CMPT 371: Data Communication and Networking
Fall 2019
Final Exam (December 6, 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 120 minutes (12:00-2:00pm)
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 10 (ten) 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)			

Note: If you choose this exam to be 35% of total mark (instead of 50%), and EP used for the remaining 15%, please check the box below, write your EP mark, and sign.

☐ Elective Project Submitted for 15%. EP Mark:

Q1 Data Link Layer (5 points). Name three broad classes of Multiple Access protocols and compare them in terms of efficiency.

Q2 Network Layer (5 points). Explain the count to infinity problem using the following graph and your choice of weights and network changes.
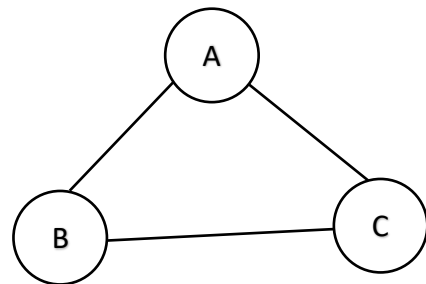
Q3 Data Link Layer (5 points). What is Binary Backoff? Where do we use it? What is its purpose? Name a protocol that uses it.

Q4 Transport Layer (5 points). Is TCP Fair? Why?

Q5 Application Layer (10 points). Assume an enterprise network connected to the Internet through one access link. Assume the average web request rate from this network's browsers is 120 requests per second, and average object size transferred is 100,000 bits.

Also assume the capacity of the institutional link providing access of this enterprise to the internet is 10Mbps. Estimate the average response time for this enterprise with and without a proxy server assuming a hit rate of 70% for the proxy server, and abundant bandwidth and negligible delay at local network.

Q6 Transport Layer (10 points). You decide to modify the TCP stack on your machine so that you can experience better performance.

(a) Is this modification possible given that you only have control over your side of the TCP? (1 point)

(b) In a trial and error way, you first decide to disable timeout retransmissions on your side and only retransmit using fast retransmissions. Would this help improve your performance? Why? (4 points)

(c) Then you decide to disable RTT estimation and use the initial values of RTT for the rest of a session. Would this help improve your performance? Why? (5 points)

Q7 Link Layer (10 points). What is the maximum number of VLANs that can be configured on a switch supporting the 802.1Q protocol? Why?

Q8 Network Layer (15 points). Assume you have a Strict Priority Queue (SPQ) and a Weighted Fair Queue (WFQ). You have five classes of traffic in your network, as follows:

- Traffic class A, which is control traffic
- Classes B, C, D, and E are data traffic
- Traffic class B should get 2 times the bandwidth of class C
- Traffic class C requires 2 times the bandwidth of class E
- Traffic class D requires 3 times the bandwidth of class E

(a) Given these requirements, assign each traffic class into one queue and draw the diagram to describe the queuing discipline. (5 points)

(b) For input traffic rates as below and assuming the queues are being serviced by a processor at the rate of 12Mbps, please provide the output rates for each of the queues. (10 points)

A	B	C	D	E
2	4	2	3	1
2	2	1	1	1
7	4	2	3	1
1	3	2	1	1
0	8	0	0	7

Q9 Network Layer (15 points). Assume we have three Asynchronous Systems: AS1, AS2, and AS3. Answer to the questions below assuming we are running OSPF for intra-AS, and BGP for inter-AS routing.
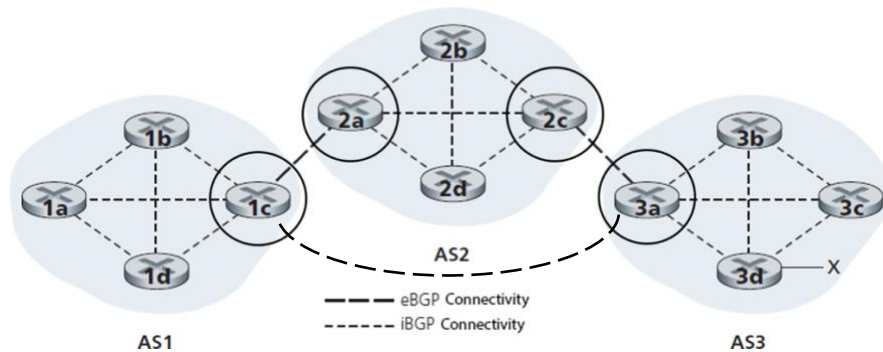
(a) What is hot-potato routing? Explain it using the network shown. (6 points)

(b) What AS-paths are advertised in this network? (3 points)

(c) Discuss BGP policies that might be applied at 2b in choosing the path to X and their result. (6 points)

Q10 Network Layer (20 points). Dijkstra's shortest path algorithm.

(a) Using a pseudo-code, explain Dijkstra's algorithm (10 points)

(b) Run Dijkstra's algorithm on network below. Show iterations of the algorithm and path cost updates for the paths starting from u to the other nodes in the network. (10 points)
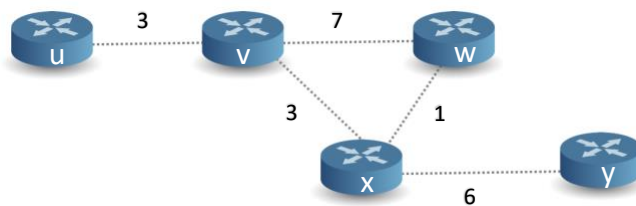
Bonus (5 Points) Suppose you need to use a web application, residing in the cloud. If you need to receive data from this application whose resources are located in a distant datacenter, you may experience low performance due to large RTT and TCP slow start. Can you think of a solution to improve performance?