THE UNIVERSITY OF BRITISH COLUMBIA
Computer Science 317, Section 201
Quiz 1
January 29, 2020

Last Name: _____

First Name: _____

Student ID: _____ **CSID:** _____

Date	January 29, 2020
Time Period	3:00PM - 3:50PM
Duration of Exam	50 minutes
Number of Test Pages	7 pages (pages double-sided, excluding top sheet)
Total Possible Marks	50
Additional Materials Allowed	None. (SIMPLE CALCULATORS)

Instructions

1. Write your name and ID number at the top of this page.
2. Please note that there are questions on both sides of the page.
3. Answer the questions in the spaces provided. Sufficient space for the answer has been provided. Other white space can be used should you require any additional space.
4. **Your grade will be influenced by how clearly you express your ideas, and how well you organize your solutions. Numerical answers should be in exact values.**
5. **DO NOT WRITE FORMULAS ON THIS COVER PAGE.**

1. (10 points) Answer the following questions in the space provided.

   (a) (2 points) List in order from top to bottom the 5 layers of the Internet stack. Number them (1) for top to (5) for bottom.

   Solution: 1. application, 2. transport, 3. network, 4. link, 5. physical.

   (b) (2 points) In which of the following situations would you expect statistical multiplexing for resource sharing to work well. Select (by letter) all statements that are correct. (A) Users call their friends on their birthday. (B) Users call their family when there is an earthquake. (C) Users access the network independently. (D) User needs to transfer a huge amount of data to a data center.

   Solution: (A) and (C)

   (c) (2 points) Suppose we have a connection between a source and destination in a network where the state in some intermediate device is destroyed and the session between the source and destination fails. This situation violates which of the design principles discussed in class?

   Solution: fate sharing

   (d) (2 points) What is the network address of 198.162.23.5/20 in dotted decimal CIDR (i.e. slash) notation?

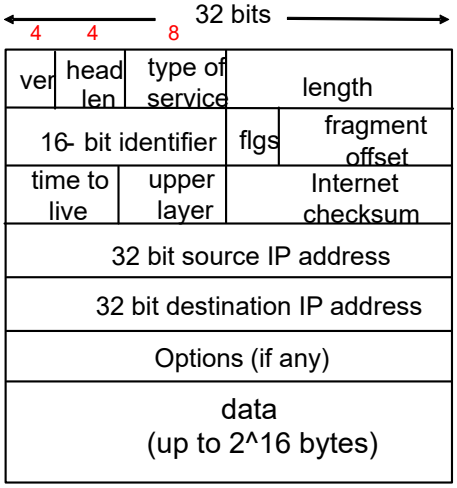
   Solution: 198.162.16.0/20

   (e) (2 points) Give two reasons why BGP is used for Interdomain routing instead of a link-state protocol such as Open Shortest Path First (OSPF) that calculates optimal least-cost routes.

   Solution: 1) Scalability (IGP algorithms do not scale) 2) Allow for different polices among different administrative domains.

2. (8 points) Consider the following IP datagram:

0100 0101	0000 0000	0000 0001	0001 0011
1001 1100	0101 1101	0100 0000	0000 0000
0011 0110	0001 0001	0100 0100	1100 1010
1001 0111	1010 0100	0000 0001	0000 1000
0000 1010	0000 0000	0000 0000	0000 0110



(a) (2 points) In the above IP datagram, what is the size of the datagram, in bytes? **275**.

(b) (2 points) In decimal, the payload will be passed to what upper level protocol?

Solution: Passed to protocol number 17

(c) (2 points) What is the destination IP address of this IPv4 datagram in dotted decimal notation?

Solution: 10.0.0.6

(d) (2 points) When a router forwards an IPv4 packet from one network to another, what fields if any, must change? Assume that the "do not fragment" flag is set.

Solution: TTL flag and checksum need to change

3. (8 points) Host X has IP address 192.168.1.97 and is connected through two routers R1 and R2 to another host Y with IP address 192.168.1.80. Router R1 has IP addresses 192.168.1.135 and 192.168.1.110. R2 has IP addresses 192.168.1.67 and 192.168.1.155. Assume that the network all consists of "/27" networks (mask 255.255.255.224).

   (a) (2 points) Draw the previously given network. Include the links and label the devices using X, Y, R1 and R2.

   Solution: X (97) —- (110) R1 (135) —— (155) R2 (67) —- (80) Y

   (b) (2 points) There are at least how many distinct subnets in this network? **3**.

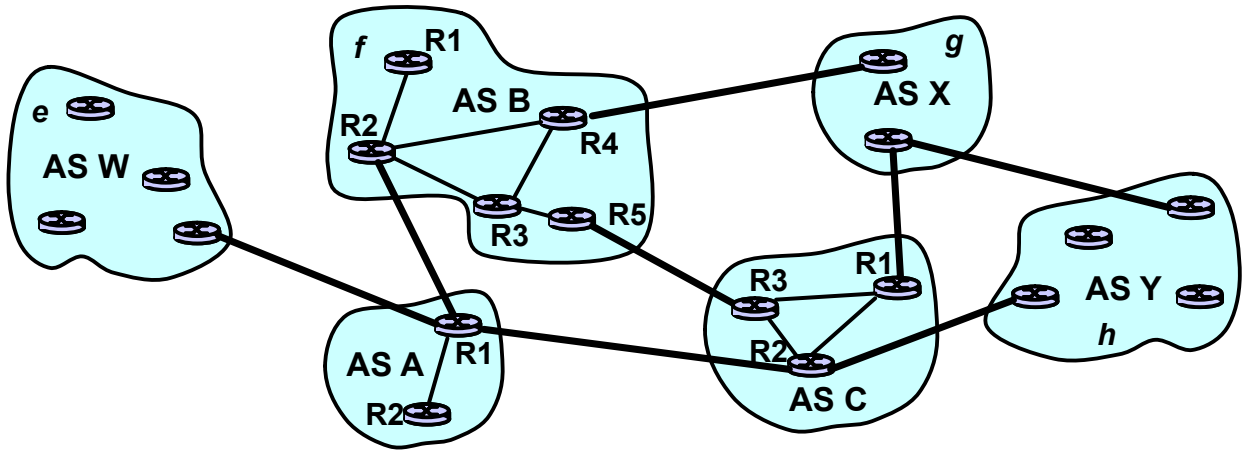
   (c) (2 points) Which router shares its network with Host X? Give the **network address** in CIDR notation of the router interface that is connected to X.

   Solution: R1 has network address 192.168.1.96/27

   (d) (2 points) Which router shares its network with Host Y? Give the **network address** in CIDR notation of the router interface that is connected to Y.

   Solution: R2 has network address 102.168.1.64/27

4. (12 points) Consider the following collection of Autonomous Systems A, B, C and X, Y, W. Autonomous systems A, B, and C are all backbone provider networks (transit networks) and X, Y and W are access ISP networks (stub ASes). As shown, AS X is a customer of AS B and AS C, AS Y is a customer of AS C, and AS W is a customer of AS A. AS X and AS Y have a peering agreement. The following policies are in place. Transit networks only carry traffic whose source or destination is in a customer network. Access networks only route datagrams whose source or destination is in its own network. As peers, AS X and AS Y also agree to deliver datagrams whose source AND destination is in X or Y. Answer the following questions based on these policies and the diagram below.



(a) (2 points) How many routers in the diagram are eBGP speakers? **12**

(b) (2 points) Would AS X advertise "Y:h" to AS B? Explain why or why not?

Solution:
No, because AS X is not a transit network and does not want to receive datagrams whose destination is NOT in X. The peering relationship has nothing to do with it since it is only for data between X and Y.

(c) (2 points) Will AS Y receive the advertisement "C-X:g" from AS C? Should AS C accept this advertisement? Explain.

Solution:
Yes it will receive the advertisement (X is a customer of C and it is a possible route for datagrams destined for g.) Yes, C should accept it and advertise it. You could also say NO, if your reason was because C-X:g was a loop. (The question should have read Should AS C accept advertisement "X:g" from X.) Again peering between X and Y doesn't matter. C doesn't have to know about any arrangements between X and Y, and it provides an extra path between X and Y, which is fine.

(d) (2 points) What routes will be advertised to AS Y for network "e" in AS W?

Solution:
Just the one because of transit network rules CAW:e. Route CBAW:e is the only other possibility but AS W and Y are not clients of AS B. Also can't go WABXY — peering agreement does not cover this. Route CXBAWe isn't possible because X won't carry messages for Y to X.

(e) (2 points) Suppose AS B in the diagram uses **hot potato routing**, a datagram arrives from AS X at R4 for destination network "e". What is the router corresponding to the **next hop** address attribute for the BGP route to "e". Briefly explain why?

Solution:
Router R1 in AS A. This is because the shortest route to the border from R4 to AS-A is to R2, so the next hop (first router on the other side of the border) is R1.

(f) (2 points) Suppose we have the following networks in the forwarding table of router in AS B: 192.168.1.0/24, 187.200.4.0/25, 187.200.4.192/26, 187.200.4.128/26. Specify the network addresses in CIDR notation that the router needs to advertise? (Hint IP aggregation)

Solution:
192.168.1.0/24 187.200.4.0/25 187.200.4.192/26 187.200.4.128/26
Needs to advertise 192.168.1.0/24 and 187.200.4.0/24
0—000 0000 11—00 0000 10—00 0000

5. (6 points) Answer the following TRUE/FALSE questions by circling the correct answer: (Note: +1pts for each correct answer, -1pts for each wrong answer, 0 pts if left blank, 0pts minimum)

(a.) Every host implements the transport layer. TRUE FALSE

(b.) The fact that BGP4 uses TCP is a layering violation. TRUE FALSE

(c.) Every router implements the network layer. TRUE FALSE

(d.) Network order is little endian. TRUE FALSE

(e.) When protocol packet A is encapsulated into protocol packet B, Protocol B's header is sent before packet A's header. TRUE FALSE

(f.) Passive mode FTP avoids the problem of a server having to connect to the client. TRUE FALSE

Solution:
TRUE, TRUE, TRUE, FALSE, TRUE, TRUE

6. (6 points) Consider a router with the forwarding table shown below:

Network Address	Network Mask	Interface
128.96.170.0	255.255.254.0	If0
128.96.168.0	255.255.254.0	If1
128.96.166.0	255.255.254.0	If2
128.96.164.0	255.255.254.0	If3
0.0.0.0	default	If4

(a) (2 points) Given the network mask 255.255.254.0, using CIDR in dotted decimal notation what is the network address of 128.96.171.92.

Solution: 128.96.170.0/23

(b) (4 points) For each IP address in the table below identify the correct choice of interface for the next hop using the entries from the forwarding table above. (Note: the default entry is used when there is no match.)

IP address	Outgoing Interface
128.96.171.92	If0
128.96.167.151	If2
128.96.163.121	If4 (doesn't exist)
128.96.165.121	If 3

Solution:
170 is 1010101–0
168 is 1010100–0
166 is 1010011–0
164 is 1010010–0
One simple thing to spot is that all the addresses are ODD (3rd octet)