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

   (1). Which of the following protocols is stateless? _____
   　A. HTTP　　　　　B. FTP　　　　　C. POP3　　　　D. SMTP

   (2). In FTP, the well-known port _____ is used for the control connection and the well-known port _____ for the data connection.
   　A. 20;21　　　　　B. 21;20　　　　C. 21;22　　　　D. 22;21

   (3). In a _____ connection, one TCP connection is made for each request/response.
   　A. persistent　　　B. nonpersistent　　C. HTTP　　　D. TCP

   (4). _____ is a supplementary protocol that allows non-ASCII data to be sent through e-mail.
   　A. SMPT　　　　　B. MPEG　　　　C. MIME　　　　D. POP

   (5). When a browser simultaneously opens two connections to the same Web server, which of the following parameters of TCP connections is different? _____
   　A. source port　　　B. destination port　C. source IP　　D. detination IP

   (6). Suppose host A sends host B one TCP segment with sequence number 418, acknowledgement number 571, and 4 bytes of data. Then the sequence number in the acknowledgement to this segment is _____
   　A. 422　　　　　B. 418　　　　　C. 571　　　　　D. 575

   (7). 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.

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

   (9). Which of the following devices performs Lay-3 switch? _____
   　A. switch　　　　　B. hub　　　　　C. router　　　D. bridge

   (10). IP is responsible for _____ communication while TCP is responsible for _____ communication.
   　A. host-to-host; process-to-process　　　B. process-to-process; host-to-host
   　C. node-to-node; point-to-point　　　D. point-to-point; node-to-node

   (11). Which of the following algorithm has the so called count-to-infinity problem?

A. Flooding algorithm　　　　　　　　B. Link-state algorithm
C. Distance vector algorithm　　　　　D. None of the above

(12). What is a broadcast IP address for 193.140.141.128 / 26 ?
   A. 193.140.141.128　　　　　　　　B. 193.140.141.127
   C. 255.255.255.63　　　　　　　　　D. 193.140.141.191

(13). Let's assume there is 16-bit piece data 1011 1011 1001 1001, The 8-bit Internet checksum for this data should be _____
   A. 01010100　　　　　　　　　　　B. 01010101
   C. 10101011　　　　　　　　　　　D. 10101010

(14). For the data in (13), the CRC is applied to it with generator 1001. Thus the CRC bits should be _____
   A. 010　　　　　B. 001　　　　C. 111　　　　D. 101

(15). What is the name of the algorithm used in CSMA/CD networks in order to avoid repeated collisions?
   A. collision avoidance　　　　　　　B. crash prevent
   C. exponential back-off　　　　　　　D. exponential collisions

(16). 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

(17). Which of the following protocol layers is not explicitly part of the Internet Protocol Stack? _____
   A. application layer　　　　　　　　B. session layer
   C. data link layer　　　　　　　　　D. transport layer

(18). What is the name of the forwarding device in the middle of the diagram below?
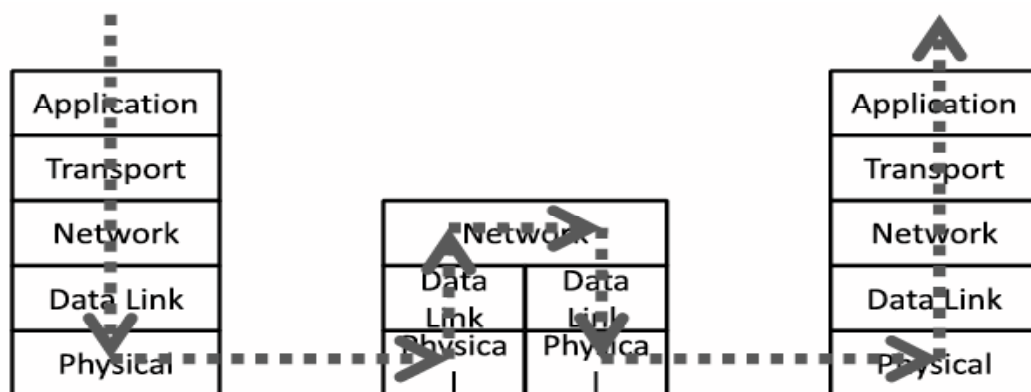
   A. Switch　　　　B. Router　　　　C. Hub　　　　D. Bridge

(19). In the Internet protocol stack, the link layer provides the service to _____
   A. physical layer　　　　　　　　　B. network layer
   C. transport layer　　　　　　　　　D. application layer

(20). 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

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

(1). It is possible for a mail client to send e-mail messages over HTTP rather than SMTP.

(2). The Slow-Start algorithm increases a source's rate of transmission faster than "additive increase"

(3). There is no network congestion in a circuit switching network.

(4). TCP applies fast retransmit to a segment when it estimates unusually large RTT.

(5). BGP exchanges link weights.

(6). In IP, CRC is introduced for error dection.

(7). RTS/CTS is used to solve hidden-terminal problem.

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

(9). 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. [12a]

(10).　When a TCP segment arrives to a host, the socket to which the segment is directed　depends on the source IP address of the datagram encapsulated the segment，the source port number，the destination port number and the destination IP address.

3. please answer following questions briefly (36 points)。

(1). (8 points) Consider a subnet with prefix 202.202.202.64/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to an interface in this network. Suppose an ISP owns the block of addresses of the form 202.202.202.64/26. And suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?

(2). (15 pionts)Suppose that a browser on host A wants to retrieve an HTML document (D), and an embedded image (I), from a host B. Assume that A does not initially now the IP address of B, but A's local name server S does know B's IP address. Also, assume that the browser on A uses HTTP/1.0 (the non-persistent version).

Show the chronological sequence of transport layer segments (TCP or UDP) sent and the respective application layer data type (DNS or HTTP) by filling in the following table. Also,

for each TCP packet state when any of the SYN, FIN and/or ACK bits in the TCP header are set to 1.

	source	destination	Transport Layer protocol	Application Layer Protocol
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

(3). (13 points) You are sending a message with 10 segments, each having a sequence number from 1 to 10. The flow control algorithm used between the sender and receiver is Go-Back-N using cumulative ACKs where the sender window size is 3. Under the set of assumptions below, how long does it take before the sender deems the transmission complete if:

- The first transmission of segment 5 is not received by the receiver.

- The second transmission of segment 5 is received by the receiver but the ACK is slow, taking 60 ms (instead of 20ms as mentioned below). It still takes 20 ms for the segment to be sent from the sender to the receiver.

- The first ACK sent by the receiver after receiving segment 8 is not received.

Several assumptions:

- Sequence numbers are assigned to segments rather than bytes.

- Unless indicated otherwise, all segments were received properly and received in the same order as they were sent.

- It takes the sender 10 ms to "push" the segment onto the network. This means that if segment 1 is pushed onto the network starting at time 0, then segment 2 can started to be pushed onto the network at 10 ms.

- Unless indicated otherwise, each successfully transmitted segment has a round trip time of exactly 40ms (20 ms each way). This time includes transmission time.

- The sender only retransmits on timeouts. The timeout timer is set at 60 ms for all segments.

- No congestion control is used.

- There is no processing delay. As soon as an ACK is received by the sender, it can immediately (in the same time instant) start pushing a segment onto the network if appropriate.

Show your work by filling in the table on the following page. For each time interval, write the sequence number of any segment that is sent (i.e., starting to be pushed onto the network) in the SEND column.   Similarly, write the sequence number included in any ACK received in the RECV column.   To help you get started, segments 1 is done for you.   ***Not all of the rows will be necessary***.

Time	SEND	RECV	Time	SEND	RECV
0	1		220		
10			230		
20			240		
30			250		
40		1	260		
50			270		
60			280		
70			290		
80			300		
90			310		
100			320		
110			330		
120			340		
130			350		
140			360		
150			370		
160			380		
170			390		
180			400		
190			410		
200			420		
210			430		

4. Analysis (14 points)。

As in fig 2, consider a source host connects to a destination host via a layer-2 switch and a router. Each link of the connection path is 100 Mbps. The distance beween source host and switch is 0.5 km. The distance between switch and router is 0.5 km and the distance between route and destination host is 1 km..

A. What is the total propagation delay for a packet going from source to destination? You can

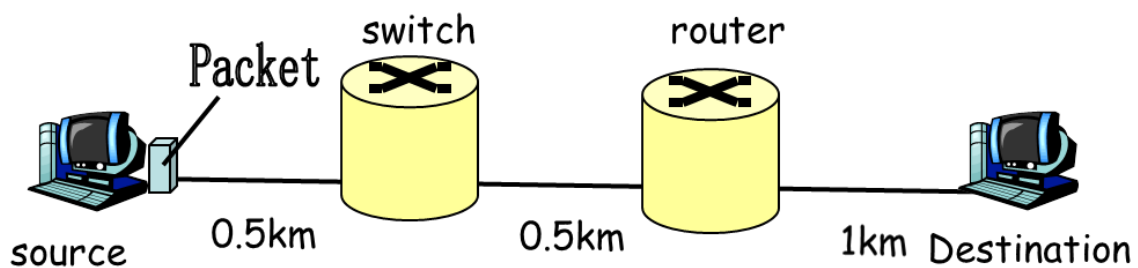assume the propagation speed of each link is 200,000 km/s. (3 pionts)

Fig 1.

B. Assume that the MTU of each link is 1500 bytes. If source host want to send a MP3 file of 3M

bytes, how many packets would be sent by source ? (4 pionts)

C. Assume that the header size of link layer protocol is 20 bytes. How long does it take to move

the MP3 file from source host to destination host ? Ignoring the processing delay and

queuing delay. (4 pionts)

D. What is the average througput for transimission this MP3 file? (3 points)