MIEEC / MIEIC

Communication Services / System and Network Services

Winter Semester 2018/2019

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Duration: 90 min

Instructions

Please write your name and student number on all answer sheets.

This exam is open book.

Partial credit is possible, so give each question a try.

Show all your work and reasoning. This is the only way to be able to give partial credit to your answers.

If you get stuck in a question, leave it for later and go on to solve the others.

The use of communication devices (e.g., computer, smartphone, mobile phone, etc) during the exam is strictly forbidden.

Voluntary Code of Ethics

Please sign below if you agree to comply with the following sentence.

I give my word of honour that I shall not use any unauthorised means to answer this exam.

Good work!

Short Questions

1. (2) HTTP 2.0 was designed to improve Quality of Experience and increase network efficiency. Identify one characteristic that has the most significant impact in each of the aspects and justify briefly.

2. (1) You are configuring a server to make available a web page which contains a logo background image, a photo of the user, and an image that changes sporadically. Which caching headers would you use for each of the objects?

3. (1) Explain using a drawing for support how a CDN may use DNS to re-direct clients to a geographically near and lightly loaded server.

4. (1) Consider a CDN that uses DNS to direct clients to the best server, has 2 levels of hierarchy within its domain, one directs to distinct geographic clusters, and another one direct to the least loaded server. How would you set the Time To Live (TTL) for the two internal name resolutions? Justify briefly.

5. (1) The most likely reason that a peer-to-peer network might be preferred to a content-delivery network to host the webpage of a commercial company is ...

6. (2) Describe 2 mechanisms that improve search response time in an unstructured peer-to-peer network (no trackers/ super-nodes), clarifying how (in which conditions) they improve search.

7. (2) It is possible for non-TCP flows to co-exist with TCP flows in best-effort networks without causing TCP to throttle itself. Discuss mechanisms that can be used either at the endpoints or at the routers to achieve this.

8. (1) Suppose a router with capacity to forward 50 packets per second accepted flows with TSpecs shown in the following table, described in terms of token bucket filters with token rate r packets per second and bucket depth B packets.

r [packets per second]	B [packets]
20	20
20	10

   Could a flow with TSpecs r=10 packets/second, B=20 packets be admitted at this router? Please justify.

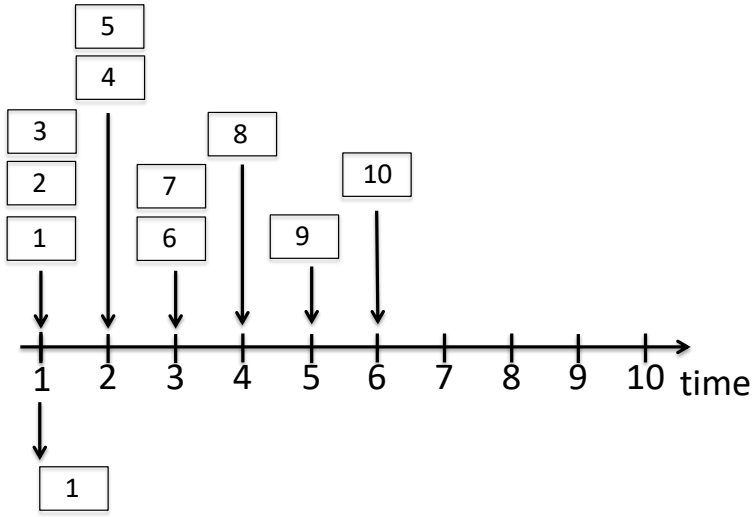
9. (1) Should the router of the previous exercise, having only the initially available flows, and assuming it uses round robin scheduling, accept a flow that requests a guaranteed delay of 0.1 seconds?

10. (1) Explain briefly the difference between RED and ECN. Which one is more efficient from a network perspective?

Problems

Please show all your calculations and justify your options.

1. Please consider the following packet arrival sequence. Assume that one packet can be transmitted per time slot.



   a. (1) Assuming FIFO service, indicate the time at which packets 2 through 10 each leave the queue. For each packet, what is the delay between its arrival and the beginning of the slot in which it is transmitted? What is the average of this delay over all 10 packets?
   b. (1) Now assume priority service, and assume that odd-numbered packets are high priority, and even-numbered packets are low priority. Indicate the time at which packets 2 through 10 each leave the queue. For each packet, what is the delay between its arrival and the beginning of the slot in which it is transmitted? What is the average of this delay over all 10 packets?
   c. (2) Now assume round robin service. Assume that packets 1, 3, 6, 8, 9 are from class 1, and packets 2, 4, 5, 7, 10 are from class 2. Indicate the time at which packets 2 through 10 each leave the queue. For each packet, what is the delay between its arrival and its departure? What is the average delay over all 10 packets?
   d. (2) Now assume weighted fair queueing (WFQ) service. Assume that odd-numbered packets are from class 1, and even-numbered packets are from class 2. Class 1 has a WFQ weight of 2, while class 2 has a WFQ weight of 3. For each packet what is the delay between its arrival and its departure? What is the average delay overall 10 packets?
   e. (1) What do you notice about the average delay in all four cases (FIFO, RR, priority, and WFQ)?