Section I. Multiple Choice Questions (MCQs)

Each MCQ has one correct answer. There is no penalty for wrong answers.

1. Which of the following statements about HTTP is FALSE?
   - **A.** HTTP runs on top of TCP.
   - **B.** HTTP is an application layer protocol.
   - **C.** In HTTP/1.0, the server will close the connection after every request.
   - **D.** In HTTP/1.1, the default connection type is persistent.
   - **E.** HTTP is only used to download HTML data from a Web server.

2. UDP uses _____ to dispatch incoming packets to different processes in the same host.
   - **A.** multiplexing
   - **B.** de-multiplexing
   - **C.** congestion control
   - **D.** flow control
   - **E.** IP address

3. Which of the following statements about DNS is FALSE?
   - **A.** DNS provides hostname to IP address mapping.
   - **B.** A hostname may be mapped to multiple IP addresses.
   - **C.** The root servers have to be accessed for every DNS query.
   - **D.** DNS servers listen to UDP port 53.
   - **E.** Failure to contact DNS servers can cause disruption in access to Internet services.

4. A port number in TCP is _____ bytes long.
   - **A.** 1
   - **B.** 2
   - **C.** 4
   - **D.** 16
   - **E.** 32

5. In a _____ network, data is first divided into manageable chunks before being sent.

   A. connection-oriented
   B. connection-less
   C. circuit-switching
   D. packet-switching
   E. telephone

D. ✓

6. The _____ layer of the Internet protocol stack is responsible for delivering data from sending process to receiving process.

   A. application
   B. transport
   C. network
   D. link
   E. physical

B. ✓

7. In HTTP, a response status code of 404 tells you

   A. Web server is unavailable
   B. Web server is currently busy
   C. your browser needs to be updated to the latest version
   D. the requested Web object is not found
   E. your HTTP request is malformed

D. ✓

8. It's said that a TCP Client/Server connection formation is "asymmetric" because a TCP server must exist before a TCP client can communicate with it. What can be said about UDP-based connection formation?

   A. A UDP client may send data to a non-existing UDP server without noticing that server is offline. ✓
   B. A UDP server must exist before a client can send data to it. Otherwise client will encounter an exception. ✗
   C. A UDP client and server must exchange control information before the client can send data to the server. ✗
   D. Two UDP clients on one host cannot communicate with the same UDP server at the same time. ✗
   E. None of the rest

A. ✓

9. Which of the following is a correct description of **`nslookup`**?

   A. It is used to check network connectivity to destination host.
   B. It is used to trace the network path between source and destination hosts.
   C. It is used to show network configuration of a host.
   D. It is used to find the DNS mapping between hostname and IP address.
   E. None of the rest

D.

10. In rdt 3.0, what does the sender do if it receives a corrupted ACK and what does the receiver do if it receives a corrupted packet?

   A. Sender does nothing; receiver does nothing.
   B. Sender does nothing; receiver sends ACK for the previous packet.
   C. Sender resends data packet; receiver does nothing.
   D. Sender resends data packet; receiver sends ACK for the previous packet.
   E. None of the rest

B.

11. Suppose there are multiple unacknowledged packets. Upon a timeout event, GBN sender retransmits __all__ packet(s), SR sender retransmits __that__ packet(s) and TCP sender retransmits __that.__ packet (s).

   A. One; one; one
   B. One; multiple; multiple
   C. Multiple; one; multiple
   D. Multiple; one; one
   E. None of the rest

TCP ACK up to first missing byte.

E. D.

12. In SR, ACK m means _____.

   A. Receiver has received all the packets up to packet m.
   B. Receiver has received all the packets up to packet m-1.
   C. Receiver has received packet m. But there is no implication on the receipt of other packets.
   D. The next in-order packet expected by receiver is packet m.
   E. None of the rest

C.

13. How many of the following IP addresses belong to the subnet 192.168.160.0/20?

i. 192.168.15.1
ii. 192.168.177.254
iii. 192.188.168.230
iv. 192.168.169.31

A. 0
B. 1
C. 2
D. 3
E. 4

14. Study the following Python code snippet.

```
s = socket(AF_INET, SOCK_STREAM)
s.connect(("www.example.org", 12345))
```

Suppose the above code snippet is executed with no error, which of the following protocols is NOT directly or indirectly invoked?

A. TCP
B. UDP
C. HTTP
D. DNS
E. None of the rest

15. A huge file is transferred over an existing TCP connection (i.e., 3-way handshake is already done). The connection is still open after transmission. The first and last TCP segments have the sequence numbers 12,345 and 2,105 respectively. MSS is 1,024 bytes and TCP sends as much data as possible in a segment.

How many TCP segments are used to transfer the file (i.e. carries file data), assuming the communication channel is perfectly reliable?

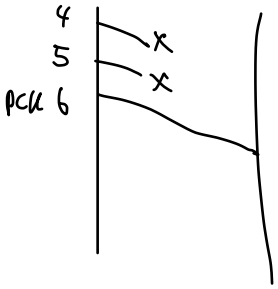
(Hint: TCP sequence number will wrap up and restart from 0 after reaching the biggest sequence number)

A. 10
B. 4,194,294
C. 4,194,295
D. 4,194,303
E. None of the rest

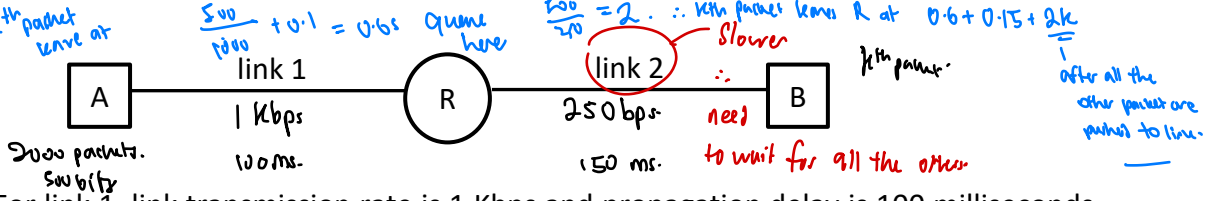
16. Consider a sender and a receiver communicating using Selective Repeat protocol. Every packet embeds a 3-bit sequence number field. Sender just sends a packet with sequence number 6. Sender window size is 3.

Which of the following CANNOT possibly be the sequence number of the next packet transmitted by sender?

A. 0
B. 2
C. 4
D. 5
E. 6



17. Two hosts **A** and **B** are connected by a router **R** as shown in the following diagram.



For link 1, link transmission rate is 1 Kbps and propagation delay is 100 milliseconds. For link 2, link transmission rate is 250 bps and propagation delay is 150 milliseconds. Suppose Host **A** sends 2000 packets to Host **B** continuously and each packet is 500 bits long. Host **A** starts sending the 1st packet at time t = 0.

When (in seconds) will host **B** receive the k^{th} packet ($1 \le k \le 2000$)?

A. $0.75 + 2k$
B. $2.75k$
C. $0.6 + 2k$
D. $0.6 + 2.15k$
E. None of the rest

Section II. SHORT QUESTIONS

Your answer for each of the following questions should be a single number (without any extra character such as blank space or punctuation).

18. Suppose two hosts are connected by a direct link of 1 Mbps. A stop-and-wait protocol is used to transfer 10 packets from the sending host to the receiving host. Each packet is 1000 bytes long. RTT is 24 milliseconds. No packet is lost or corrupted during transmission and ACK packets are of negligible size.

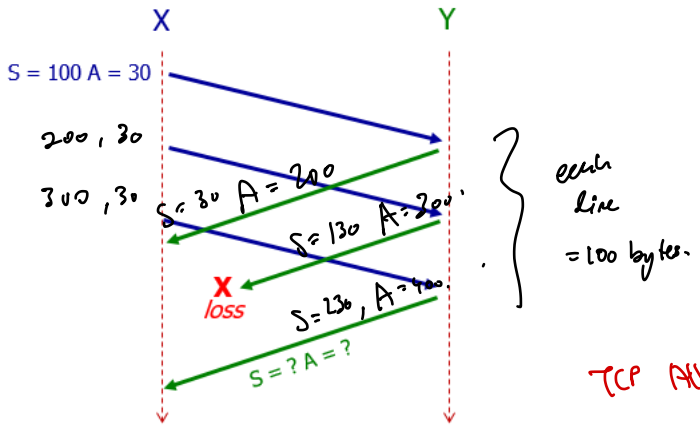
    What is the throughput (in bps) of the transmission?

    _____

19. If a UDP segment contains no application data, what is the binary value of the "length" field in UDP header?

    _____

20. The following diagram shows two hosts **X** and **Y** communicating over a channel using TCP. **X** and **Y** are sending data to each other. Each TCP segment contains 100 bytes of data. None of the segments shown in the figure are retransmitted, out-of-order or corrupted packets. However, the second segment send by **Y** is lost. There are no other unacknowledged segments.



    What would be the sequence number (S) and acknowledgement number (A) in the last segment sent by **Y**?

    S = _____

    A = _____

Suggested answers

1. E
2. B
3. C
4. B
5. D
6. B
7. D
8. A
9. D
10. B
11. D
12. C
13. B
14. C
15. C
16. B
17. A
18. 250000
19. 00000000000 01000
20. 230/400