Final 2021 solutions - Midterm Exam Solution

Computer Networks (City University of Hong Kong)

Grading Scheme for MCQ questions:

- Points for Questions 1, 4, 5 (4 answers in total):
  - Marked all (correct and wrong) answers: 0
  - Marked 2 correct answers and 1 wrong answer: 1.5
  - Marked 1 correct answer and nothing else: 1.2
  - Marked 1 correct answer and 1 wrong answer: 1
  - Marked 1 correct answer and 2 wrong answers: 0.5

- Points for Questions 7, 8 (5 answers in total):
  - Marked all (correct and wrong) answers: 0
  - Marked 2 correct answers and 1 wrong answer: 1.8
  - Marked 2 correct answers and 2 wrong answers: 1.2
  - Marked 1 correct answer and nothing else: 1.3
  - Marked 1 correct answer and 1 wrong answer: 1
  - Marked 1 correct answer and 2 wrong answers: 0.7
  - Marked 1 correct answer and 3 wrong answers: 0.5

Solutions

1) Correct answers:
To resolve the IP address of hostnames
To provide multiple names to the same machine.

2) Correct answers:

Nodal processing delay

3)

Possible answers:
1. Reliability is not required, so UDP is better to avoid the overhead of TCP.
2. UDP does not have congestion control (or flow control) and the rate at which data is received is important for this application.

4) Correct answers:

Web caches can significantly reduce the response time during web browsing.

Web caches may reduce the traffic intensity on a network's access link.

5) Correct answers:

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

Once the number of clients becomes large, a P2P architecture is likely to outperform the client-server architecture.

6)

SMTP is used to push mail from the client to the server and to communicate between the email servers.
A mail access protocol is used to fetch mail from a users mailbox on the mail server.

7) Correct answers:

The server-side of the HTTP protocol does not need to remember the previous exchange with the client.
A client can establish parallel TCP connections to the same web server.

8) Correct answers:

The traffic intensity is exactly 1 for (A).

(A) will incur a larger average queuing delay compared to (B).

9)

A) K/R1 + K/R2.
B) min(R1,R2)

10)

No the receive cannot discover the error because 2 bits flipped in the same column and the sum will be the same in both cases.

11)

A) TCP: 3, 4
B) UDP: 1, 2, 3, 4

12)

A) The top (R_S) links are the bottlenecks
B) 60 Mbps

13) 5000 bytes

14)

A) 6, 14, 25
B) 1-4, 7-10, 15-18, 26-29 (it's fine if the rightmost point of each interval is missing.)

Note: Some students misinterpreted the assignment of the numbers on the x-axis. For these students all the numbers might be off by either 1 or 0.5. We will consider that as correct.

15)

RTT = 2 * 50 msec = 0.1 sec

A)

Base html file: 2 RTT + Transmission time = 0.2 + 500*10^3 / (50*10^6) = 0.2 + 0.01 = 0.21 sec

Each image object: 2 RTT + Transmission time = 0.2 + 1000 * 10^3 / (50*10^6) = 0.2 + 0.02 = 0.22 sec

Total time = 0.21 + 3*0.22 = 0.87

B)

Base html file: 2 RTT + Transmission time = 0.2 + 500*10^3 / (50*10^6) = 0.2 + 0.01 = 0.21 sec

After receiving the base file, we can send all requests back to back and the server will transmit the responses back to back:

Total time = Base file + (1 RTT + Transmission time for 3 images) = 0.21 + 0.1 + 3 * 1000 * 10^3 / (50*10^6) = 0.21 + 0.1 + 0.06 = 0.37 sec

Note: Some students also accounted for the transmission delay for the TCP control messages (i.e. the first RTT). As this wasn't clearly specified we will also consider that as correct.