TF 5

SECTION I

[5 Marks] True/False – Assess whether the following statements are true or false.

a) [1 Marks] The queuing delay in a router buffer increases with the length of the corresponding link.

False

b) [1 Marks] SMTP can be used to download your emails to your machine from your email server.

False

c) [1 Marks] With non-persistent connections between browser and origin server, you cannot send two distinct HTTP request messages.

True

d) [1 Marks] HTTP/2 is a stateless application layer protocol.

True

e) [1 Marks] Applications can enjoy reliable data transfer over unreliable UDP.

True

Q1 3

SECTION II

1) [6 Marks] Consider an application that transmits data at a steady rate (i.e., not a bursty rate and where the time interval between generated packets is fixed and small), and when it starts, it will stay on for a relatively long period of time. Answer the following questions, briefly justifying your answer:

a) [2 Marks] Which approach to switching, circuit or packet, can support more network users in theory?

Packet switching

-1: reason is ?

b) [2 Marks] Would a packet-switched or a circuit-switched network be more appropriate for the application described above? Why?

Circuit-switched network would be more appropriate.

Because the application wants to transmits data at a steady rate Circuit-switched guarantees bandwidth better than packet-switched

c) [2 Marks] Suppose that a packet-switching network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed (Yes/No)? Why?

Yes.

Since each picket stay on link for a long period of time and the time interval is small so that we need to form congestion control to prevent sender send too many pickets.

3

Q2 8

2) [8 Marks] Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B.

a) [2 Marks] Ignoring the processing and queuing delays, state the expression for the end-to-end delay.

end-to-end delay = $d_{transmission} + d_{prop}$

$= \frac{L}{R} + \frac{m}{s}$ ✓

b) [2 Marks] Suppose Host A begins to transmit the packet at time t = 0. At time t = d_{trans}, where is the last bit of the packet?

The last bit of packet is just accessed to the single link, it is at the beginning of the link, since it just start the propagation ✓

c) [2 Marks] Suppose $d_{prop} > d_{trans}$. At time t = d_{trans}, where is the first bit of the packet?

The first bit of the packet is still on the the single link ✓

d) [2 Marks] Suppose $s = 2.5 \times 10^8$, L = 120 bits, and R = 56 kbps. Find the distance m so that d_{prop} is equal to d_{trans}?

$d_{trans} = \frac{L}{R} = \frac{120}{56 \times 10^3} = 2.143 \times 10^{-3}$ s

Since $d_{prop} = d_{trans}$

$\frac{m}{s} = 2.143 \times 10^{-3}$

$m = 2.143 \times 10^{-3} \times 2.5 \times 10^8$

$m = 5.357 \times 10^5$ m ✓

4

Q3 6

3) [6 Marks] Consider queuing delay in a router buffer.

a) [3 Marks] Suppose N packets arrive simultaneously and no packets are currently being transmitted or queued. Each packet is of length L and the link has transmission rate R. What is the average queuing delay for N packets? Show your working.

First Second third ... Last one

$$\text{The average queuing delay} = \frac{0 + \frac{L}{R} + \frac{2L}{R} + \frac{3L}{R} + \cdots + \frac{(N-1)L}{R}}{N}$$

$$= \frac{L(1+2+3+\cdots(N-1))}{NR}$$

$$= \frac{L \cdot N(N-1)}{2NR}$$

$$= \frac{L(N-1)}{2R}$$

b) [3 Marks] Now suppose that N such packets arrive in batches to the link every LN/R seconds. What is the average queuing delay of a packet? Justify your answer.

Since N packets arrives to the link every $\frac{LN}{R}$ seconds, it implies that when N packets arrives, the link is empty again. So the average queuing delay is the same as (a)

$$\frac{L(N-1)}{2R}$$

5

Q4 0.5

SECTION III

4) [8 Marks] Answer the following questions:

Should state the difference of parameter and data passing -1

a) [2 Marks] What is the difference between HTTP GET and HTTP POST requests?

Get is HTTP request ~~command~~ primitive

Incorrect difference -1

post is HTTP respond primitive

b) [2 Marks] Given an HTTP request. Can you tell if the browser is requesting a ~~persistent connection? How~~ can you tell the IP address of the host on which the

Should use the 'connection' header instead of http version -0.5

n determine it by check it is whether HTTP/1.0 or HTTP/1.1 . Check the header line of request.

IP is not present in the HTTP request -1

as IP address in the format of request

c) [2 Marks] What is the benefit of "Server Push" in HTTP/2? Explain.

reduce the traffic

Advoid head-of-line blocking problem.

transmit independently

Should mention server pushing resources without client request -2

d) [2 Marks] How does HTTP/2 resolve the head-of-line blocking problem in HTTP/1.x?

transmit into multiple and ~~interleaved~~ line to request. and receive independently

By interleaving BOTH requests and responses. Request will not wait. Responses with more delay don't cause delay for others. -2

6

Q5 6

5) [6 Marks] Suppose Bob joins a BitTorrent swarm for the first time.

a) [2 Marks] How will Bob start receiving the file chunks?

Bob starts receiving by other peers since other peers may optimally unchock Bob

2

b) [2 Marks] Suppose Alice provides chunks to Bob throughout a 30-second interval. Must Bob return the favor and provide chunks to Alice in this same interval? Why or why not?

No, because Alice may not be in Bob's top 4 sending rates since other peers may have higher sending rate than Alice

2

c) [2 Marks] Bob claims that he can be a "free-rider" and receive a complete copy of the file that is shared by the other peers. How is this possible with the "tit-for-tat" fair trading scheme in BitTorrent?

Since Bob can be selected randomly by other peer, that is so called optimally unchoke, it can get received by other peers a complete copy of a shared file.

2

7

Q6 1.5

6) [8 Marks] Answer the following questions:

a) [2 Marks] What is the difference between `MAIL FROM:` in SMTP and `From:` in the mail message itself?

use SMTP directly in the client mail server

MAIL FROM is format in SMTP request

MAIL FROM: in SMTP is a message from the SMTP client that identifies the sender of the message to the SMTP server.

st a line in the message, it
ovide any information to the
ver.

b) [2 Marks] download-and-delete mode. Complete the following transaction:

```
C: List
S: 1 498
S: 2 912
S: .
C: retr 1
S: blah blah ...
S: ......blah
S: .
?
?
```

C: download 1

C: delete 1

c) [2 Marks] Does web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?

Web caching reduce the delay for only some of the objects.

Because wer may request for a new web that eb caching.
ing will discard objects periodlly.

-2: It reduces the delay for all objects. For the non-cached objects, the network load is reduced due to the cached objects.

website that wants to keep a purchase record for each of its customers. Describe how this can be done with cookies.

The site will create a unique entry (history of purchase) for each customer to store his or her information to backend database.

once a customer purchased something, the site will modify that cookie which store its purchase history for that customer at the backend database.

-1: Customer ID is generated and stored as cookie number and sent to the client, which is then stored and managed by the browser. The same ID is stored in the database as well. The browser sends the cookie number back in subsequent requests to the website.

9

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Q7 3

7) [8 Marks] Most CDNs take advantage of DNS to intercept and redirect requests. Suppose a content provider, NetCinema, employs the third-party CDN company, KingCDN, to distribute its videos to its customers. On the NetCinema Web pages, each of its videos is assigned a URL that includes the string "video" and a unique identifier for the video itself; for example, Transformers 7 might be assigned http://video.netcinema.com/6Y7B23V. List the two steps that will occur to redirect a request to receive the video from a KingCDN content server. Specify the DNS query and response messages in these steps. You must indicate the type of the received resource record e.g., NS, A, CNAME, MX.

asks the ip adress in the
local DNS will return the
server, The customer
DNS server and then redirect request
itive DNS server to get to
a.. The netcinema will
ma. video to local DNS server
DNS server give it back to
customer.

The client submits a request for the IP of video.netcinema.com to its authoritative DNS server. Because we want to redirect the client to KingCDN, instead of returning an IP we answer with the canonical name of the

Query: video.netcinema.com ? Answer: video.netcinema.com, 1105.kingcdn.com, CNAME **-1**

Now that the client has the canonical name, it queries KingCDN's DNS servers for KingCDN's IP. **-2**

Query: 1105.kingcdn.com ? Answer: 1105.kingcdn.com, IP, A **-1**

10

Q8 3.5

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SECTION IV

8) [12 Marks] Answer the following questions:

a) [2 Marks] Why is it that voice and video traffic is UDP in today's internet?

Since TCP is reliable, SSL and need flow Con UDP can't do so.

Since most firewalls are configured to block UDP traffic, using TCP for video and voice traffic lets the traffic though the firewalls.
or
It may be desirable to employ DASH, which is over TCP. In DASH, video/audio (chunks) are encoded at different bitrates corresponding to different quality levels. Clients can then dynamically choose chunks at different bitrate based on available bandwidth. **-2**

b) [2 Marks] Suppose you have the following 16-bit

1 1 1 0 0 1 1 0 0 1 1 0 0 1 1
1 1 0 1 0 1 0 1 0 1 0 1 0 1 0

Compute the Internet checksum.

1 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0
1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1
+ 1
Sum 1 0 1 1 1 0 1 1 1 0 1 1 1 0 0

∴ the check sum is 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 1

c) [2 Marks] Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Explain.

No

No, the receiver cannot be absolutely certain that no bit errors have occurred. This is because of the manner in which the checksum for the packet is calculated. If the corresponding bits (that would be added together) of two 16-bit words in the packet were 0 and 1 then even if these get flipped to 1 and 0 respectively, the sum still remains the same. Hence, the 1s complement the receiver calculates will also be the same. This means the checksum will verify even if there was transmission error. **-1.5**

d) [2 Marks] An application may choose UDP for a transport protocol because UDP offers finer application control (than TCP) on when the segment is sent. Why?

TCP is slower/has additional overhead due to congestion control and flow control. **-2**

e) [2 Marks] Suppose an application uses rdt 3.0 as its transport layer protocol. As the stop-and-wait protocols have very low utilization, the designers let the receiver send back a number (more than two) of alternating ACK0 and ACK1 even if the corresponding data has not arrived at the receiver. Would this design increase the channel utilization? Why? Are there any potential problems with this approach? Explain.

Yes. This actually causes the sender to send a number of pipelined data into the channel. Yes. Here is one potential problem. If data segments are lost in the channel, then the sender of rdt 3.0 will not re-send those segments, unless there are some additional mechanism in the application to recover from loss. **-2**

f) [ol provides data delivery service ransport layer protocols? Justify.

layer protocol provides logical communication between host and host while transport layer protocols provide logical communication between progress and progress

whaaaat??? it is called "process" not "progress" **-1**

Q9 5

9) [8 Marks] Consider pipelined reliable data transfer protocol behavior in figures below:

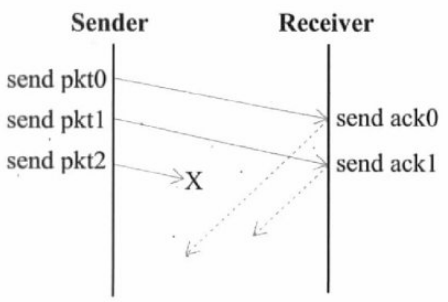

Figure A

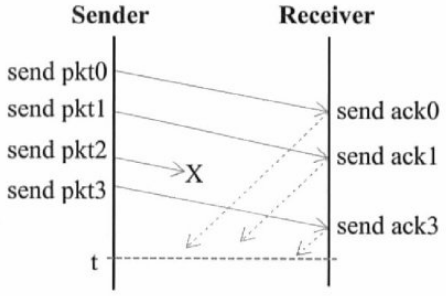

Figure B

a) [4 Marks] Indicate whether Go-Back-N or Selective Repeat is being used, or there is not enough information to tell, in Figure A and B. Explain your answer.

A: there is not enagh information to tell

Explanation?

B.= there is not enough information to tell

b) [4 Marks] Consider Figure B. Suppose the sender and receiver windows are of size N = 4 and suppose sequence number space is [0, 15]. Show the positions of the sender and receiver windows over this sequence number space at time t (the horizontal line).

Sender windows: the positions does not change, still at 0

receiver windows: the position shift; it is at 2

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Q10 2

10) [5 Marks] Consider the following primitives for a simple transport service:

Primitive	Packet Sent	Meaning
LISTEN	(none)	Block until some process tries to connect
CONNECT	CONNECTION REQ.	Actively attempt to establish connection
SEND	DATA	Send information
RECEIVE	(none)	Block until a DATA packet arrives
DISCONNECT	DISCONNECTION REQ.	Request a release of the connection

Primitives of transport service assume asymmetry between the two end hosts during connection establishment, one end (server) executes LISTEN, while the other end (client) executes CONNECT. However, in P2P applications, such as file sharing systems, all end hosts are peers. There is no server or client functionality. How can these transport service primitives be used to build such P2P applications?

In P2P applications, each host acts like both server and client.

For sending:

peers execute CONNECT to the rarest peer while others execute LISTEN. Once connected, then sender SEND (Data), then Disconnect

For receving:

peers excutes 4 L

receive data packet from 4 peers which are the top-4 sending rate.

It need to check whether a peer is in top-4

And periodlly, receiver randomly pick 4 peers to receive.

A separate application-level mechanism is needed that informs the end hosts at run time about which end will act as server and which end will act as client, as well as their addresses.

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