

CMPT 371: Data Communication and Networking
Fall 2019
Midterm Exam (October 17, 2019)

First Name:
Last Name:
Student Number:

Instructions:

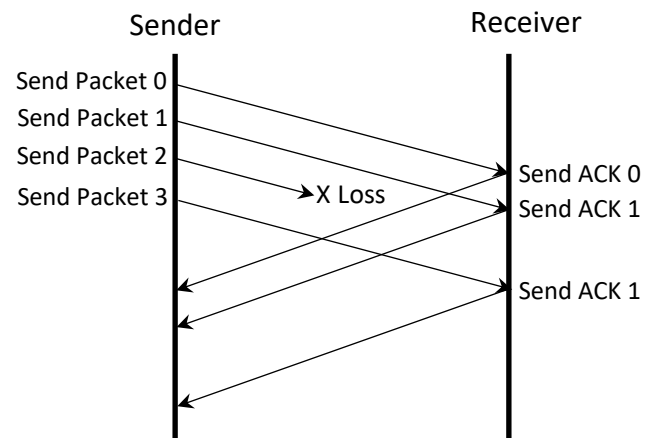
1. This is a closed book examination.
2. No electronic devices may be used.
3. Please write down your answers using a pen.
4. Exam duration is 90 minutes (9:30-11:00am)
5. This exam includes 10 question. Answer all the questions.
6. Answer each question in the space provided. You should not need more space.
7. The exam is 8 (eight) pages. Make sure you have all of the pages.

| Question | Mark | Question | Mark |
|--------------------|------|----------------|------|
| 1 (5 points) | | 6 (10 points) | |
| 2 (5 points) | | 7 (10 points) | |
| 3 (5 points) | | 8 (15 points) | |
| 4 (5 points) | | 9 (15 points) | |
| 5 (10 points) | | 10 (20 points) | |
| Bonus | | | |
| Total (100) | | | |

Q1 (5 points). What are the layers in the OSI Reference model? Which of those layers are in the Internet Protocol Stack, and what kind of functionality they provide?

Q2 (5 points). We described Internet as a network of networks. What type of ISPs and entities are interconnected to build this network? How are they connected to build this network of networks?

Q3 (5 points). Consider the sliding window protocol in the figure below. Does this figure indicate whether Go-Back-N or Selective Repeat is being used? (2 points) How did you come up with that conclusion? (3 points)



Q4 (5 points). You want to check www.cbc.ca and the first step is to obtain the IP address of the web server. IP address is not cached at the local DNS server and the local DNS server has not cached an entry for the .ca DNS server. Please describe the iterative process to obtain the IP address.

Q5 (10 points). We have a 2 Mbps link, and users with 400kbps bandwidth when active. Given users are active 10% of the time, how many users can we support with Circuit Switching? (5 points)

If we have 30 users, using Packet Switching, what is the probability that the same number of users that we can support with circuit switching are active simultaneously? (5 points)

Q6 (10 points). You want to see an HTML file that references 6 very small objects on the same server. RTT to the local DNS server is RTT_D and it has cached the address, and RTT to the web server is RTT_s . Argue how much time you will experience for loading your page in each of the following scenarios:

- (a) Non-Persistent HTTP with no parallel TCP Connections (5 points)
- (b) Persistent HTTP (5 points)

Q7 (10 points). We want to register the domain `www.MyTestDomain.com`. This domain is hosted on the web server that is running on `199.188.200.110`. It has two DNS servers DNS1 and DNS2 with addresses `199.188.200.111` and `199.188.200.112`, and it has a mail server on `mail.MyTestDomain.com`. What are records we need to insert into the DNS system? (5 points) and where these records need to be stored and propagated? (5 points)

Q8 (15 points). Alice wants to send an email to Bob. Alice is at `alice@sender.com` and bob is at `bob@receiver.org`. Describe the process (5 points), system components (5 points), and the protocols (5 points) that are involved in the process from when Alice types the email to when Bob reads the email.

Q9 (15 points). Describe the components of end-to-end delay for sending one packet of length L over N links, each of transmission rate R_i , for $i=1,\dots,N$. You do not have any additional information available.

- (a) Please write the formula for finding this end-to-end delay using the described components, and $R_i = R$ for $i=1,\dots,N$.
- (b) Generalize your formula for sending M back-to-back packets.

Q10 (20 points). Draw the Sender FSM for TCP Congestion Control. On your state machine, indicate states (3 points), events (5 points), and triggers and actions associated with each state transition (12 points).