**1. Abbreviation Expansion. There are 10 abbreviations of term below. Please expand these abbreviations to the complete terms in either English or Chinese. (10 points, 1 point for each abbreviation)**

(1) MTU [ maximum transmission unit 最大传输单元 ]

(2) CSMA [ carrier sense multiple access 载波多路侦听 ]

(3).OSPF [ open short path first 开放式最短路径优先 ]

(4).ICMP [ internet control message protocol 互联网控制报文协议 ]

(5).LAN [ local area network 局域网 ]

(6).BGP [ border Gateway protocol 边界网关协议 ]

(7).ADSL [ Asymmetric digital line 非对称数字线路 ]

(8).FTP [ 文件传输协议 ]

(9).MIME [ multipurpose internet mail extensions 多用途互联网邮件扩展类型 ]

(10).DHCP [ Dynamic host configuration protocol 动态主机配置协议 ]

**2. Multiple Choice (24 points, 2 points for each question)**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C | D | C | D | A | C | A | D | C | B | C | B |

(1). Which of the following IP address doesn't belong to the 202.128.0.0/9 network?
A. 202.128.128.1 B. 202.128.127.11 C.202.127.14.120 D. 202.129.1.129

(2). Which of the following physical medium belongs to unguided media?
A. Twisted-Pair Copper Wire B. Coaxial Cable C. Fiber Optics D. Radio Channels

(3). Which of the following is true about ARP and learning bridges?
A. A learning bridge maintains state that maps IP addresses to hardware (MAC) addresses.
B. A learning bridge maintains state that maps MAC addresses to IP addresses.
C. A host's ARP table maintains state that maps IP addresses to hardware (MAC) addresses.
D. A host's ARP table maintains state that maps hardware addresses to IP addresses.

(4). Which of the following services is not provided by DNS?
A. host aliasing B. mail server aliasing C. load distribution D. IP address allocating

(5). When a user retrieves his email from mail server, which of following protocols can't be used?
A. SMTP B. HTTP C. POP3 D.IMAP

(6). Suppose host A sends host B one TCP segment with sequence number 118, acknowledgement number 471, and 4 bytes of data. Then the sequence number in the acknowledgement to this segment is?
A. 122 B. 118 C. 471 D. 475

(7). Which best describes the Ethernet protocol?
A. Talk only if you hear no one else talking, but stop as soon as you hear anybody else.
B. Pass a ticket around and only talk if you are holding the ticket.
C. Raise your hand and wait till a moderator gives you permission to talk.
D. Every person is scheduled a time to talk.

(8). Which of the following protocols runs on UDP?
A. SMTP B. ICMP C.ARP D. DHCP

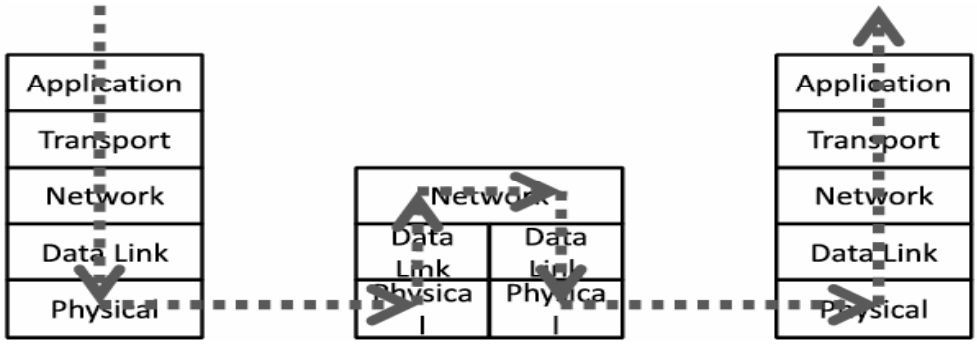
UDP：DNS，TFTP，RIP，BOOTP，DHCP，SNMP，NFS，IGMP

(9). During normal IP packet forwarding at a router, which of the following packet fields are updated?
A. Source IP address B. Destination IP address
C. Check sum D. Destination port number

(10). In OSPF network, a _____ belongs to both an area and the backbone.
A. internal router B. area border router C. boundary router D. backbone router

(11). Which of the following is true about persistent HTTP connections?
A. Persistent HTTP allows a server to track the client's requests through a persistent session.
B. Only one TCP connection must be opened for downloading a "page", if that page does not include any embedded objects served by other servers.
C. Persistent HTTP shows the greatest performance advantage over nonpersistent HTTP when downloading a page with large objects.
D. When the server has finished sending data for all objects referenced by the initially requested page, the server closes the connection.

(12). What is the name of the forwarding device in the middle of the diagram below?




A. Switch B. Router C. Hub D. Bridge

**3. True or False （15 points, 1.5 point for each statement）。**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| F | F | T | F | F | T | F | F | T | T |

(1) Manchester encoding requires that sender and receiver have clocks that run at approximately the same rate, so they can differentiate between the encoding of a single "0" and that of multiple "0"s.

(2) An Ethernet switch maintains a mapping of IP addresses to MAC addresses.

(3) Both Ethernet and 802.11 ("Wifi") combine Carrier Sense with Collision Detection to ensure fair media access for multiple parties on a LAN.

(4) 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.

(5) The size of the TCP RcvWindow never changes throughout the duration of the connection.

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

(7) Switches decrement the TTL field in the IP header.

(8) A query for an A record may return multiple IP addresses in the response.

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

(10) A web cache is both a client and a server at the same time.

**4. Please answer the following questions briefly (25 points )。**

***4-1.*** **【*Services provided by the Internet transport protocols*】** *(6 points)* Indicate whether TCP or UDP (or both or neither) provide the following services to applications:

A. 【 TCP 】Reliable data transfer between processes.

B. 【 Neither 】Minimum data transmission rate between processes.

C. 【 TCP 】Congestion-controlled data transfer between processes.

D. 【 Neither 】Guarantee that data will be delivered within a specified amount of time.

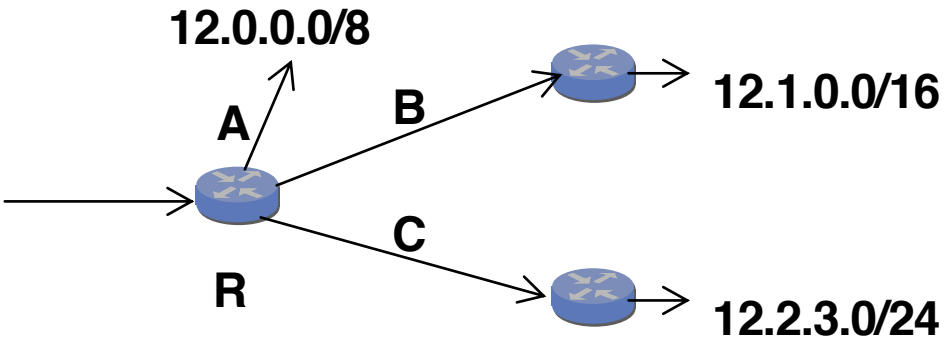
E. 【 Both 】Preserve application-level message boundaries. That is, when a sender sends a group of bytes into a socket via a single send operation, that group of bytes will be delivered as a group in a single receive operation at the receiving application.

F. 【 TCP 】Guaranteed in-order delivery of data to the receiver.

***4-2.*** **【*MAC and IP Address*】** *(6 points)* List three key differences between MAC and IP addresses.

***4-3.*** **【*IP Prefixes and Packet Forwarding*】** *(13 points)*

Consider the following three routers, where router R has outgoing interfaces A, B, and C:




A. How many IP addresses does the prefix 12.2.3.0/24 represent? 2^8=256

B. List the forwarding-table entries for router R. How does R perform look-ups in this table?

12.2.3.0/24 —> C
12.1.0.0/16 —> B
12.0.0.0/8 —> A

C. Which outgoing interface does R use for a packet with destination 12.2.3.1? C

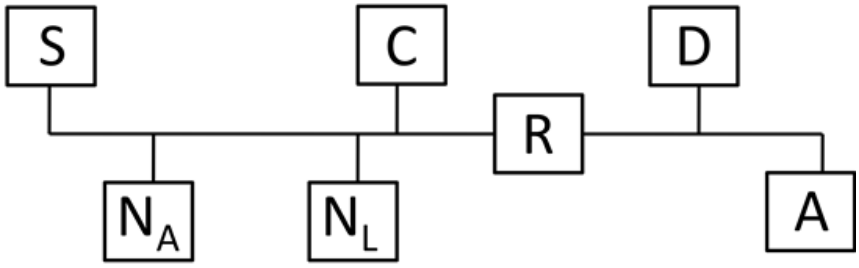
D. Which outgoing interface does R use for a packet with destination 12.1.2.3? B

E. Which outgoing interface does R use for a packet with destination 12.2.4.5? A

**5. Application (26 points)**

5-1 **【*Your Web Browser in action*】**（*12 points*）In the topology shown below, machine A is a desktop client, D is a local DHCP server, R is A's gateway router, S is a Web server, and C is a

Web cache. $N_L$ is C's local nameserver, while $N_A$ is the nameserver authoritative for S. Client A is configured to use Web cache C for all requests (assume that the Web cache resolves the name for any Web server and that the client is configured with the IP address of the cache). All wires/links are Ethernet segments.




**Assume the following:**

- All the machines were just booted and their associated caches (ARP, DNS, Web, persistent connections) are all empty
- http://S/index.html fits in a single packet
- Persistent HTTP connections are used among A, C, and S (i.e. you should assume that once any connection between these hosts is established it is never closed)
- Web caches respond to TCP requests that look like packet two in table 1 below (e.g., GET http://foo/bar/). They reply with the normal web cache contents.

**A.** The user on machine A, requests the web page http://S/index.html. Table 1 shows a number of messages sent/received in servicing this request (this is not necessarily a complete list of all packets). In addition, there are a few bogus(虚假的) packets that are never sent/received. The packets are not listed in temporal order.

**Table 1**

| ID | SRC | DST | SRC Port | DST Port | Protocol | Contents |
|---|---|---|---|---|---|---|
| 1 | C | DNS root | | DNS | UDP | Query for S |
| 2 | A | C | | Web cache | TCP | GET http://S/index.html |
| 3 | $N_L$ | DNS root | | DNS | UDP | Query for S |
| 4 | C | S | | HTTP | TCP | SYN |
| 5 | C | S | | HTTP | TCP | GET index.html |
| 6 | S | A | HTTP | | TCP | index.html |
| 7 | A | Broadcast | | | ARP | Who is R |
| 8 | C | A | Web cache | | TCP | index.html |
| 9 | $N_L$ | C | DNS | | UDP | Address for S |
| 10 | S | C | HTTP | | TCP | index.html |
| 11 | A | Broadcast | | DHCP | UDP | DHCP Request from A |
| 12 | $N_L$ | $N_A$ | | DNS | UDP | Query for S |

**(SRC—Source, DST---Destination)**

List the proper order of packets (in terms of their IDs) that are sent on the network:

11,7,2,3,12,9,4,5,10,8

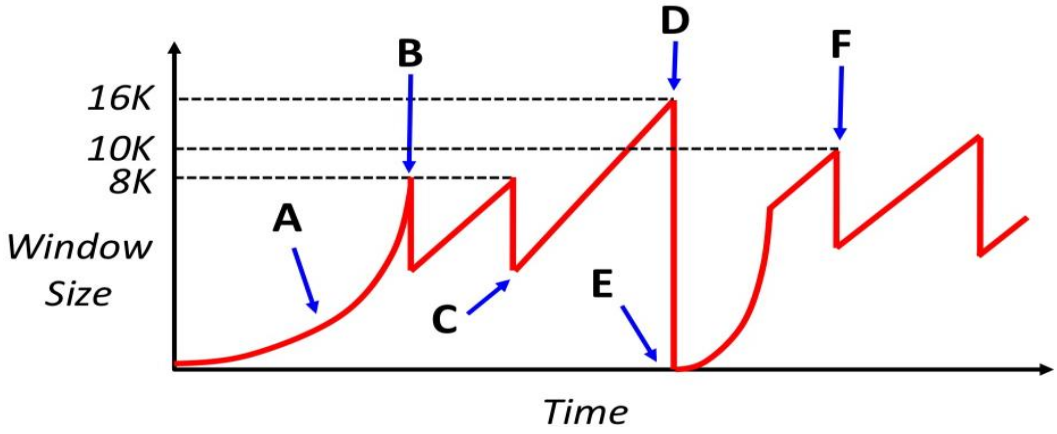
**B.** Assume that the client A has no local Web or DNS cache and that cache C has no DNS cache.

However, all other cacheable things are cached. On a subsequent request for http://S/ index.html,

List the proper order of packets (in terms of their IDs) that are sent on the network:

11,7,3,12,9,4,5,10

5-2 **【*TCP and Congestion Control*】***(8 points)*Consider the following graph of TCP throughput (NOT DRAWN TO SCALE), where the y-axis describes the TCP window size of the sender. We will later ask you to describe what happens on the right side of the graph as the sender continues to transmit.




A. The window size of the TCP sender decreases at several points in the graph, including those marked by B and D.

*A-1*. Name the event at B which occurs that causes the sender to decrease its window.

Triple Duplicate ACK

*A-2*. Name the event at D which occurs that causes the sender to decrease its window.

Timeout

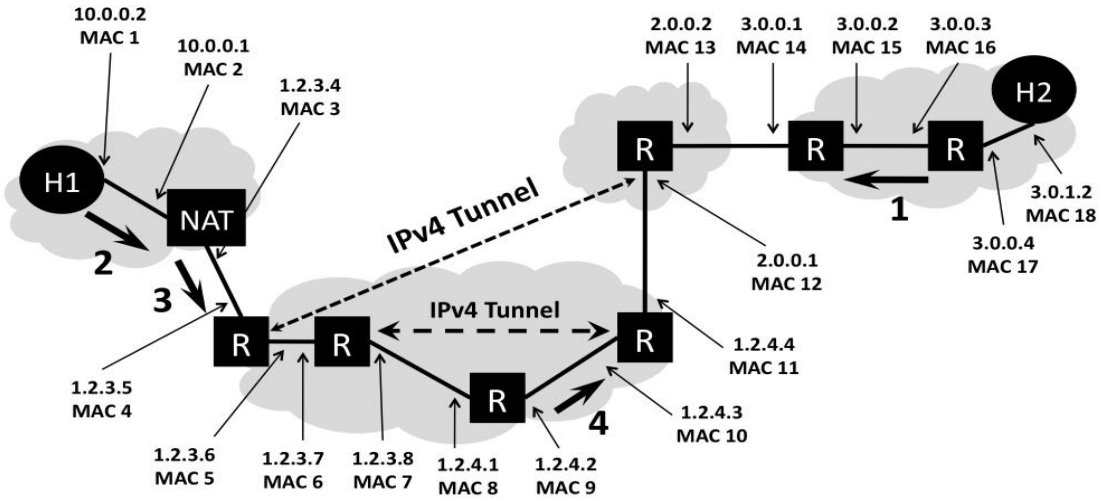
Consider the curved slope labeled by point A. Why does the TCP window behave in such a manner, rather than have a linear slope? (Put another way, why would it be bad if region A had a linear slope?)

B. Assume that the network has an MSS of 1000 bytes and the round-trip-time between sender and receiver of 100 milliseconds. Assume at time 0 the sender attempts to open the connection. Also assume that the sender can "write" a full window's worth of data instantaneously, so the only latency you need to worry about is the actual propagation delay of the network.. How much time has progressed between points C and D?

12RTT

5-3 **【*Routing, addressing, and tunneling*】***(6 points)*

The following figure shows a network topology. The LAN on the left uses a NAT to connect to the Internet and includes a client host H1. The LAN on the right includes a webserver H2. Packets between the two endpoints are routed along the path shown by a heavy dark lines, which includes two IPv4 tunnels. All packets which traverse the path use both tunnels. The various network interfaces have IP and MAC addresses as shown.




H1 has established an HTTP session with web server H2 and data packets are flowing between the two machines. As an example, we have filled in the headers for packet 1 (traveling from the server H2 to the client H1). Note that you should order your headers from "outermost" in, as shown: Ethernet should be listed before IP, because the Ethernet packet exists first on the wire.

| **Header Type** | **Source** | **Destination** |
|---|---|---|
| Ethernet | MAC 16 | MAC 15 |
| IP | 3.0.1.2 | 1.2.3.4 |

You only have to fill in the header type and the source and destination address for the network and data-link layer headers for packets 2, 3 (these packets are all traveling from the client H1 to the server H2, as marked on the figure with heavy black arrows and numbers). Note: You might not need to use all the rows supplied.

A. Header for packet 2:

| Header Type | Source | Destination |
|---|---|---|
| Ethernet | MAC 1 | MAC 2 |
| IP | 10.0.0.2 | 3.0.1.2 |
| | | |

B. Header for packet 3:

| Header Type | Source | Destination |
|---|---|---|
| Ethernet | MAC 3 | MAC 4 |
| IP | 1.2.3.4 | 3.0.1.2 |
| | | |

整理人：刘哲
有疑问请qq联系：
994771138