CS413 Computer Networks

Final Exam Solution

December 21, 2005

Student ID:_____

Name:_____

Problem No.	Assigned Marks	Your Marks
1	20	
2	7	
3	6	
4	6	
5	7	
6	10	
7	7	
8	10	
9	7	
Total	**80**	

Note: You may write the answers in either English or Korean.

[Marking schemes are given in blue color and the answers are given in red color.]

1. Answer True or False for the following statements. [20 marks]

[T] (a) Multiplexing involves the sharing of a layer *n* service by multiple layer n+1 users. Demultiplexing is carried out by the layer *n* entity at the other end.

[T] (b) The longer the frames or the shorter the propagation time, the higher utilization can be achieved in CSMA LANs.

[T] (c) With Go-back-N error control protocol, it is not required that each individual frame be acknowledged.

[F] (d) Stop-and-Wait, Go-back-N and Selective-reject are examples of continuous ARQ.

[T] (e) IEEE 802.2 defines the logical link control layer and provides three types of services: 1) unacknowledged connectionless service, 2) connection-mode service, and 3) acknowledged connectionless service.

[F] (f) In CSMA/CD LANs, the amount of time that it takes to detect a collision is never greater than the end-to-end propagation delay.

[T] (g) When the bit length of the link is greater than the frame length, multiple frames can be in transit at one time.

[T] (h) The telephone network service was designed to receive, switch and transmit analog signals in the voice-frequency range of about 300 to 3400 Hz.

[T] (i) The block of information passed between layer *n* and layer *n+1* entities consist of control information and a layer *n* service data unit, which is the layer *n+1* protocol data unit itself.

[T] (j) LAN medium access control protocols are categorized as round robin, reservation and contention MAC protocols.

[F] (k) A host with 192.9.200.14 IP address is attached to a Class B IP network.

[F] (l) ATM is one of IEEE 802 standards, which specifies token ring as its MAC protocol and uses the fiber optic technology for its physical transmission medium.

[T] (m) Each host on a public IPv4 Internet network is assigned a unique 32-bit IP address that is used in all communication with that host.

[T] (n) The vulnerable period of Slotted Aloha is exactly a half of that of Pure Aloha.

[F] (o) An L4 switch forwards network traffic based on IP addresses.

[F] (p) BGP is an example of interior routing protocol.

[F] (q) The key technology ingredients that determine the nature of a LAN or WAN are topology, transmission speed and medium access control technique.

[T] (r) When using the 1-persistent CSMA technique, if the medium is busy, the station continues to listen until the channel is sensed idle and then transmits immediately.

[T] (s) Even though the transmission rates are different, ATM and Ethernet can coexist and interoperate in a LAN.

[T] (t) The **netstat** utility is used to query a host about its TCP/IP network status.

2. Name the seven layers defined in the ISO OSI Reference Model. [7 marks]

[ANSWER: 1 mark for listing each layer]

Layer 1: Physical

Layer 2: Data Link

Layer 3: Network

Layer 4: Transport

Layer 5: Session

Layer 6: Presentation

Layer 7: Application

3. Consider a half-duplex point-to-point link using a stop-and-wait protocol.

[2 marks for correct answer]

(a) What is the effect on link utilization of increasing the message size so that fewer messages will be required? Other factors remain constant. [2 marks]

Since only one frame can be sent at a time and transmission must stop until an ACK is received, there is **no effect** in increasing the size of the message if the frame size remains the same.

(b) What is the effect on link utilization of increasing the number of frames for a constant message size? [2 marks]

Increasing the number of frames would decrease frame size. This would serve to **lower link efficiency** since the propagation time is unchanged but more ACKs are needed

(c) What is the effect on link utilization of increasing frame size for a constant message size? [2 marks]

For a given message size, increasing the frame size decreases the number of frames. This would serve to **increase link efficiency** since the propagation time is unchanged but less ACKs are needed.

4. The following questions deal with broadcasting protocols used in LANs.

(a) What is the main difference between the Aloha protocols and CSMA protocols? [2 marks]

[1 mark for each]

- Aloha does not sense carrier and simply transmits whenever it has data
- CSMA senses carrier (listens if the medium is idle) and transmits if idle

(b) What is the main difference between the CSMA and CSMA/CD protocols? [2 marks]

[1 mark for each]

- CSMA does not listen while transmitting
- CSMA/CD does listen while transmitting and detects collision if any

(c) When is the binary exponential backoff algorithm used in the CSMA/CD LANs? Briefly explain how it works. [2 marks]

[1 mark for when and 1~mark for description]

- It is used when a transmitting station detects a collision.
- After each collision, the mean value of the random delay (backoff) before attempting to retransmit is doubled.

5. Is it possible for a network to offer best-effort connection-oriented service? If so, how could the network operate? What features would such a service have, and how does it compare to best-effort connectionless service? [7 marks]

[1 mark for YES and 2 marks each for explanation]

- Yes, it is possible.
- Best-effort connection-oriented service would require some means for establishing a path prior to the transfer of packets. Best-effort connectionless service would involve the transfer of packets in a datagram fashion, where routing decisions are made independently for each packet.
- Best-effort connection-oriented service would involve the transfer of packets along a pre-established path in a manner that does not provide mechanisms for dealing with the loss, corruption or misde-livery of packets.
- The path setup requirement makes connection-oriented service more complex than connectionless service. On the other hand, once a path is established, less processing is required to decide how a packet is to be forwarded. Connectionless service is more robust than connection-oriented service since connectionless service readily reroutes packets around a failure while VC service requires that new paths be established.

6. The TCP/IP protocol suite includes two transport-layer protocols, UDP and TCP.

(a) How does UDP determine whether the received PDU is damaged? [2 marks]

[2 marks for correct answer]

- by performing a checksum calculation on the received UDP header and data and comparing with the checksum field in the header

(b) What does UDP do when it detects an error on the received PDU? [2 marks]

- it simply discards the PDU and does not do anything about it

(c) What does the transport service using TCP guarantee to its users? [2 marks]

[1 mark for each]

- error-free data delivery
- sequenced (ordered) data delivery

(d) What are "well-known" ports? Describe how they are used in the Internet. Give two examples of Internet application that uses a well-known port. [4 marks]

[2 marks for description, 1 mark each for any one of the examples]

- Well-known ports are those which have been pre-assigned IANA to some frequently used Internet applications. The users accessing those applications (particularly servers) over the Internet only need to know their IP addresses
- the following are examples of Internet applications using well-known ports: ftp (port 21), telnet (port 23), whois (port 43), finger (port 79), netstat (port 15), time (port 37), httpd (port 80)

7. (a) What does ARP do? What does RARP do? [2 marks]

[1 mark for each]

- ARP is used to find the MAC address for a given IP address.
- Reverse ARP (RARP) is used by a device to find its IP address given its MAC address.

(b) Does it make sense to do reassembly at intermediate routers? Explain. [3 marks]

[1 mark for the answer and 2 marks for explanation]

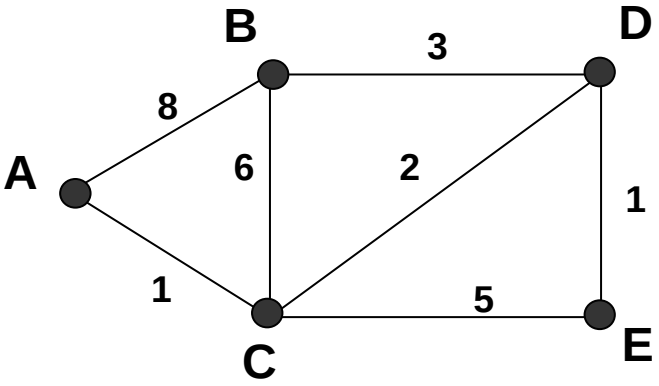
- No, because the packet may be de-fragmented again, and all the time required to wait for all fragments and to reassemble the packet will be wasted. Also it is not guaranteed that all fragments go through the same path and arrive at the same node in a datagram network such as IP.

(c) Name two interior gateway protocols learned in class. [2 marks]

[1 mark for each]

- RIP
- OSPF

8. Fill in the table provided below for the given packet switched network starting from Node A using the Dijkstra's least-cost algorithm discussed in class. Numeric values on links joining the nodes represent the cost of packet transmission on their respective links. [10 marks]



[-1 marks for each mistake, 10 mistakes or more -- give 0/10]

Iteration	M	Db	Path	Dc	Path	Dd	Path	De	Path
1	{A}	8	A-B	1	A-C	Infinity	--	Infinity	--
2	{A,C}	7	A-C-B	1	A-C	3	A-C-D	4	A-C-E
3	{A,C,D}	6	A-C-D-B	1	A-C	3	A-C-D	4	A-C-D-E
4	{A,C,D,E}	6	A-C-D-B	1	A-C	3	A-C-D	4	A-C-D-E
5	{A,B,C,D,E}	6	A-C-D-B	1	A-C	3	A-C-D	4	A-C-D-E

9. (a) Identify the address class of the following IP addresses. [3 marks]

[1 mark for each]

200.58.20.165: **Class C**

128.167.23.20: **Class B**

16.196.128.50: **Class A**

(b) Describe what each of the following provides [4 marks]

[2 marks for each]

DNS: provides the IP address associated with the domain or host name

NAT: involves re-writing the source and/or destination addresses of IP packets as they pass through a router or firewall. Most systems using NAT do so in order to enable multiple hosts on a private network to access the Internet using a single public IP address.