MIEEC / MIEIC

Communication Services / System and Network Services

Winter Semester 2017/2018

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Duration: 90 min

Instructions

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

This exam is open book.

Each question is worth 1 value /20.

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 luck!

Short Questions

1. In the first laboratory work, you deployed a small email infrastructure with a local mail server and a relay mail server. The user email accounts must correspond to
   a. user accounts on the machine where the local server ran
   b. user accounts on the machine where the relay server ran
   c. any of the above
   d. none of the above

Only one answer is correct.

2. Enumerate 3 changes of HTTP 2.0 with respect to HTTP 1.1 and explain how they improve the performance perceived by the user.

3. Explain the use of Etag, cache-control and max-age header tags for HTTP caching.

4. How long after changing the DNS record of a server is inconsistent name resolution possible? As domain administrator, can you take any measure(s) to control it?

5. Enumerate and explain the meaning of 2 relevant quality of experience (QoE) metrics for the web and another 2 for video streaming.

6. Explain why MPLS has faster forwarding lookup than IP.

7. Compare search for content in Gnutella and Bittorrent unstructured peer-to-peer networks.

8. Suppose you have a 100Mbps link being shared by 4 flows: 1 MPEG-DASH video stream with adaptive bit rate, 8 file downloads using TCP, 1 UDP flow of 10Mbps. The MPEG-DASH flow offers the following possible rates {275241, 548104, 745370, 1502455, 3709841, 5130872, 6930945} bps. Consider a perfect adaptation mechanism, i.e. disregard the known harmful interactions with TCP. To which rate will MPEG-DASH adaptive bitrate mechanism converge?

9. Explain 2 ways in which interactions between MPEG-DASH's adaptation mechanism and TCP congestion control can lead to converge to a lower streaming rate than would be possible.
10. Name 2 measures that could improve this behaviour and explain why.

Problems

Please show all your calculations and justify your options.

1. Suppose a router has 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]
4	8
4	4
1	2

All flows are in the same direction, and the router can forward one packet every 0.1 seconds.

a. What is the maximum delay a packet might face?

b. What is the average load on the router?

c. What is the minimum number of packets from the 3rd flow that the router should send over 3.0 seconds assuming that the flow sent packets at its maximum rate uniformly?

d. Given the reserved average data rates, calculate the fairness index for this reservation.

e. Could a flow with TSpecs r=2 packets/second, B=10 packets be admitted at this router? Please justify.

2. Consider the following peer to peer network. Node A has just joined and is searching for contents that are located in node M.
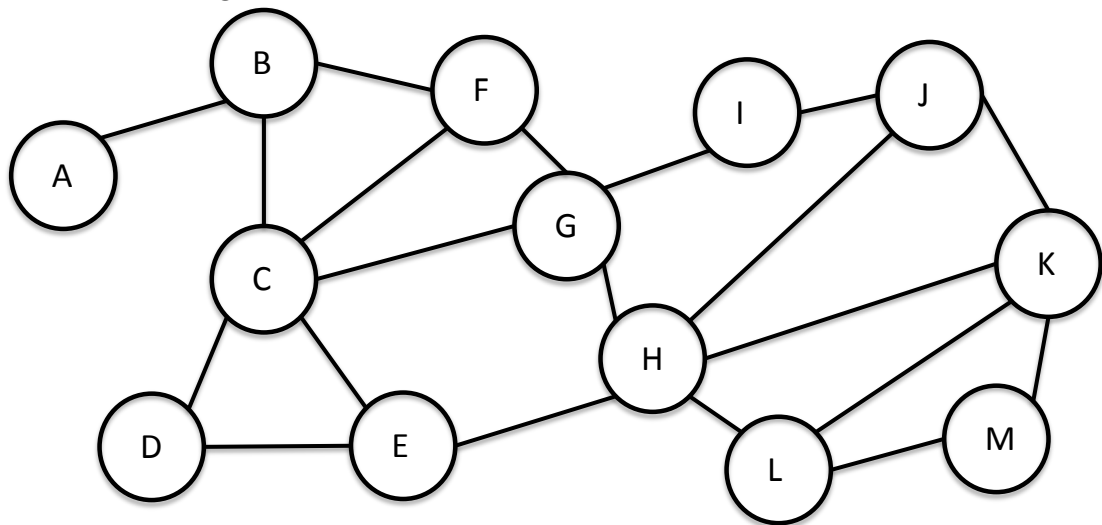
Consider that all packets occupy 1 time unit, and each link is bi-directional. Query and response packets occupy equal time.

a. How many messages would be sent on the network on a query that uses plain flooding? How long would it take for A to discover the node that has the desired contents? Show how you arrived at the answer.

b. How many messages would be sent on the network on a query that uses limited flooding if the search depth is limited to 3 hops in the first iteration, increases by 1 if unsuccessful, and the timeout is the minimum possible to support this scheme? How long would it take for A to discover the node that has the desired contents? Show how you arrived at the answer.

c. What information is carried in the response packet once the contents are found?

d. If you wanted to choose 2 super-nodes among these nodes in this network, which ones would you choose? Consider that they must not be neighbours. Please justify.

e. Consider the nodes you chose are super in this network. How many messages would be sent on the network on a query? How long would it take for A to discover the node that has the desired contents? Show how you arrived at the answer.