1. Multiple Choice (30 points, 1.5 points for each question)

（1）Which of the following protocol layers is not explicitly part of the TCP/IP architecture?

A) application B) session C) data link D) Transport

（2）In the 1-persistent approach in CSMA, when a station finds an idle line, it _____.

A) sends immediately B) waits 0.1 s before sending

C) waits 1 s before sending D) waits a time equal to (1 - p) seconds before sending

（3）Transport-layer packet is called _____.

A) message B) segment C) datagram D) frame

（4）Among the following applications, which one is not suitable for P2P architecture.

A) file sharing B) video streaming C) instant message D) electronic banking

（5）A Web cache _____.

A) can help prevent DoS attacks.

B) is a network entity that guarantees anonymity of Internet traffic.

C) responds to HTTP requests on the behalf of a Web server.

D) makes use of cookies to reduce the response time for a client request.

（6）In TCP, the timeout interval is a function of _____:

A) estimated RTT at the sender B) MSS and the overhead of a segment

C) the size of buffer at the receiver D) the size of sending window

（7）In an Ethernet frame, the preamble is responsible for _____

A) collision detection

B) error detection

C) synchronization of the receiver's clock to the sender's clock.

D) multiplexing/ demultiplexing

（8）What is the main difference between stop-and-wait and pipelined reliable data transfer protocol?

A) The pipelined protocol uses the NAK packets, whereas in the stop-and-wait protocol senders always wait for ACK packets.

B) With the pipelined protocol, the sender can send several packets in row, whereas in the stop-and-wait protocol the sender cannot send the packets in row.

C) With the pipelined protocol, the receiver must send one ACK for several packets (cumulative ACK), whereas in the stop-and-wait protocol the receiver can not send the cumulative ACK.

D) The pipelined protocol uses timeouts, whereas the stop-and-wait protocol does not use the timeout.

（9）Given that the requested information is not available at any intermediate databases, a purely recursive DNS query from a requesting host would follow the path _____:

A) Root name server; TLD name server; local name server; authoritative name server.

B) authoritative name server; TLD name server; Root name server; local name server

C) TLD name server; Root name server; local name server; authoritative name server;

D) local name server; Root name server; TLD name server; authoritative name server;

（10）Which of the following nodes belongs to the network core? _____

A) a Web Server B) a Host with Win2003 Server

C) a Router with NAT service D) a Supernode on Skype Network

（11）When a user retrieve his email from mail server, which of following protocols can't be used?

A) POP3 B) HTTP C) IMAP D) SMTP

（12）In the _____ random-access method collision is avoided.

A) CSMA/CD B) CSMA/CA C) ALOHA D) token-passing

（13）____ is an interdomain routing protocol using path vector routing.

A) BGP B) RIP C) OSPF D) None of the choices are correct

（14）The use of hierarchy in routing tables can _____ the size of the routing tables.

A) reduce B) increase

C) neither reduce nor increase D) None of the choices are correct

（15）IP is a _____ protocol.

A) connection-oriented unreliable B) connection-oriented reliable

C) connectionless unreliable D) connectionless reliable

（16）During an FTP session the control connection is opened _____.

A) once B) twice C) many times D) none of the choices are correct

（17）DHCP is a (an) _____ layer protocol.

A) application B) transport C) network D) data-link

（18）In a centralized P2P network, the directory system uses the ____ paradigm; the storing and downloading of the files are done using ____ paradigm.

A) client-server; client-server B) peer-to-peer; client-server

C) client-server; peer-to-peer D) peer-to-peer; peer-to-peer

（19）RIP uses the services of _____.

A) TCP B) IP C) UDP D) None of the choices are correct

（20）In the CSMA/CD protocol, what condition on the transmission delay T_{trans} and the propagation delay T_{prop} has to be satisfied to guarantee that a node always detects a collision?

A) $T_{trans} > T_{prop}$ B). $T_{trans} > 2T_{prop}$ C) $T_{trans} < T_{prop}$ D) . $T_{trans} < 2T_{prop}$

2. Fill in the blank （15 points, 1.5 point for each blank）。

（1）Suppose host A sends host B one TCP segment with sequence number 800, acknowledgement number 580, and 40 bytes of data. Then the sequence number in the acknowledgement to this segment is [①]

（2） Let's assume there is 8-bit piece data 11001001, and the CRC is applied to it with generator 1001. Thus the CRC bits should be [②]

（3）The flag [③] in TCP segment header is used during the shutdown of a TCP connection.

（4）In a TCP connection , there is a timeout event when the value of threshold is 32 and the size of congestion window is 16. According to the TCP congestion control policy, the new value of threshold should be [④] and the new size of congestion window should be [⑤].If there is a duplicate ACK event, the new value of the threshold should be [⑥] and the new size of congestion window should be [⑦].

（5）Suppose the IP address of a host is 192.168.5.121, and its subnet mask is 255.255.255.248, then the netid of the host is [⑧], and the broad cast address of the network is [⑨]

（6）In CSMA/CD, after the 4^{th} collision, the probability that a node chooses $K=4$ is [⑩]

3. True or False （10 points, 1 point for each statement）。

（1） Switches will decrease the TTL field in the IP header.

（2） In the 5-layer Internet reference model, network layer handles point-to-point functions while transport layer handles end-to-end functions.

（3） Wireless networks can perform collision detection

（4） A drawback of distance vector routing algorithm is count-to-infinity problem.

（5） Congestion control reduces the transmission rate at the sender when the receiver is overloaded

（6） Network node means to end host or router or switch

（7） TCP waits until it has received two duplicate ACKs before performing a fast retransmit.

（8） When an Ethernet sender detects that the media is idle, it sends a jam signal onto the media to tell other devices not to transmit, and then it sends its packet.

（9） If there are some errors in the routing tables at some routers, then, with IPv4, it is possible that a packet loops forever.

（10） With the SR protocol, it is possible for the sender to receive an ACK for a packet that falls outside of its current window.

4. Please answer the following questions briefly (20 points)

(1). ***[6 points]*** The following shown the processes between Host A and Host B to communicate to transfer a mail message, answer the questions based on the conversation.

A: 220 beta.gov simple mail transfer service ready
B: HELO alpha.edu
A: 250 beta.gov
B: MAIL FROM: smith@alpha.edu
A: 250 mail accepted
B: RCPT TO: jones@beta.gov
A: 250 recipient accepted
B: RCPT TO: green@beta.gov
A: 250 no such user here
B: RCPT TO: brown@beta.gov
A: 250 recipient accepted
B: DATA
A: 354 start mail input; end with <CR><LF>.<CR><LF>
B: Date: Sat 12 May 2012 13:26:31
B: From: smith@alpha.edu
B: …….
B: ……
B: .
A: 250 OK
B: QUIT
A: 221beta.gov service closing transmission channel.

QUESTIONS:

I. What is the name of the host sending mail? And what is the name of the user sending the mail?(2 points)

II. How many users to whom the sender wants to send mail? And what is the name for each user?(2 points)

III. What is the name of the host receiving the mail?(1 point)

IV. in order to receive the mail, what is the port number to which the receiving host is waiting for being connected?(1 point)

(2). ***[5 points]*** Suppose you open a startup company "starwar" and want to set up your company network. Your network has the following servers:

DNS server: "dns1.starwar.com" with IP as "128.119.12.40"
Web server: "starwar.com" with two IP as "128.119.12.55" and "128.119.12.56". The web server also has a name as "www.starwar.com".
Email server: "galaxy.starwar.com" with IP as "128.119.12.60"
Your company's email address is "username@starwar.com".

QUESTIONS

I. What resource records (RRs) do you need to provide to the top-level domain ".com" Registrar? (2 points)

II. What RRs do you need to put in your company's DNS server? (3 points))

(3). ***[5 points]*** A router has the following (CIDR) entries in its routing table

Address/mask	***Next Hop***
135.46.56.0/22	*interface 0*
135.46.60.0/22	*interface 1*
192.53.40.0/23	*router 1*
Default	*router 2*

For each of the following IP addresses, what does the router do if a packet with that address arrives?

I. 135.46.63.10

II. 135.46.57.14

III. 135.46.52.2

IV. 192.53.40.7

V. 192.53.56.7

(4). ***[4points].*** Consider the BGP protocol, an autonomous system (AS) A, and some destination network X. How does A control whether or not other autonomous systems route traffic destined to X through A?

5. Application (25 points)

(1). ***[13 points]*** Consider the network scenario shown below, assume the MAC address of the host is *00-15-c5-c1-5e-28*, and its IP address is *10.2.128.100* (private address), figure 5-1 is the network topology, and figure 5-2 is the first 80 bytes of the frame which encapsulated the http request message when the host request a web page which is located in a web server somewhere in the Internet, and the frame is presented in hexadecimal(十六进制) and ASCII. Figure 5-3 is the Ethernet frame structure and figure 5-4 is the format of the header of IPv4 datagram.

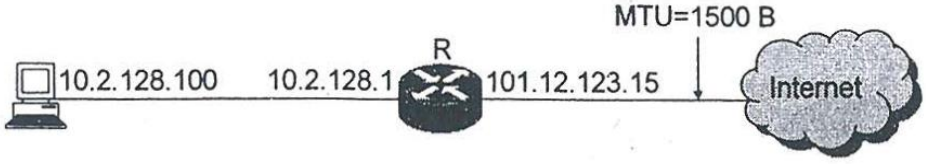

Figure 5-1 Network Topology

```
0000  00 21 27 21 51 ee 00 15  c5 c1 5e 28 08 00 45 00   .!'!Q... ..^(..E.
0010  01 ef 11 3b 40 00 80 06  ba 9d 0a 02 80 64 40 aa   ...;@... .....d@.
0020  62 20 04 ff 00 50 e0 e2  00 fa 7b f9 f8 05 50 18   b ...P.. ..{...P.
0030  fa f0 1a c4 00 00 47 45  54 20 2f 72 66 63 2e 68   ......GE T /rfc.h
0040  74 6d 6c 20 48 54 54 50  2f 31 2e 31 0d 0a 41 63   tml HTTP /1.1..Ac
```

Figure 5-2 the First 80 bytes of an Ethernet Frame

Dest. MAC (6B)	Source MAC(6B)	Type (2B)	DATA(16-1500B)	CRC(4B)

Figure 5-3 Ethernet Frame Structure

Version(4b)	Hlen. (4b)	Type of Service(4b)	Datagram Length(16b)	
Identifier(16b)			flags	Fragmentation offset(13b)
Time-to-live(8b)		Upper layer protocol(8b)	Header Checksum(16b)	
Source IP address				
Destination IP address				

Figure 5-4 IPv4 Datagram Header

Answer the following questions based on figure 5-1 and 5-2

I. What is the *IP address* of the web server visited by the host? what is the *MAC address* of the default gateway(router) of the host? (4 points)

II. When the host constructs the frame shown in figure 5-2, *what protocol* was used to determine the destination MAC address? And what is the destination MAC address of the Ethernet frame which encapsulated the request of the protocol? (4 points)

III. Assume HTTP /1.1 uses persistent connections without pipelining, and there are 5 jpeg images referenced in *rfc.html*, how many RTTs will it take to obtain all the objects from sending the request message? (2 points)

IV. When router R forwarded the datagram encapsulated in the frame, which fields in the header of the datagram would be updated? (3 points)

(2). ***[5 points]***Suppose that x bits of user data are to be transmitted over a k-hop path in a packet-switched network as a series of packets. Each containing p data bits and h header bits, with $x>>p+h$, the transmission rate of the channel is b bps and the prorogation delay is negligible. What value of p minimizes the total delay?

(3). ***[7 points]***Suppose a network runs RIP, the routing table in router B shown as below

Destination network	**distance**	**next-hop**
N1	7	A
N2	2	C
N6	8	F
N8	4	E
N9	4	F

NOW, Router B receives d-v vectors from Router C, shown as below

Destination network	**distance**
N2	4
N3	8
N6	4
N8	3
N9	5

What is C's new routing table?