spring 02

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Thanks

University of Southern California
EE450: Introduction to Computer Networks
Final Exam, Two Hours
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Part 1	10%	8
Part 2	20%	19
Part 3	20%	20
Part 4	20%	15
Part 5	15%	15
Part 6	15%	12
Total	100%	

89

Notes:

- All your answers should be on the exam paper. If you need additional paper, please write your name, ID and location in each extra sheet
- You can work the problems in any order you wish (the goal is to try to accumulate as many points as you can)
- Try your best to be clean, and to show all the steps of your work

Rules:

- This is a closed book, closed notes exam. One 5"x7" containing formulas only and another 5"x7" containing the TCP/IP header structures are allowed along with a calculator

- Adherence to the University's **Code of Ethics** will be strictly monitored and enforced. Academic Integrity violations, such as cheating, will result in a series of actions and penalties including the student failing the class.

Part 1: Multiple Choice Question (10 points)

1. The Protocol that is used to when a browser requests a webpage from a webserver is

a) HTML
b) HTTP
c) TCP
d) Microsoft Explorer
e) Netscape Navigator

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2. With token rings,

a) only the node holding the token can transmit a message
b) only the node holding the token can receive a message
c) any node can transmit so long as the medium is not used
d) collisions may occur if the traffic is heavy
e) a and b only

3. A host with a domain name "zahid.rcf.usc.edu" is on which level of the DNS hierarchical tree (The root is level one)

a) Second
b) Third
c) Fourth
d) Fifth
e) Not enough information

root / edu

4. Which of the following best describes the difference between bridges and routers?

a) Bridges can segment network traffic but routers can't
b) Routers can choose between multiple paths but bridges can't
c) Bridges can only be installed on an ETHERNET network whereas routers can be installed on any type of network
d) Routers can link networks using different physical media but bridges can't

5. Which of the following is not a function of the IP Protocol

a) Addressing
b) Assuring end-to-end Packet delivery ? not IP protocol 的 function
c) Segmentation of messages into Packets
d) All of the above are functions of the IP Protocol
e) None of the above are functions of the IP Protocol

6. **An Acknowledgement number of 1000 in a TCP segment means:**

a) 999 bytes have been successfully received
b) 1000 bytes have been successfully received
c) Segment # 999 have been successfully received
d) Segment # 1000 have been successfully received
e) None of the above

7. **Which address uniquely specify the connection between a client process and a server process?**

a) MAC Address
b) IP Address
c) Port Address
d) Host Address
e) Socket Address

8. **Which of the following does UDP guarantee?**

a) Non-duplicated data delivery to the application layer
b) In-order data delivery to the application layer
c) Error-free data delivery to the application layer
d) a and b only
e) None of the above

9. **A static IP address is assigned to your workstation. A second work station is assigned the same IP address. What would happen as far as communication with these two workstations?**

a) The second workstation will take over communications when it boots.
b) The first workstation to boot and log-in will communicate
c) Both stations are OK
d) Neither workstation will be able to communicate on the network.

10. **The network topology describes :**

a) How a workstation gains access to the medium
b) The transmission medium speed
c) The model used to layout the medium and node connections
d) The distance covered by a LAN
e) All of the above

Part 2: True/False Question (20 Points)

F 1. The lowest protocol within the TCP/IP suite is the MAC/DLC layer which specifies ~~the~~ format of the frame ~~.~~

F 2. The sequence number in the header of the TCP segment identifies the sequence number of the segment being transmitted

T 3. Connection-oriented, reliable message transfer can be provided over an un-reliable, connection-less packet switch network

T 4. TCP uses checksum, acknowledgements and time-out mechanisms for end-to-end error detection and control checksum, ACK, time-out → TCP layer

F 5. Route calculation is a function of the IP where as error control isn't ?

F 6. address resolution protocol ARP is a protocol that provides a mechanism for a host to learn the MAC address of any other host across the Internet when knowing only the IP address of that other host

F 7. To send an http request to a webserver, a browser must know the webserver's name address

F 8. Flow control seeks to prevent sender from overburdening the network and thus from causing the router's buffers to overflow

F 9. In ~~recursive~~ iterative DNS services, the local DNS service will return, to the DNS client, the IP address of a DNS server that will probably have the IP address of a host whose name address was specified in the DNS query.

F 10. Switched hubs have ~~multiple~~ one broadcast domains where as shared hubs have single broadcast domain

F 11. TCP has the property of slow start to avoid congestion in the network

T 12. All subnets on a network must have the same network address

T 13. The MTU is the maximum number of octets that the ~~IP~~ Data Link Layer protocol can encapsulate

T 14. All internet protocols, including IP, TCP and UDP discard packets with checksum errors

F 15. The maximum window size in TCP is limited by ~~the round trip time~~ RTT of the connection TCP segment format

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F (16) A Host can get its IP address dynamically from its DHCP server by using 255.255.255.255 as a source IP address and 0.0.0.0 as the destination IP address.

T (17) A TCP/IP port number is a logical connection place by client programs to specify a particular server program running on a computer on the network. It is defined at the transport layer

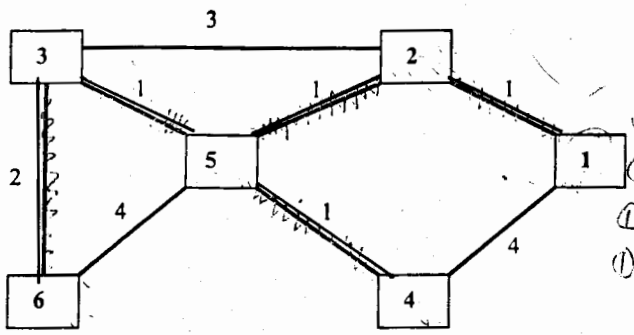
T 18. In link state routing, every router has exactly the same link state database but the routing tables are different in each router

F 19. In distance vector routing, each router receives routing tables from ~~every router~~ in the network

F (20) IP fragmentation is always performed by routers

Part 3 (20 points)

a) For the network shown below, Use Dijkstra routing algorithm to find the shortest path tree (SPT) from source node "1" to all other nodes. Show your solution step-by-step. I am not interested in final answer only.

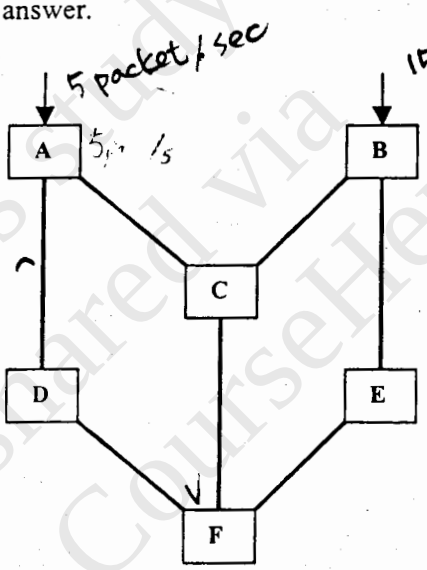


SPT | D(2) P(2) | D(5) P(5) | D(4) P(4) | D(6) P(6)

b) Consider the network shown below. The purpose of this problem is to illustrate how routing decisions effect congestion in the network. Assume the capacity of each link is 10 packets/sec. Traffic is generated at node A at a rate of 5 packets/sec and at node B at a rate of 15 packets/sec. Both traffic are destined to node F. Illustrate the routing decisions at nodes A and B that will result in

- **Congestion in the network** (i.e. bad routing decision)
- No congestion in the network (i.e. good routing decision)

Comment on your answer.



• Congestion will happen when A forward packets to nodes C. The congestion will happen in node C. B have to use node C
→ Bad routing decision

• No congestion will happen when node A only forward to node D and B forward 10 packet/sec to node C, C forward 5 packet/sec to E
→ good routing decision

Part 4 (10 points for part1, 10 points for part 2)

1) Suppose we have two nodes "A" and "B" that are attached at the opposite ends of a 900 meters cable. Assume they both a 1000-bits frame (including headers, trailers) to send to each other. Both nodes attempt to transmit at t = 0. Assume that there are four repeaters separating the two nodes, each introducing a 20-bit delay. Assume the transmission rate is 10 Mbps and that CSMA/CD is used. After the first collision, node "A" will retransmit immediately after it senses the medium is idle. Station "B" will retransmit 51.2 μseconds after it senses the medium is idle.

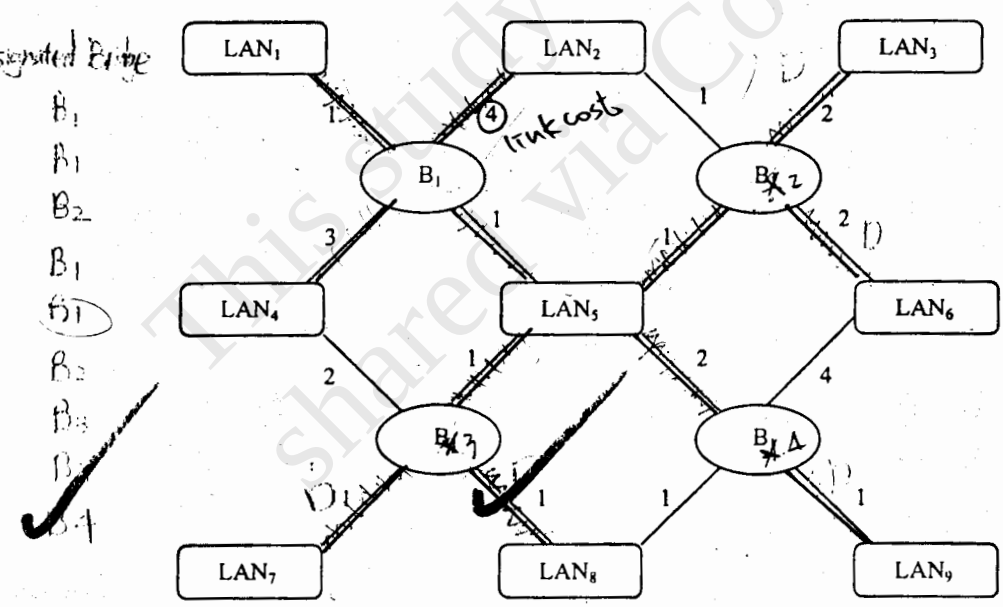
a) What is the one-way propagation delay (including repeaters delay) between "A" and "B"? Assume that the speed of propagation is 2×10^8 m/sec

b) At what time will node "A" start retransmission? At what time will the frame from "A" be completely delivered to "B"? Will there be a collision the second time?

c) What is the effective throughput?

d) Now suppose that ONLY "A" has a frame to transmit (i.e. there is no collision) and that the repeaters are replaced by bridges. Suppose each bridge introduces 20-bit delay of processing, store & forward, etc... At what time will the frame from "A" be completely delivered to "B"? What is the throughput in this case?

2. Apply the spanning tree algorithm to the network shown below. Assume that B_1 is the root-bridge. Draw the resulting spanning tree. The label of each link is the link cost. Indicate clearly the designated bridges. (10-points)



LAN	Designated Bridge
1	B1
2	B1
3	B2
4	B1
5	B1
6	B2
7	B3
8	B3
9	B4

Part 5 (10 points for part 1, 5 points for part 2)

1. Assume that you are using TCP over a 100Mbps link with an RTT of 100ms to transfer 1MByte file. The receiver's advertised window size is 64KBytes. Assume that the TCP connection is already set-up. Assume that the maximum segment size is 1KByte. Assume there is no congestion and no packet losses. The TCP client starts slowly sending one segment at t = 0.

a) What is the sender's maximum window size?

b) How many RTTs does it take to open the sender's window size to its maximum?

c) How many RTTs does it take to send the 1MByte file?

d) What is the effective throughput of the transfer?

e) What is the link utilization (in %)

2. Illustrate, using a detailed timing diagram, TCP's connection setup procedure. Assume the client chooses its initial sequence number "x" and the server chooses its initial sequence number as "y"

1. (a) ... no congestion & no packet ... receiver's advertised window size ...

1. (b) Starts slowly at ... with W_c = 1 KBytes. Assume receiver send ACK ... after 1 RTT, get ACK ... W_c = 2 K Bytes. (2 segments)
after another 2 RTT, get ACK ... W_c = 4 K Bytes. (4 segments)
⇒ " 3 RTT, 5 (8 segments)
" 4 RTT, 16 (16 segments)
5 RTT, 32 (32 segments)
6 RTT, 64 (64 segments)
⇒ after 6 RTT ...

(c) ⇒ ... 1000 K Bytes file.

$\frac{(1000-64-32-16-8-4-2-1)}{64} = 13.64$ ⇒ 14 + 6 = 20 RTT

after 20 RTT 1 Mbyte ...

(d) throughput $\frac{0.1 \times 10^6}{20 \times 100 \text{ ms}} = 4$ Mbps

(e) $\eta = \frac{4M}{100} = 4\%$

close enough

Part 6 (15 points, 5 each)

(a) An organization is granted a class B network address 130.221.0.0. The administration wants to create 30 subnets. Find an appropriate subnet mask. Find the range of subnet addresses. How many hosts could there be on each subnet? What is the subnet address on which a host whose IP address is 130.221.203.10 is located? What is the range of host addresses on that particular subnet? Assume the all 0's and the all 1's pattern ***can't*** be used for the subnet fields or for the host fields.

(b) You are the manager of a network consisting of 5 subnets. A user on subnet 4 complains that he can connect to local servers (on the same subnet) but he can not connect to a server on subnet 1. Other users on subnet 4 have no problem connecting to the server on subnet 1. You perform IPCONFIG on that machine and you get the following:

A user on subnet 4

IP address: 132.132.223.19
Subnet mask: 255.255.224.0
Default Router/Gateway: 132.132.224.1

What is/are the reason(s) why that user is not able to connect to the remote server? Explain your answer carefully

- The IP address of the station should fall between 132.132.224.1 and 132.132.255.254
- The default gateway is incorrect ⟶ the default gateway is incorrect ⇒ the user's host can't send the request to the correct Router/Gateway and leave from the subnet.
- The subnet mask should be 255.255.192.0
- The subnet mask should be 255.255.255.224

(c) Suppose a router has built up the routing Table as shown in the following Table. The router can deliver packets directly over interfaces e_0 and e_1 or it can forward packets to Routers R_2, R_3 and R_4. Describe what the router does with a packet addressed to each of the following destination:

1. 128.96.39.10
2. 128.96.40.12
3. 128.96.40.151
4. 192.4.153.17
5. 192.4.153.90

Destination Subnet ID	Subnet Mask	Next Hop
128.96.39.0	255.255.255.128	Interface e_0
128.96.39.128	255.255.255.128	Interface e_1
128.96.40.0	255.255.255.128	R_2
192.4.153.0	255.255.255.192	R_3
Default		R_4