Q 2 → Not checked

Q 1 b & d → Please recheck.

verified

CSL374/CSL672/COL334: Computer Networks, Fall 2015

Minor-1 exam: 60 minutes

CREDIT-

Name: Akhil Soni

Entry #: 2013CS50300

Evaluation (leave blank)

Q1	11	5	Q6	
Q2	7	1.5	Q7	
Q3	5	5	Q8	
Q4	7	2 ✓	Q9	
Q5	7	4½	Q10	

Total (out of 37): 18

1(a) - ~~Answ~~ Time saved is 2.25 s. ✓

1(b) - Three methods are there.

URL Rewriting, HTTP redirect,

1 mark for each method

1. Akamai and Limelight are two content delivery networks.

Akamai places its content servers inside the networks of regional ISPs. An ISP like Airtel may have an Akamai server inside its network, and similarly Reliance may also have an Akamai server inside its network.

Limelight instead runs its own ISP network and peers with regional ISPs. So Airtel will establish a peering relationship with Limelight, so will Reliance, and Limelight servers inside the Limelight network may serve users from Airtel and Reliance.

a. If you run a whois on the IP address of an Akamai server, what ownership will the whois service return? [1]

The ownership will be of Airtel or Reliance, inside which the Akamai server resides.

1

b. Suppose a content provider like Facebook wants to use content delivery networks such as Akamai and Limelight. Give two ways in which Facebook can indicate to clients, to download content from the content delivery network instead of the Facebook servers? Hint: One solution will use DNS and another one will use HTTP. [3]

The DNS way

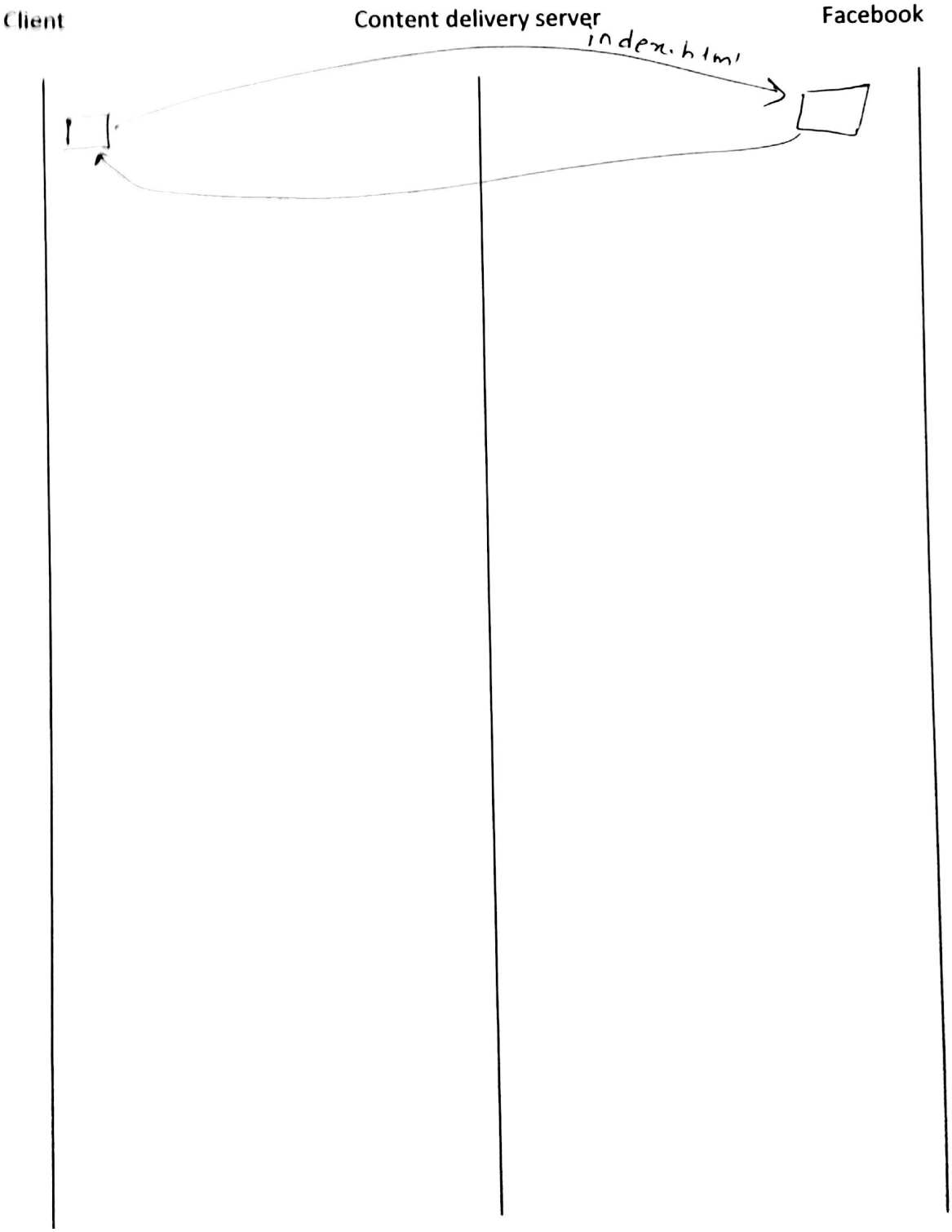
Instead of routing the clients requests' to the Facebook servers' IP, facebook can now route the requests' to Akamai & Limelight servers' IP address. Hence, the clients will now get a reply from Akamai and Limelight instead of facebook which serves the purpose.

The HTTP Way

Facebook can also redirect to the U.R.L. of these content delievery networks like Akamai & Limelight. Hence, now the content will be downloaded from here.

2

c. Assume the page structure is as follows: an index.html file 100KB (1KB = 10^3 bytes) in size, referring to 10 images each 200KB in size. The index.html file is hosted on a Facebook server and the images are all hosted on a content delivery network. The round trip latency between the client and the Facebook server is 500ms (milli seconds), and that between the client and the content delivery server is 250ms. The bandwidth is limited at the client to 100KBps (1KBps = 10^3 bytes per second). Fill out the transaction diagram below assuming persistent HTTP but no pipelining, on a single TCP connection. Assume that DNS resolution has already happened but TCP connection establishment has not. [4]



d. If persistent HTTP were used with pipelining, how much benefit would have been gained for the overall page load time? [3]

In persistent HTTP with pipeling, it takes just one R.T.T. to fetch all responses.
Hence, there would be a benefit of one second since we can throw all the requests simultaneously without having to wait for the responses

Ans 2.2

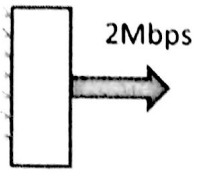
2. Your IP address is 100.100.100.100. A wireshark output indicates that you have received an HTTP packet on port 34262 from IP address 200.200.200.200 with a remaining TTL value of 35 and Ethernet CRC of 0xEDB88320. The application data is "HTTP/1.1 200 OK\r\nContent-Length: 31\r\n<html> Hello there </html>". Mark all this information in the appropriate headers in packet below. [6]

Link layer header	Network layer header	Transport layer header	App layer
0xEDB88320 ✓ 1	HTTP/1.1 200 ✗	Content-Length:31 ✗	~~Hello there~~ <html> Hello there </html> 0.5

What header fields are used at the link layer and network layer to indicate which upper layers should the packet be destined? [1]

The link layer uses the Ethernet header field and the network layer used the H.T.T.P header field. ✗ Wrong Answer

3. The edge router of an ISP has a 2Mbps (1Mbps = 10^6 bits per sec) transit capacity, and the ISP wants to provide 200Kbps (1Kbps = 10^3 bits per sec) throughput to its users.



a. How many users can the router support under circuit switching? [1]

$\frac{2 \times 10^6}{200 \times 10^3} = \frac{2 \times 10^3}{2 \times 10^2} = 10$

Hence, 10 users ✓ (1)

b. Write an equation to find the number of users the ISP can support under packet switching, if the probability of a user being active is 0.1 and the ISP wishes to provide the promised service to its users more than 95% of the time. You do not have to solve the equation. [4]

Let total number of users be n.

Suppose there can be maximum k users online at a single point of time.

$k = 10$.

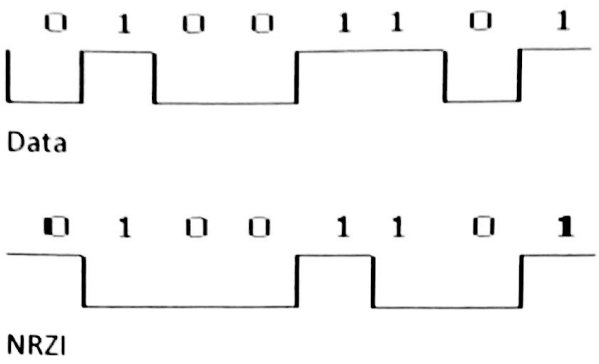
$\therefore \left[{}^{n}C_{10}(0.1)^{10}(0.9)^{n-10} + {}^{n}C_{9}(0.1)^{9}(0.9)^{n-9} + \cdots \right.$
$\left. {}^{n}C_{0}(0.1)^{0}(0.9)^{n-0} \right] \times 2 \times 10^5 \geq 0.95$

Solving for n, we can get maximum no. of users ✓ (4)

4. Given below is a table for 4B/5B encoding, and an example to help you recall NRZI.

4-Bit Data Symbol	5-Bit Code
0000	11110
0001	01001
0010	10100
0011	10101
0100	01010
0101	01011
0110	01110
0111	01111
1000	10010
1001	10011
1010	10110
1011	10111
1100	11010
1101	11011
1110	11100
1111	11101

Table 2.4 4B/5B encoding.



a. Encode the following sequence of bits using 4B/5B with NRZI.
00100111

[2]

10100 01111

b. Why is 4B/5B used with NRZI?

[2]

c. If the bits can be written on to the medium at a rate of 10 Mbps (1 Mbps = 10^6 bits per sec), what is the length of one bit on the medium? Assume c = 2 x 10^8 m/s. [2]

Length of one bit is 20 m.

d. How many bits are on the medium at any time if the propagation delay of the link is 100 ms. [1]

$10^7 - 10^6$ bits

10^6 bits

5. Following are a few short answer questions. Be as brief as possible.

a. In a congested buffer in a router, how can you ensure that large flows do not starve out small flows? [1]

Use TCP protocol.

b. How does the TTL field in the IP header prevent packets from traveling endlessly in the network, in case route fluctuations introduce cycles? [1]

If the TTL limit exceeds, the packet gets dropped

TTL is decreased by 1 at each router

At each router on the route, the TTL keeps decreasing by 1. Since the packet will be dropped once the TTL becomes 0, so it will never get caught in cycles. The routers will send the packets to their destination.

c. FTP combines control and data on the same TCP connection while HTTP keeps them separate. True/false? [1]

False.

d. How many IP addresses does a router have? [1]

A router has 2 IP addresses

One for each subnet it is connecting

e. A communication link exists via a satellite that is 30,000km from the Earth. The link supports an uplink (from the earth to satellite) rate of 25KBps (1KBps = 10^3 bytes per sec) and a downlink (from the satellite to earth) rate of 100KBps. The speed of signal propagation is 3 x 10^8 m/s, queueing delay at the satellite is 50ms, and processing delay is negligible. What is the total one way latency to send a packet of 1KB (1KB = 10^3 bytes) from one earth station to another via the satellite? [3]

Total one way latency = $50\text{ms} + \frac{1}{25}\text{s} + \frac{2 \times 30{,}000 \times 10^3}{3 \times 10^8}\text{s} + \left(\frac{1}{100}\right)\text{s}$

$= \left(\frac{5}{100} + \frac{1}{25} + \frac{2 \times 1}{10} + \frac{1}{100}\right)\text{s}$

$= 0.05 + 0.04 + 0.1 + 0.01 + 0.1$

$= 0.3\text{ s}$

Hence, total one way latency is 0.3 s.

(3)