

# 四川大学期末考试试题（闭卷）

（2019~2020 学年第 1 学期）

A 卷

课程号: 311105040 课程名称: 计算机网络 任课教师: \_\_\_\_\_

适用专业年级: 软件工程 2017 级 学号: 2019141420032 姓名: 李美瑾

## 考生承诺

我已认真阅读并知晓《四川大学考场规则》和《四川大学本科学子考试违纪作弊处分规定（修订）》，郑重承诺：

- 1、已按要求将考试禁止携带的文具用品或与考试有关的物品放置在指定地点；
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- 3、考试期间遵守以上两项规定，若有违规行为，同意按照有关条款接受处理。

考生签名: \_\_\_\_\_

题 号	1 (30%)	2 (20%)	3 (30%)	4 (20%)
得 分				
卷面总分		阅卷时间		

- 注意事项:**
1. 请务必将本人所在学院、姓名、学号、任课教师姓名等信息准确填写在试题纸和添卷纸上；
  2. 请将答案全部填写在本试题纸上；
  3. 考试结束，请将试题纸、添卷纸和草稿纸一并交给监考老师。

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评阅教师	得分

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

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

- A (1) Which of the following protocols is an application protocol? \_\_\_\_\_  
☒ SMTP      B. IGRP      ☒ ARP      ☒ ICMP
- A (2) In the Internet, the equivalent concept to end systems is \_\_\_\_\_  
☒ hosts      B. servers      C. clients      D. routers
- D (3) In the following options, which belongs to the network core? \_\_\_\_\_  
A. hosts      B. servers      C. clients      ☒ routers
- B (4) The Internet's network layer is responsible for moving network-layer packets known as \_\_\_\_\_ from one host to another.  
A. frame      ☒ datagram      C. segment      D. message

- B (5) Suppose,  $a$  is the average rate at which packets arrive at the queue,  $R$  is the transmission rate, and all packets consist of  $L$  bits, then the traffic intensity is \_\_\_\_.
- A.  $LR / a$       ☒ B.  $La / R$       C.  $Ra / L$       D.  $LR / a$
- C (6) The time required to propagate from the beginning of the link to the next router is \_\_\_\_.
- A. queuing delay    B. processing delay    ☒ C. propagation delay    D. transmission delay
- C (7) The virtual-circuit networks is a kind of \_\_\_\_ networks.
- A. datagram      B. circuit-switched      ☒ C. packet-switched      D. telephone
- D (8) The following technologies use FDM, except \_\_\_\_.
- A. HFC      B. DSL      C. 2G-cellular network      ☒ D. Ethernet LAN
- D (9) In the following applications, which one is a loss-tolerant application? \_\_\_\_.
- A. E-mail      B. file transfer      C. instant messaging      ☒ D. real-time audio
- B (10) Suppose a web page consists of a base HTML file, and 4 embedded JPEG images, and also suppose HTTP uses persistent connection with pipelining, the total response time is \_\_\_\_.
- A. 2RTT      ☒ B. 3RTT      C. 4 RTT      D. 8 RTT
- D (11) Suppose A (with a Web-based e-mail account) sends a message to B (who accesses his mail server using POP3), which application-layer protocol is not used? \_\_\_\_
- ☒ A. HTTP      ☒ B. SMTP      ☒ C. POP3      ☒ D. IMAP
- C (12) In the following four options, which one is not the part of cookie technology? \_\_\_\_
- A. Cookie header lines in the HTTP response message and request message.
- B. One cookie header file kept on the user's end system and managed by the user's browser.
- ☒ C. A network entity that satisfies HTTP requests on the behalf of an origin Web server
- D. A back-end database at the Web site      Web cache
- (13) FTP uses two parallel TCP connections to transfer a file, there are \_\_\_\_ .
- ☒ A. control connection and data connection
- B. receiving connection and sending connection
- C. client connection and sever connection
- D. program connection and process connection
- A (14) These two minimal transport-layer services—\_\_\_\_ and \_\_\_\_—are the only two services that UDP provides
- ☒ A. process-to-process data delivery, error checking
- B. congestion control, reliable data transfer
- C. flow control, congestion control

D. In-order data transfer, error checking

- A (15) The UDP header has only four fields, they are \_\_\_\_\_.  
☒ A. Source port number, destination port number, length and checksum  
 B. Source port number, destination port number, source IP and destination IP  
 C. source IP, destination IP, source MAC address and destination MAC address  
 D. source IP, destination IP, sequence number and ACK sequence number
- C (16) Suppose host A sends host B one TCP segment with sequence number 266, acknowledgement number 388, and 4 bytes of data. Then the sequence number in the acknowledgement to this segment is \_\_\_\_\_.  
 A. 266      B. 270      ☒ C. 388      D. 392
- D (17) An IP datagram of 1020 bytes (20 byte of IP header plus 1000 bytes of IP payload) arrives at a router and must be forwarded to a link with an MTU of 500 bytes. Thus the router have to fragment the datagram. To the last fragment, the value of offset should be \_\_\_\_\_.  

$$\begin{matrix} 500 & + & 500 & + & \dots \\ 0 & & 1 & & 2 \end{matrix}$$

$$\frac{480}{8} = 60$$
 A. 960      B. 1000      C. 100      ☒ D. 120
- B (18) 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.  $T_{trans} > 2 T_{prop}$       C.  $T_{trans} < T_{prop}$       D.  $T_{trans} < 2 T_{prop}$
- B (19) Let's assume there is 16-bit piece data 1100 0011 1000 0001. The 8-bit Internet checksum for this data should be \_\_\_\_\_.  
 A. 01000101      ☒ B. 10111010      C. 01000100      D. 10111011
- B (20) For the data in (19), the CRC is applied to it with generator 1001. Thus the CRC bits should be \_\_\_\_\_.  
 A. 000      ☒ B. 011      C. 010      D. 111

评阅教师	得分

## 2. True or False (20 points, 2 point for each statement)

1	2	3	4	5	6	7	8	9	10

~~(X)~~ Store-and-forward connection means that the switch must receive the entire packet before it can begin to transmit the first bit of the packet onto the outbound link.

~~(X)~~ In a circuit-switched network, if each link has  $n$  circuits, for each link used by the end-to-end connection, the connection gets  $n$  times of the link's bandwidth for the duration of the connection.  
fraction

- ~~(3)~~ If the traffic intensity is close to one, the average queuing delay will be close to ~~one~~.  $\infty$   
~~(4)~~ HTTP uses non-persistent connections in its default mode.  
~~(5)~~ A web cache can reduce traffic on an institution's access link to the Internet.  
~~(6)~~ Flow control and congestion control are same at that they all limit the rate of the sender but differ in that flow control limits its rate by the size of RcvWindow while congestion control by the traffic on the link  
~~(7)~~ Either of the two processes participating in a TCP connection can end the connection.  
~~(8)~~ The pipeline protocol is highly inefficient when there is a large distance between source and destination and the transmission rate is high. stop-and-wait  
~~(9)~~ The ARP table is configured by a system administrator  
~~(10)~~ The MAC address doesn't change no matter where the adapter goes.

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### 3. Please answer following questions briefly (30 points.).

ssn=64 MSS=4 rwind=24

- (1) Consider a TCP connection using the slow-start congestion control scheme with an initial THRESHOLD value of 64kB and a Maximum Segment Size (MSS) of 4kB. The receiver's advertised window is initially 24kB. The first transmission attempt is numbered 0, and all transmission attempts are successful except for Timeouts on attempt number 4. In the ACKs for transmission attempt number 6 and subsequently, the receiver's advertised window is reset to 12kB. Find the size in kB of the sender's sending window for its first 9 transmission attempts (numbers 0 – 8) (8 points)

Transmission Attempts no.	Size of Sending Window (kB)
0	4
1	8
2	16
3	24
ssn=12 <u>4</u> lost	<del>4</del> 4
5	<del>8</del> 8
6 ack rw=12	<del>12</del> 12
7	<del>12</del> 12
8	<del>12</del> 12

此时MSS变为1  
但大小为4kB

- (2) The figure 1. shows a portion of the internet with four autonomous systems, one of which is shown with four routers, each with its own /16 subnet. Note that each of the other ASs has a /8 subnet. (10 points)

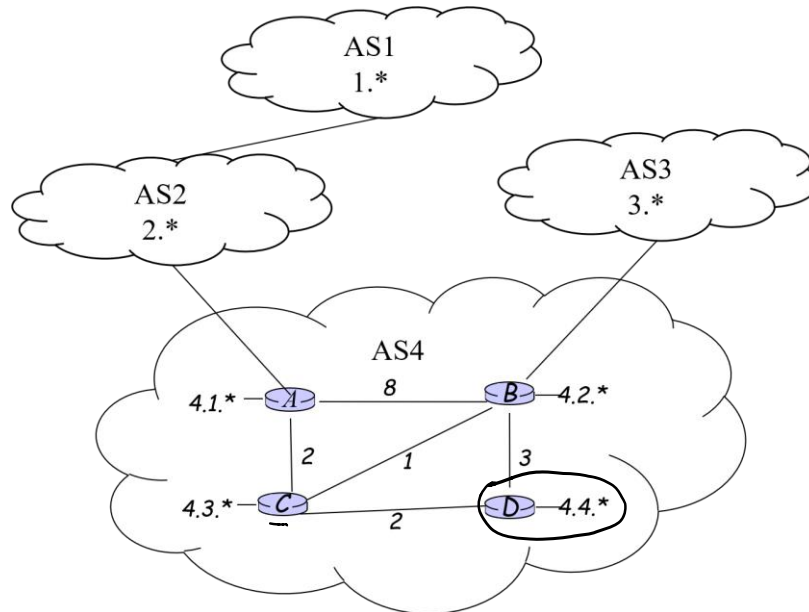


figure 1.

- a) Assume that AS4 uses a LS algorithm as its intra-AS routing algorithm and each node initially knows the costs to each of its neighbors. Show how node D compute the shortest path to all the other nodes by filling the following table (4 points)

N'	D(A), P(A)	D(B), P(B)	D(C), P(C)
D	$\infty$	3, D	2, D ✓
DC	4, C	3, D ✓	
DCB	4, C		
DCBA			

- b) Assume that BGP as the inter-AS routing algorithm among these Ases and there are no policy constraints that must be satisfied. There is a part of the forwarding table on node D. Please complete it (3 points).

prefix	Output link
1.*	(D,C)
2.*	(D,C)
3.*	(D,B)

- c) For AS4, which routers are gateway routers? (1 point)

routerA routerB

- d) Router A learns the prefix 3.\* from which protocol: eBGP, ~~iBGP~~ or LS ? (1 point)

iBGP

- e) Router A learns the prefix 1.\* from which protocol: ~~eBGP~~, iBGP or LS? (1 point)

eBGP

- (3) Consider a network in Figure 2, where 2 hosts are connected by 5 links and 4 relay devices. One host wants to send a file of 10M bits to the other host. The network is lightly loaded so that there are no queuing delays. The total propagation delay between the two hosts is fixed on 2000 bit times. The transmission rate of each link is 100M bps and the links are full duplexed. The process delay on hosts and relay devices are ignored. Unless indicated otherwise, all packets are received properly and in the same order as they are sent. (12 points)

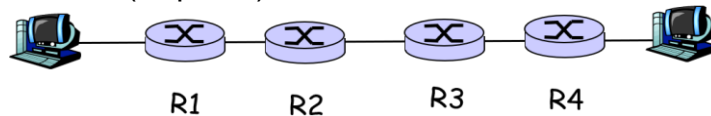


figure 2.

- a) Suppose the network is a virtual circuit network and all the relay devices are virtual circuit switches. Suppose the VC set-up time is 20ms and the whole file is transferred as one packet. Ignoring the bits of header appended during the transmission, how long does it take to send the file from source to destination? (2 points)

$$2000 \text{ bit time} = \frac{2000 \text{ b}}{100 \text{ Mbps}} = 0.02 \text{ ms}$$

$$20 \text{ ms} + \frac{10 \text{ Mb}}{100 \text{ Mbps}} \times 5 + 0.02 \text{ ms} = 520.02 \text{ ms}$$

- b) Suppose the network is a datagram network and all the relay devices are routers. Further suppose that a connectionless service is used and the whole file is transferred as one packet. Ignoring the bits of header appended during the transmission, how long does it take to send the file? (2 points)

$$\frac{10 \text{ Mb}}{100 \text{ Mbps}} \times 5 + 0.02 \text{ ms} = 500.02 \text{ ms}$$

- c) Suppose the network is a datagram network and all the relay devices are routers. Further suppose that the whole file is broken into 10 equal sized packets and a connectionless service is used. Ignoring the bits of header appended during the transmission, how long does it take to send the file? (2 points)

$$\frac{1 \text{ Mb}}{100 \text{ Mbps}} \times (5 + 10 - 1) + 0.02 \text{ ms} = 140.02 \text{ ms}$$

- d) Suppose the network is a datagram network. The relay device R1 is a switch, R2 is a HUB, and R3 and R4 are two routers. Further suppose that the whole file is broken into 10 equal sized packets and a connectionless service is used. Ignoring the bits of header appended during the transmission, how long does it take to send the file? (2 points)

$$\begin{aligned} & \frac{1 \text{ Mb}}{100 \text{ Mbps}} \times (4 + 10 - 1) + 0.02 \text{ ms} \\ &= 130 \text{ ms} + 0.02 \text{ ms} = 130.02 \text{ ms} \end{aligned}$$

- e) Suppose the network is a datagram network and all the relay devices are routers. Further suppose that the whole file is broken into 10 equal sized packets and a stop-and-wait based reliable data transfer protocol (for example, rtd 3.0) is used. Ignoring the bits of header appended during the transmission and the transmission delay of ACKs, how long does it take to send the file? (2points)

$$RTT = \frac{1Mb}{100Mbps} \times 5 + 0.02ms + 0.02ms = 10.04ms$$

$$10 \times RTT = 100.4ms$$

- f) Suppose the network is a datagram network and all the relay devices are routers. Suppose that the whole file is broken into 10 equal sized packets and the SR scheme is used for transmission. The timer is fixed on 1 second and the size of sending window is fixed on 5 packets. Assume the ACK packet for the first transmission of 4th data packet lost and all the other packets and ACKs are received correctly and in the same order they are sent. Ignoring the bits of header appended during the transmission and the transmission delay of ACKs, how long does it take to send the file? (2 points)

$$\text{发送一个窗口所需时间} = 5 \times \frac{1Mb}{100Mbps} = 50ms < RTT$$

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评阅教师	得分

#### 4. Analysis & Calculation. Please illuminate your analysis or calculation process step by step. (20 points)

Consider a network in Figure 3, where three routers R1, R2 and R3, a HUB H1, and three switches S1, S2, and S3, connect 6 hosts (from A to F). The numbers (1, or 2) besides the routers indicate their interfaces. A DHCP server runs on the router R1.

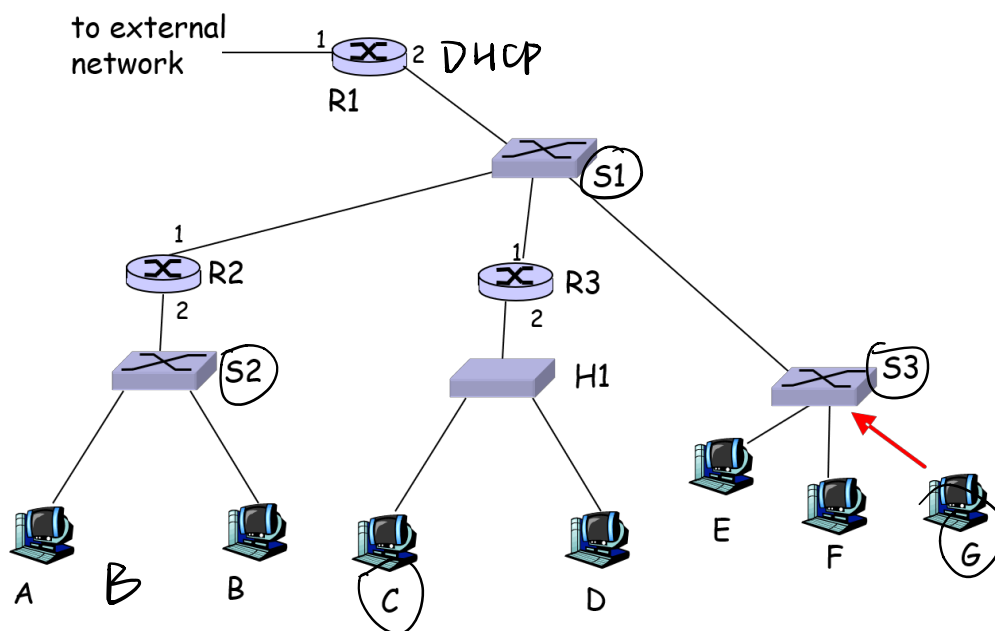


Figure 3

- 1) Suppose host A wants to send an IP datagram packet to host B. Host A will send a packet like below. How does host A know that it can directly forward the packet to host B instead of asking for its default router R2 to help deliver it. (2 points)

*The packet from A to B*

Source MAC	Destination MAC	Source IP	Destination IP
A's MAC address	B's MAC address	A's IP address	B's IP address

对比A与B的IP地址,在同一子网中,  
则不需要通过默认网关R2进行路由。

- 2) Suppose a new host (host G) is connected this network via the switch S3. The host G has to send a DHCP discover message to request an IP address. Please list the source and destination MAC address and IP address in this DHCP discover message. (2 points)

*The DHCP discover message*

Source MAC	Destination MAC	Source IP	Destination IP
G's MAC	FF	G's IP	255.255.255.255

- 3) Which of the nodes in this network will receive the DHCP discover message? (2 points)

R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, E, F

路由器会处理避免广播风暴, R<sub>2</sub>与R<sub>3</sub>不会转发 DHCP message

- 4) Once receiving this DHCP discover message, the DHCP server on R1 sends a DHCP offer message. Please list the source and destination MAC address and IP address in this DHCP offer message. (2 points)

*The DHCP offer message*

Source MAC	Destination MAC	Source IP	Destination IP
R1's MAC	FF	R1's IP	255.255.255.255

- 5) Which of the nodes in this network will receive the DHCP offer message? (2 points)

R<sub>2</sub>, R<sub>3</sub>, E, F, G



- 6) Suppose host C send a packet to host G, right after host G completing the DHCP process and getting an IP address. The ARP queries are needed due to the empty ARP table on host C. Please list the source and destination MAC address and IP address in the ARP query packet C send (2 points)

The ARP query packet

Source MAC	Destination MAC	Source IP	Destination IP
C's MAC	FF	C's IP	<del>G's IP</del>

R3 #2

- 7) Please list the source and destination MAC address and IP address in the frame C send. (2 points)

The frame C send

Source MAC	Destination MAC	Source IP	Destination IP
C's MAC	R3's MAC	C's IP	G's IP

- 8) Which of the nodes in this network will receive the above frame C send? (2 points)

router R3 以及 D

因为C、D是通过Hub连接的，Hub是物理层器件，只转发

- 9) Refer to 6), please list the source and destination MAC address and IP address in the frame G received. (2 points)

The frame G received

Source MAC	Destination MAC	Source IP	Destination IP
R3's MAC	G's MAC	C's IP	G's IP

- 10) Refer to 8), (Which of the nodes) in this network will receive the above frame G received? (2 points)

C