Midterm questions - Mid

Computer Networks (City University of Hong Kong)

Midterm Quiz

ⓘ This is a preview of the published version of the quiz

Started: Nov 10 at 1:43pm

Quiz Instructions

Time Limit: **60 minutes**.

Click on **Submit** when you are finished. Note that you cannot change your answers after submitting.

You are allowed to use the following materials/aids:
Lecture/tutorial notes, personal notes, and textbooks.
You must **not use sources from the Internet** or any other sources apart from the ones mentioned above. Using a calculator is fine.

Questions? Please send them as a **private message in the chat** of the Zoom meeting.

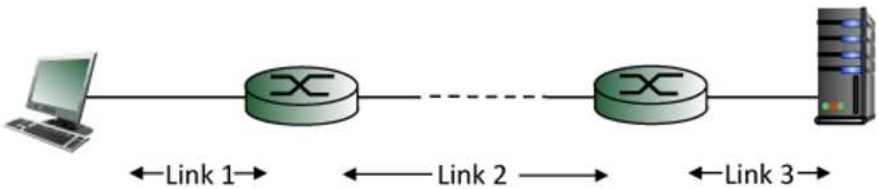
Question 1 — 2 pts

What is DNS used for?
Mark all answers that apply:

- [ ] To provide multiple names to the same machine.
- [ ] To distribute a file among a group of peers.
- [ ] To resolve the IP address of hostnames
- [ ] To transfer messages from one mail server to another.

Question 2 — 2 pts

Consider the connection between the following two hosts.



Suppose that we upgrade the propagation speed and bandwidth of Link 2 but do not change any other parameters of the connection (i.e., the routers and Links 1 and 3 remain unchanged).

Mark the delay that will not be affected by this upgrade:

- ○ Transmission delay
- ○ Queueing delay
- ○ Nodal processing delay
- ○ Propagation delay

Question 3

2 pts

Give two reasons why a video chat application may prefer to use UDP instead of TCP.

p 0 words

Question 4 2 pts

In the context of web caches, mark all correct statements:

- [ ] After sending the requested object to the client, the web cache will immediately delete the object.
- [ ] Whenever an object is updated, the origin server will automatically inform the web cache to update its stale copy.
- [ ] Web caches can significantly reduce the response time during web browsing.
- [ ] Web caches may reduce the traffic intensity on a network's access link.

Question 5 2 pts

Consider file distribution in the context of P2P architectures and client-server architectures. There is a server hosting a file and we would like to distribute the file to a group of peers. Mark all correct statements:

- [ ] The minimum distribution time of a client-server architecture scales linearly with the number of clients that want to obtain the file.

- [ ] The number of peers that can simultaneously download the file from the server is limited by the number of available ports on the server.
- [ ] Once the number of clients becomes large, a P2P architecture is likely to outperform the client-server architecture.
- [ ] In a client-server architecture, the upload capacity of the server increases linearly with the number of peers that request the file.

Question 6

2 pts

In the context of email protocols, explain the difference between SMTP and a mail-access protocol such as IMAP. (2-3 sentences suffice.)

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p 0 words

Question 7

2 pts

In the context of HTTP, mark all correct statements:

- [ ] Persistent HTTP can achieve a speedup by bypassing the transport layer protocol.
- [ ] A client can establish parallel TCP connections to the same web server.
- [ ] The server-side of the HTTP protocol does not need to remember the previous exchange with the client.
- [ ] When pipelining is used, a server will can pack multiple objects into the same HTTP response message.
- [ ] The HTTP protocol requires both the client and the server to keep track of several variables such as rcv_base.

Question 8

2 pts

Consider the following two arrival patterns of packets at a router:

- (A) N packets arrive simultaneously in the 1st timestep and no other packets arrive during the N-1 following timesteps.
- (B) There is a sequence of N timesteps with one packet arriving every second timestep.

Mark all correct statements:

- [ ] (B) will incur a larger average queuing delay compared to (A).
- [ ] The queuing delay for both (A) and (B) will be roughly the same.
- [ ] (A) will incur a larger average queuing delay compared to (B).
- [ ] The traffic intensity is exactly 1 for (B).
- [ ] The traffic intensity is exactly 1 for (A).

Question 9

4 pts

Assume that there is a single router between Alice's host and Bob's host. The bandwidth of the first link, i.e., from Alice's host to the router, is R1 bits/sec. The second link, which connects the router to Bob, has a bandwidth of R2 bits/sec.

A. What is the total end-to-end delay for a packet of K bits that is sent from Alice's host to Bob's host? Ignore queueing, nodal, and propagation delay.
B. Give a formula for calculating the throughput of the connection between the two hosts.

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Question 10

2 pts

Suppose that we use 8-bit sums instead of 16-bit sums to compute the UDP checksum. Consider the following scenario of a segment transfer between a sender and a receiver:

Transmitted by the sender	Received by the receiver
11011100 (byte 1)	1101111**0** (byte 1)
11011110 (byte 2)	1101111**0** (byte 2)
01000100 (checksum)	01000100 (checksum)

Can the receiver detect an error in the segment transmission? Justify your answer.

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Question 11 4 pts

Suppose that there are four packets arrived at a receiver, which contain the following address information, respectively

1. Source: 192.168.0.1, port: 9157;
   Destination: 193.168.20.3, port: 1200
2. Source: 192.168.0.1, port: 8528;
   Destination: 193.168.20.3, port: 1200
3. Source: 192.168.0.3, port: 8528;
   Destination: 193.168.20.3, port: 1200
4. Source: 192.168.0.3, port: 8528;
   Destination: 193.168.20.3, port: 1200
5. Source: 192.168.0.3, port: 8528;
   Destination: 193.168.20.3, port: 1000

Which of the five packets will be delivered to the same socket?

(a) Assume TCP is used.

(b) Assume UDP is used.

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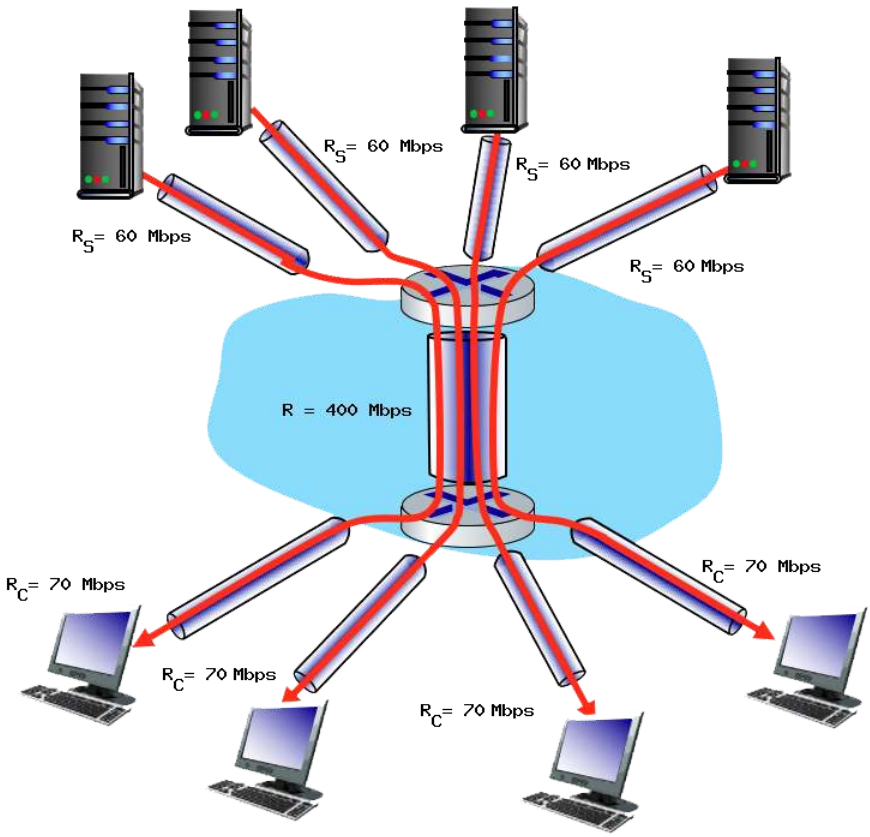
Question 12

4 pts

Consider the scenario shown below, there are four different servers connected to four different clients over four three-hop paths, where the four pairs share a common middle hop with a transmission capacity of R = 400 Mbps. Each of the four links from the servers to the shared link has a transmission capacity of R_S = 60 Mbps, while each of the four links from the shared middle link to each client has a transmission capacity of R_C = 70 Mbps.



- Which link is the bottleneck link in any routing path between a server and a client?
- What is the maximum throughput (in Mbps) for each of four client-to-server pairs, assuming that the transmission rate of middle link is fairly shared (divides its transmission rate equally) among 4 routing paths?

Question 13

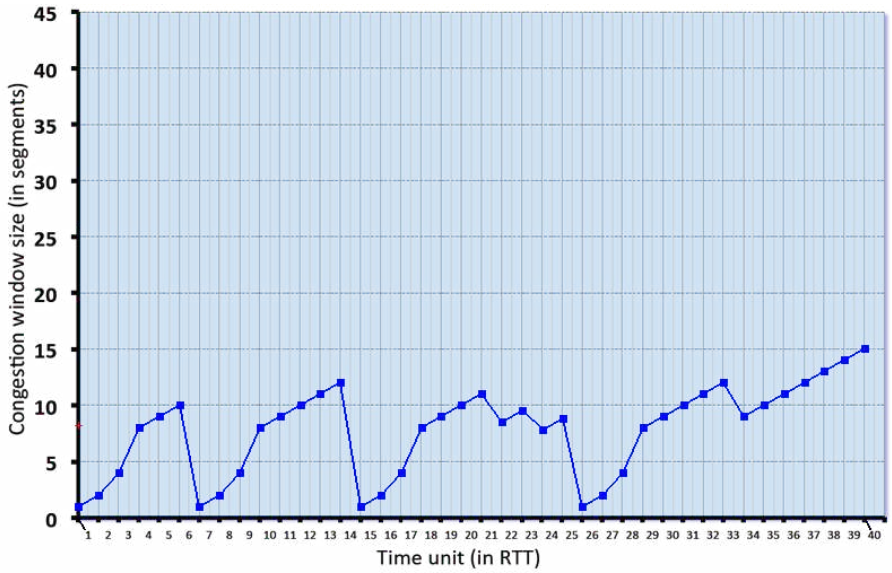
4 pts

Suppose that host A and host B communicate using the TCP protocol. What is the size of the TCP send window for host A if the value of *rwnd (receiver window)* advertised by host B is 5000 bytes, the value of *cwnd (congestion window)* is 7000 bytes, and assuming the link between A and B has a bandwidth of 4500 bytes/sec?

Question 14

6 pts

Consider the figure below, which plots the evolution of TCP's congestion window at the beginning of each time unit (where the unit of time is equal to the RTT). Assume that TCP Reno is used.



A. Give the times at which packets are lost via timeout.

B. Give the time intervals during which the congestion window is in exponential-increase mode.

Question 15

6 pts

A host is **directly** connected to a server through a link with a bandwidth of 50 Mbps ($50*10^6$ bits per second). Assume that the one-way propagation delay is 50 ms. The host retrieves a 500 Kbits ($500*10^3$ Bits) webpage from the server, where the page references 3 images and the size of each image is 1000 Kbits ($1000*10^3$ Bits**)**. Assume that the transmission delay for the HTTP request message is negligible. However, the transmission delay for HTTP response messages is not negligible**.** Calculate how long it takes for the web page (including images) to appear on the user's screen, assuming:

A. Non-persistent HTTP (without parallel connections)
B. Persistent HTTP (with pipelining)

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