

四川大学期末考试试题（闭卷）

(2020~2021 学年第 2 学期)

B 卷

课程号: 311234040 课程名称: 计算机网络和分布式系统 任课教师: _____

适用专业年级: 软件工程 2019 级 学号: _____ 姓名: _____

考生承诺

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

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- 2、 不带手机进入考场；
- 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

- (1). Units of throughput are _____.
A. bits B. bytes C. bits/second D. bytes/second
- (2). Web browsers can obtain objects from Web server through the ____ method of HTTP request.
A. GET B. GET or POST C. GET or HEAD D. GET, POST, or HEAD
- (3). POP3 is used to _____.
A. retrieve mails through Web browsers.
B. retrieve mails through Client software.
C. retrieve mails through Web browsers and Client software.
D. retrieve and send mails.

- (4). During a DNS query and response, the host who send the DNS query message receives the DNS-response message from ____.

A. local DNS server. B. authoritative DNS servers
C. top-level domain DNS servers D. root DNS servers

(5). In connectionless multiplexing and demultiplexing, the Host directs each message segment to the appropriate socket by examining ____.

A. the segment's source IP address and source port number.
B. the segment's source IP address and destination port number.
C. the segment's destination IP address and destination port number.
D. the segment's source port number and destination port number.

(6). ____ is not used to realize the reliable data transfer over a lossless channel with bit errors.

A. Error check B. receiver's feedback C. retransmit D. Timeout

(7). A host obtains the IP address of it's first-hop router through ____.

A. DHCP B. ARP C. DNS D. BGP

(8). A packet switch receives a packet and determines the outbound link to which the packet should be forwarded. When the packet arrives, one other packet is halfway done being transmitted on this outbound link and four other packets are waiting to be transmitted. Packets are transmitted in order of arrival. Suppose all packets are 1,500 bytes and the link rate is 2 Mbps. What is the queuing delay for the packet? ____.

A. 24ms B. 27ms C. 30ms D. 33ms

(9). We consider sending real-time voice from Host A to Host B over a packet-switched network (VoIP). Host A converts analog voice to a digital 64 kbps bit stream on the fly. Host A then groups the bits into 56-byte packets. There is one link between Hosts A and B; its transmission rate is 2 Mbps and its propagation delay is 10 msec. As soon as Host A gathers a packet, it sends it to Host B. As soon as Host B receives an entire packet, it converts the packet's bits to an analog signal. How much time elapses from the time a bit is created (from the original analog signal at Host A) until the bit is decoded (as part of the analog signal at Host B)? ____.

A. 17.224ms B. 17ms C. 18.224ms D. 16.224ms

(10). Suppose there is a 10 Mbps microwave link between a geostationary satellite (36000km away from earth surface) and its base station on Earth. Every minute the satellite takes a digital photo and sends it to the base station. Assume a propagation speed of 2.4×10^8 meters/sec. Let x denote the size of the photo. What is the minimum value of x for the microwave link to be continuously transmitting?

A. 6.0×10^8 bits B. 1.5×10^6 bits C. 6.0×10^7 bits D. 1.5×10^8 bits

(11). UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: 01010011, 01100110, 01110100. What is the complement of the sum of these 8-bit bytes?

A. 11010001 B. 00101110 C. 00101101 D. 11010010

(12). Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?

- A. 207 B. 127 C. 206 D. 126

(13). Suppose an application generates chunks of 40 bytes of data every 20 msec, and each chunk gets encapsulated in a TCP segment and then an IP datagram. What percentage of each datagram will be overhead?

- A. 66.67% B. 50% C. 58.82% D. 33.33%

(14). Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes?

- A. 3379 B. 3334 C. 3425 D. 3473

(15). Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

Table 1

Prefix Match	Interface
1	0
10	1
111	2
otherwise	3

Please give the associated range of destination host addresses and the number of addresses in the range of interface 0.

- A. 128 B. 64 C. 32 D. 32

(16). Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. What's the size of the last datagram?

- A. 340 B. 360 C. 320 D. 380

(17). Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4. Router 3c learns about prefix x from which routing protocol?

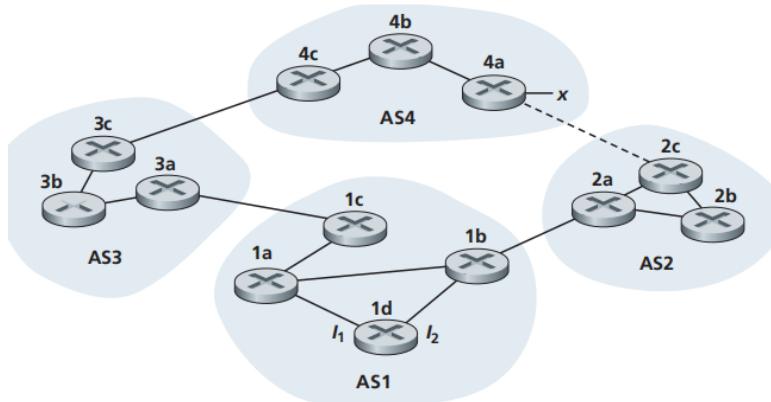


Fig. 1

A. OSPF

B. eBGP

C. RIP

D. iBGP

(18). Suppose the information content of a packet is the bit pattern 1110 0110 1001 1101 and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length checksum field is used.

A. 11101 01100 10010 11011

B. 1110 0011 0110 0111 1010 1100 1

C. 1110 1011 0010 0101 1011 1100 0

D. 1110 0011 0110 0101 1011

(19). Consider the 5-bit generator, $G=10011$, and suppose that D has the value 1010101010. What is the value of R?

A. 0111

B. 101

C. 100

D. 0100

(20). In CSMA/CD protocol, after a collision, the adapter selects random number K=100 to calculate the waiting time, how long does the adapter wait until returning to send the frame again 2 for a 10 Mbps broadcast channel?

A. 100ms

B. 0.01ms

C. 5.12ms

D. 40.96ms

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

- (1). Router and link layer switch are switch.
- (2). IEEE 802.11 is the standard of Ethernet.
- (3). The Internet core is Web servers and mail servers.
- (4). Web browsers can retrieve multiple objects over parallel connections, but only one TCP is established even when browsers work in parallel mode.
- (5). In SMTP, the body (not just the headers) of all mail messages is restricted to simple 7-bit ASCII.

- (6). The IP checksum is calculated over the datagram, but the TCP checksum is calculated over the header.
- (7). For all the ARP response messages a Host received, each different IP address has a different MAC address.
- (8). Border Gateway Protocol runs on border routers and non-border routers.
- (9). If there are two or more routes to the same prefix, then BGP uses hot-potato routing to determine final route.
- (10). HOL blocking may occur in input queue and output queue.

评阅教师	得分

3. please answer following questions briefly. (30 points)

- (1). (11 points) The relationship between TCP congestion window size (cwnd) and transmission rounds is as follows. Answers the following questions.

Table. 2

Round	1	2	3	4	5	6	7	8	9	10	11
Cwnd	1	2	4	8	16	32	33	34	35	36	37
Round	12	13	14	15	16	17	18	19	20	21	22
Cwnd	21	22	23	14	15	16	17	18	1	2	4

- a) Identify the intervals of time when TCP slow start is operating. (1 points)
- b) Identify the intervals of time when TCP congestion avoidance is operating. (1 points)
- c) After the 11th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? (1 points)
- d) After the 20th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? (1 points)
- e) What is the initial value of ssthresh at the first transmission round? (1 points)
- f) What is the value of ssthresh at the 14th transmission round? (1 points)
- g) What is the value of ssthresh at the 21th transmission round? (1 points)
- h) During what transmission round is the 65th segment sent? (2 points)
- i) Assuming a packet loss is detected after the 22th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of ssthresh? (2 points)

- (2). (9 points) A Consider a client and a Web server directly connected by one link of rate R. Suppose the client wants to retrieve an object whose size is exactly equal to $15S$, where S is the maximum segment size (MSS). Denote the round-trip time between client and server as RTT (assumed to be constant). Ignoring protocol headers, determine the time to retrieve the object (including TCP connection establishment) when
- $4S/R > S/R + RTT > 2S/R$, please draw the seqency diagram and write the calculation steps (3 points)
 - $S/R + RTT > 4S/R$, please draw the seqency diagram and write the calculation steps (3 points)
 - $S/R > RTT$, please draw the seqency diagram and write the calculation steps (3 points)
- (3). (10 points) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of $RTT_1, \dots, R T T_n$. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object,
- how much time elapses from when the client clicks on the link until the client receives the object? (2 points)
 - suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with non-persistent HTTP with no parallel TCP connections? (2 points)
 - suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with non-persistent HTTP with the browser configured for 5 parallel connections? (2 points)
 - suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with persistent HTTP? (4 points)

评阅教师	得分

4. Analysis (20 points)

Consider a network in Figure 2, where each link is labeled with band-width and propagation delay. DHCP server runs on the router 2 and router 3. The numbers (1, 2, or 3) besides the routers indicate their interfaces. Please answer the following questions.

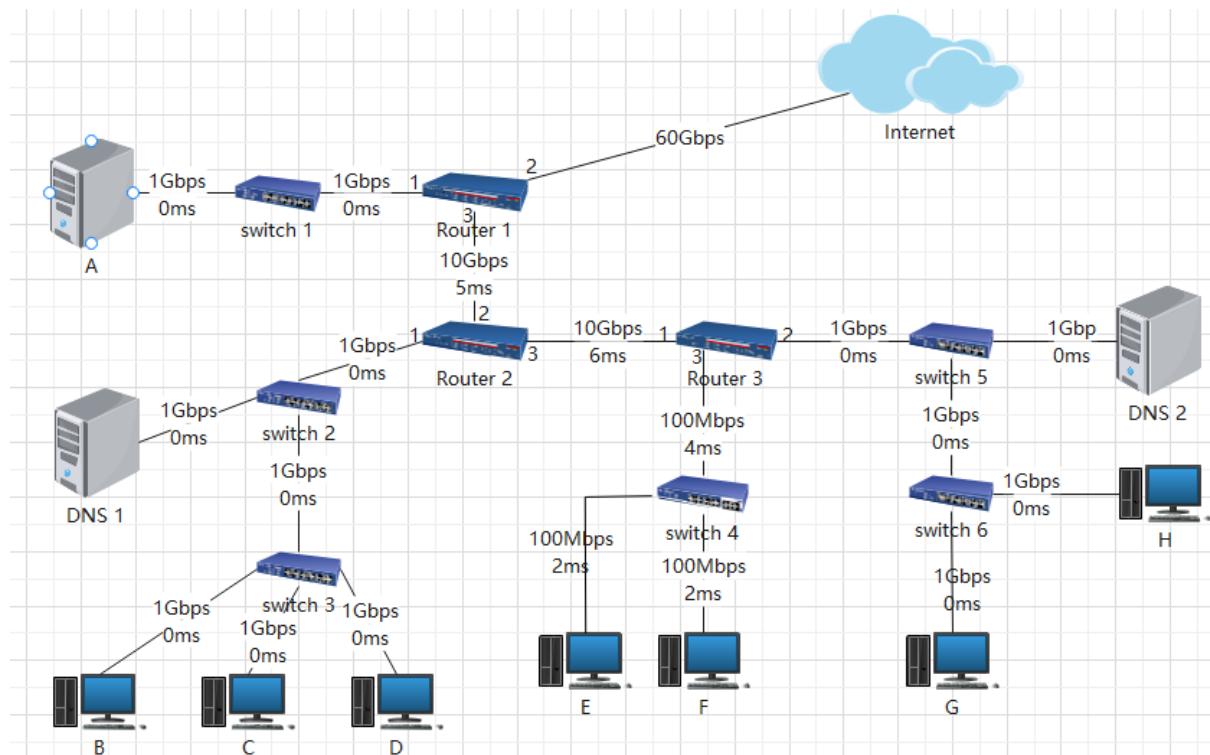


Fig. 2

- e) Identify the number of subnets in the figure above. (1 point)
- f) Let's assume that the block address is 202.115.32.46/24, please assign IP address ranges to all subnets. (5 points)
- g) Based-on the addresses you assigned in the last question, fill the forwarding tables of router 1, router2, and router3 (using longest prefix matching, the prefix should take the form a.b.c.d/x). (6 points)

router1's forwarding table

Prefix	interface

Router2's forwarding table

Prefix	interface

Router3's forwarding table

Prefix	interface

- h) What is the end--to--end delay from when a datagram whose length is 1500bytes is transmitted by host A to when it is received by E? In this case, we assume there are no caches, there's no queuing delay and no processing delay, and the header length of frame is ignored. (2 points)
- i) Now suppose the host G send a large number of UDP packets to the host F back-to-back. What is the throughput from G to F? (1 point)
- j) Suppose Host A would like to send an IP datagram to Host G, and A's ARP is empty. Thus, A will broadcast an ARP request message.
 - ① What actions will switch 6 perform once it receives the ARP request message? (1 point)
 - ② Will router 3 also receive this ARP request message? (1 point)
 - ③ If so, will router 3 forward the message to router 2? (1 point)
 - ④ Which node will send the ARP response message to Host A? (1 point)
 - ⑤ What will switch 6 do once it receives the ARP response message? (1 points)