

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

- (1) The application layer in the TCP/IP protocol suite is usually considered to be the combination of \_\_\_\_\_ layers in the OSI model
- A) application, presentation, and session      B) application, transport, and network  
C) application, data-link, and physical      D) network, data-link, and physical
- (2) Which ICMP message type is the basis for the Traceroute utility?
- A) Echo Request      B) TTL  
C) Host Unreachable      D) Fragment Reassembly Time Exceed
- (3) The \_\_\_\_\_ layer is responsible for the delivery of a message from one process to another.
- A) physical      B) transport  
C) network      D) application
- (4) In an Ethernet network, which of the following is true
- A) Ethernet switches learn addresses by looking at the destination address of packets as they pass by.  
B) Ethernet hubs and repeaters learn addresses by looking at the destination address of packets as they pass by.  
C) Ethernet switches learn addresses by looking at the source address of packets as they pass by.  
D) Ethernet hubs and repeaters learn addresses by looking at the source address of packets as they pass by.
- (5) Packet collisions occur in an Ethernet network because
- A) the Ethernet switching mechanism may occasionally send two packets through the same route  
B) two different Ethernet networks may be spliced together  
C) two Ethernet nodes can send packets at the same time  
D) the Ethernet uses a ring topology
- (6) 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
- (7) In the TCP/IP protocol suite, the \_\_\_\_\_ layer is responsible for moving frames from one hop (node) to the next.
- A) physical      B) data link      C) transport      D) network
- (8) In a client-server paradigm

- A) both the server and the client must be running all the time.  
B) both the server and the client need to be running only when they are needed.  
C) the server must be running all the time but the client needs to be running only when it is needed.  
D) the client must be running all the time but the server needs to be running only when it is needed
- (9) In a \_\_\_\_\_ connection, one TCP connection is made for each request/response.  
A) persistent  
B) nonpersistent  
C) persistent or a nonpersistent  
D) None of the choices are correct
- (10) During an FTP session the data connection may be opened \_\_\_\_\_.  
A) only once  
B) only two times  
C) as many times as needed  
D) none of the choices are correct
- (11) \_\_\_\_\_ is a supplementary protocol that allows non-ASCII data to be sent through e-mail.  
A) SMTP  
B) MPEG  
C) MIME  
D) POP
- (12) In \_\_\_\_\_ resolution, the server returns the IP address of the server that it thinks can resolve the query.  
A) iterative  
B) recursive  
C) straight  
D) None of the choices are correct
- (13) Routers in the path are not allowed to \_\_\_\_\_.  
A) fragment the packet they receive  
B) decapsulate the packet  
C) change source or destination address  
D) All of the choices are correct
- (14) In a datagram approach, the forwarding decision is based on the value of the \_\_\_\_\_ field in the packet header.  
A) source address  
B) destination address  
C) label  
D) None of the choices are correct
- (15) The performance of a network can be measured in terms of \_\_\_\_\_.  
A) delay  
B) throughput  
C) packet loss  
D) all of the choices are correct
- (16) \_\_\_\_\_ allows a site to use a set of private addresses for internal communication and a set of global Internet addresses for communication with the rest of the world.  
A) DHCP  
B) NAT  
C) IMCP  
D) None of the choices are correct
- (17) The Routing Information Protocol (RIP) is an intradomain routing based on \_\_\_\_\_ routing.  
A) distance vector  
B) link state  
C) path vector  
D) None of the choices are correct

- (18) If the sender is a host and wants to send a packet to another host on the same network, the logical address that must be mapped to a physical address is \_\_\_\_\_.  
A) the destination IP address in the datagram header  
B) the IP address of the router found in the routing table  
C) the source IP address  
D) None of the choices are correct
- (19) An ARP reply is normally \_\_\_\_\_.  
A) broadcast      B) multicast      C) unicast      D) None of the choices are correct
- (20) A user requests a Web page that consists of some text and 3 images. The browser's cache is empty. For this page, the client's browser:  
A. sends 1 http request message and receives 1 http response messages.  
B. sends 1 http request message and receives 3 http response messages.  
C. sends 3 http request message and receives 3 http response messages.  
D. sends 4 http request message and receives 4 http response messages.

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

- (1). The target of flow control is to prevent [ ① ] overflow.
- (2). Let's assume there is 8-bit piece data 10101010, and the CRC is applied to it with generator 1001. Thus the CRC bits should be [ ② ]
- (3). Assume there is the network as the figure below (fig 1). The host 10.0.0.1 can communicate with host 138.76.29.23 via a router. The router runs a NAT service and the NAT translation table is described in Fig 1. Let's assume there is a web server running on the host 139.76.29.23. The host 10.0.0.1 sent an http request via port 3345 to this web server. Therefore, for the packet received by the web server 138.76.29.23, the value of source MAC address should be [ ③ ], the value of source IP address should be [ ④ ], the value of source port should be [ ⑤ ]. After receiving the HTTP request, the web server sent a HTTP response. For the response packet received by the host 10.0.0.1, the value of source MAC address should be [ ⑥ ], the value of source IP address should be [ ⑦ ], the value of source port should be [ ⑧ ],

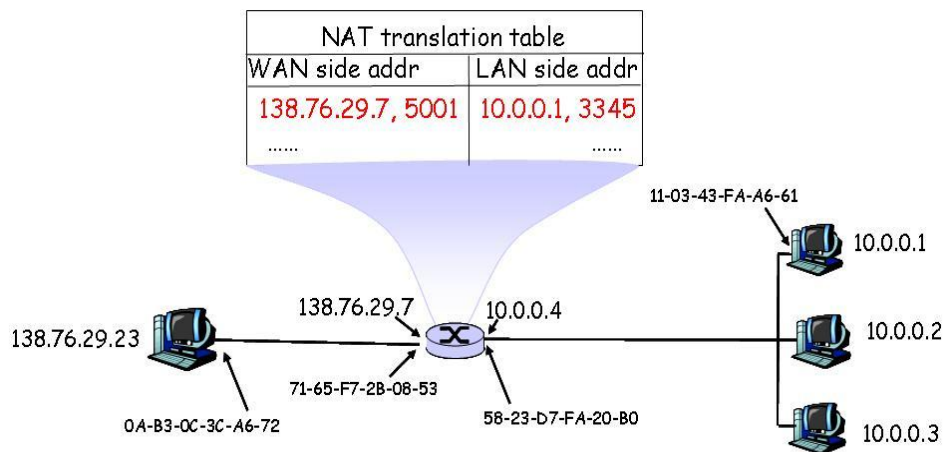


Fig 1.

- (4). Consider Fig 1. Assume the ARP table at host 10.0.0.1 is empty. Thus, the host 10.0.0.1 had to send an ARP query, before sending the http request to web server 138.76.29.23. In this ARP query, the value of destination IP address should be [ ⑨ ], and the value of destination MAC address should be [ 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). Distance Vector Routing Algorithm is newer and has more flexibility and options than Link State Routing Algorithm
- (5). A drawback of distance vector routing algorithm is count-to-infinity problem.
- (6). A web cache is both a server and client.
- (7). The sequence number range must be at least twice the send window for GBN
- (8). Congestion control reduces the transmission rate at the sender when the receiver is overloaded
- (9). Network node means to end host or router or switch
- (10). TCP waits until it has received two duplicate ACKs before performing a fast retransmit.

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

- (1). [4 points] 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?
- (2). [8 points] Fill in the value of the congestion window size (number of segments) for each transmission round. Assume the threshold starts at 30 segments and the following events occur:
  - triple duplicate ACK during round 10
  - timeout during round 12

- triple duplicate ACK during round 14
- timeout during round 22
- timeout during round 25

Round	Congestion Window Size	Round	Congestion Window Size
1	1	14	
2		15	
3		16	
4		17	
5		18	
6		19	
7		20	
8		21	
9		22	
10		23	
11		24	
12		25	
13		26	

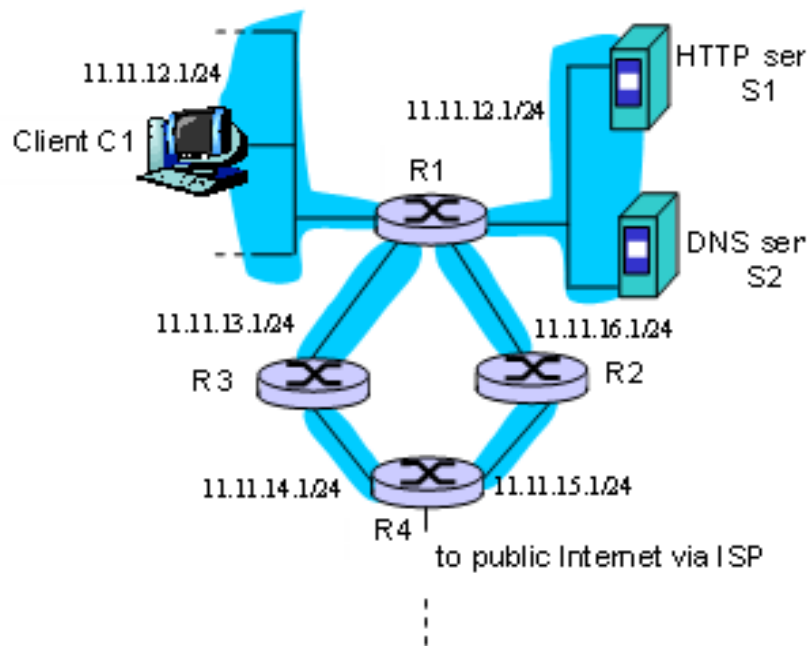
(3). [8 points] We studied a number of multiple access protocols in this course, including (1) TDMA, (2) CSMA, (3) Slotted Aloha and (4) Token passing.

1) Suppose you were charged with putting together a LAN to support IP telephony (only) and that multiple users may want to carry on a phone call at the same time. Recall that IP telephony digitizes and packetizes voice at a constant bit rate when a user is making an IP phone call. How well suited are these four protocols for this scenario? Provide a brief (e.g. one sentence) explanation of each answer.(4 points)

2) Now suppose you were charged with putting together a LAN to support the occasional exchange of data between nodes. That is, any individual node does not have data to send very often. How well suited are these four protocols for this scenario? Provide a brief (e.g. one sentence) explanation of each answer.(4 points)

### 5. Application (25 points, 18 points for 1<sup>st</sup> question and 7 points for 2<sup>nd</sup> question)

(1). Consider the network scenario shown below. Client C1, servers S1 and S2, and routers R1 through R4 are all part of the same autonomous system (e.g., the SCU network) and are connected to other ASs in the rest of the Internet via router R4.



- 1) Suppose the user at C1 enters a URL into the browser for a document at S1 and refers to S1 by its name (e.g., S1.cs.scu.edu.cn). The document stored in S1 and returned to the user at C1 contains an embedded URL that is at another site that is outside the autonomous system shown above (e.g., www.remotesite.com). Which of the elements C1, S1, R1 – R4 will make a query to DNS server S2 to resolve the name S1.cs.scu.edu.cn. (3 points)
  - 2) Which of C1, S1, S2, R1 – R4 must be running the TCP protocol? Explain your answer. (3 points)
  - 3) Identify the individual networks (in an IP addressing sense) in the figure above. Specify an internet address for one interface in each of the networks (3 points)
  - 4) Which of C1, S1, S2, R1 – R4 run an intra-domain routing protocol? (3 points)
  - 5) Which of C1, S1, S2, R1 – R4 run an inter-domain routing protocol? Given your answer in c), what address prefix is advertised to ASs outside this network? (3 points)
  - 6) Assume that the client and servers are connected to R1 using Ethernet, and that the routers are interconnected using a point-to-point protocol. Which of C1, S1, S2, R1 – R4 must be running the ARP protocol? Explain your answer. (3 points)
- (2). Consider the network shown below. Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from B to all destinations. (7 points)

