbps each. Find the maximum value of R as a function of the maximum latency T through the system (ignoring propagation times and processing times). Show your work.