CSCI 4311/5311 Final
Spring-2022

Instructions:
Submit your answer as PDF file on Moodle.
Submissions other than PDF file will not be graded.
You need to sign this form. Without signature, your exam will not be graded.
The test starts at 3 pm. The submission closes at 5 pm.
After 5 pm, I will not accept any submissions.
Make sure your handwriting is readable.
Use your own words, do not copy paste from slides, book, or internet
Total Marks = 100 **Time: 120 minutes**

If I see any sign of cheating, I will give 0 for all sides who involved the cheating activity. If you get 0 from the final, you will directly get "F".

You are to abide by the University of New Orleans honor code.
Please sign below to signify that you have kept the honor code pledge.

Honor code pledge:
I pledge that I have completed the work I am submitting according to the principles of academic integrity as defined in the statement on Academic Dishonesty in the UNO Student Code of Conduct.
For more details: https://www.uno.edu/media/15321

Academic dishonesty includes, but is not limited to, the following:
Cheating, Plagiarism, Academic Misconduct, Falsification and Fabrication

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ID: 2587927

Signature: Jacques Janvier

Date: 5/17/22

Good Luck!

(Q1) [18 points] 4.096

a-)[5 points] What is the **maximum and minimum waiting time** for a node on a 1 Gbps ethernet network after the 4th collision?

$(2^4-1)(4.096)(10^{-6}) = 61.44 \cdot 10^{-6}$

min = 0s
max = $61.44 \cdot 10^{-6}$ s

b-)[6 points] What is the **maximum and minimum waiting time** for a node on a 10 Gbps ethernet network after the 8th collision?

$(2^8-1)(4.096)(10^{-6}) = 1044.48 \cdot 10^{-6}$

min = 0s
max = $1044.48 \cdot 10^{-6}$ s

c-)[7 points] What is the **maximum and minimum waiting time** for a node on a 100 Mbps ethernet network after the 18th collision?

$(2^{18}-1)(5.12)(10^{-6}) = 1342172.16 \cdot 10^{-6}$
$= 1.34$

min = 0s
max = 1.34s

(Q2) [14 points] Briefly explain the following questions.

a-) [7 points] Explain the difference between forwarding and routing.

Forwarding is a router level action that sends packets to appropriate outputs.

Routing is a network level action that sends packets from source to destination. Routing directs traffic and chooses the most efficient path.

b-)[7 points] Explain the difference between router and switch.

A router connects multiple devices including switches and their networks to create a bigger network. A router also grants internet access to the devices on the network.

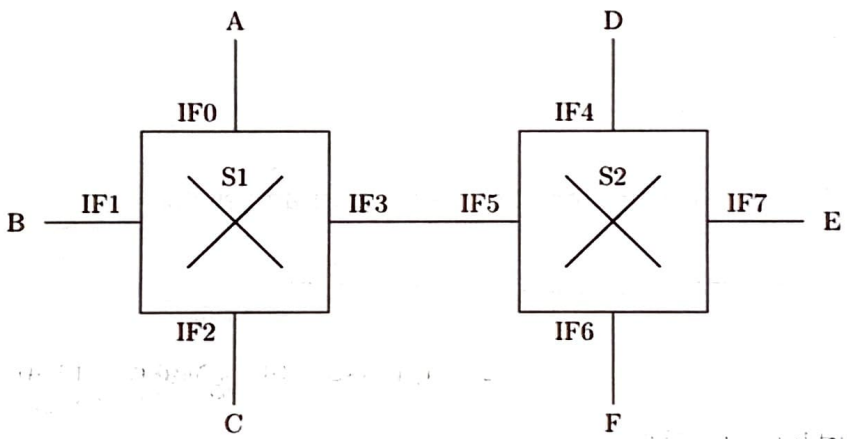
A switch connects devices such as computers, [redacted], servers, and printers to form a network. A switch grants access for these devices to communicate with each other.

(Q3) [25 points]

Consider the following network topology that has two switches and 6 hosts. The host MAC addresses are A to F and the switch interface numbers run from IF0 to IF7. Initially, all of the switching tables are empty. The following packets with destination and source MAC addresses are sent in the network.

Give a step by step account of the forwarding decisions made by the switches. At each stage, show the switching tables.
Note: You can assume that TTL is 60.

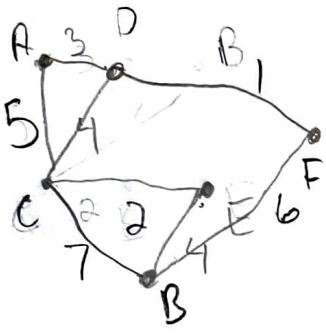
	Source MAC	Destination MAC
1	B	A
2	D	C
3	C	F
4	F	E
5	E	C



	S1			S2		
	MAC	**Interface**	**TTL**	**MAC**	**Interface**	**TTL**
0 - Initial	Empty	Empty	Empty	Empty	Empty	Empty
1 = B – A	A	IF0	60	Empty	Empty	Empty
2 = D – C	C	IF2	60	C	IF5	60
3 = C – F	F	IF3	60	F	IF6	60
4 = F – E	Empty	Empty	60	E	IF7	60
5 = E - C	C	IF2	60	C	IF5	60

(Q4) [16 points]

We have 6 routers labeled A-F. Suppose we have the initial link weights shown below.



A	
Destination	**Cost**
A	0
B	-
C	5
D	3
E	-
F	-

B	
Destination	**Cost**
A	-
B	0
C	7
D	-
E	4
F	6

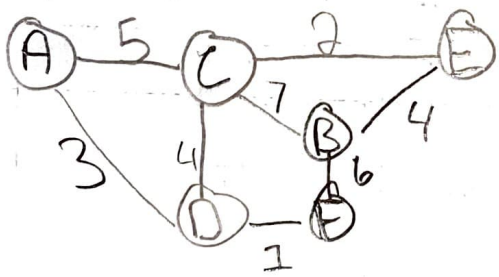
C	
Destination	**Cost**
A	5
B	7
C	0
D	4
E	2
F	-

D	
Destination	**Cost**
A	3
B	-
C	4
D	0
E	-
F	1

E	
Destination	**Cost**
A	-
B	4
C	2
D	-
E	0
F	-

F	
Destination	**Cost**
A	-
B	6
C	-
D	1
E	-
F	0

(a)[8 points] Draw the graph consistent with these tables. Make sure that you label all routers and write the link weights.
P.s. Present your graph as simple as possible. I don't want to see lots of crossing lines which makes the graph hard to see.
Hint: Yes, you can present this graph without crossing any links.



Note for b and c: You need to show all routers in the path. E.g. if the path is A-B-D-E show it like this and calculate the path cost. Also, there might be more than 1 possible paths, but you need to show the least costly path.

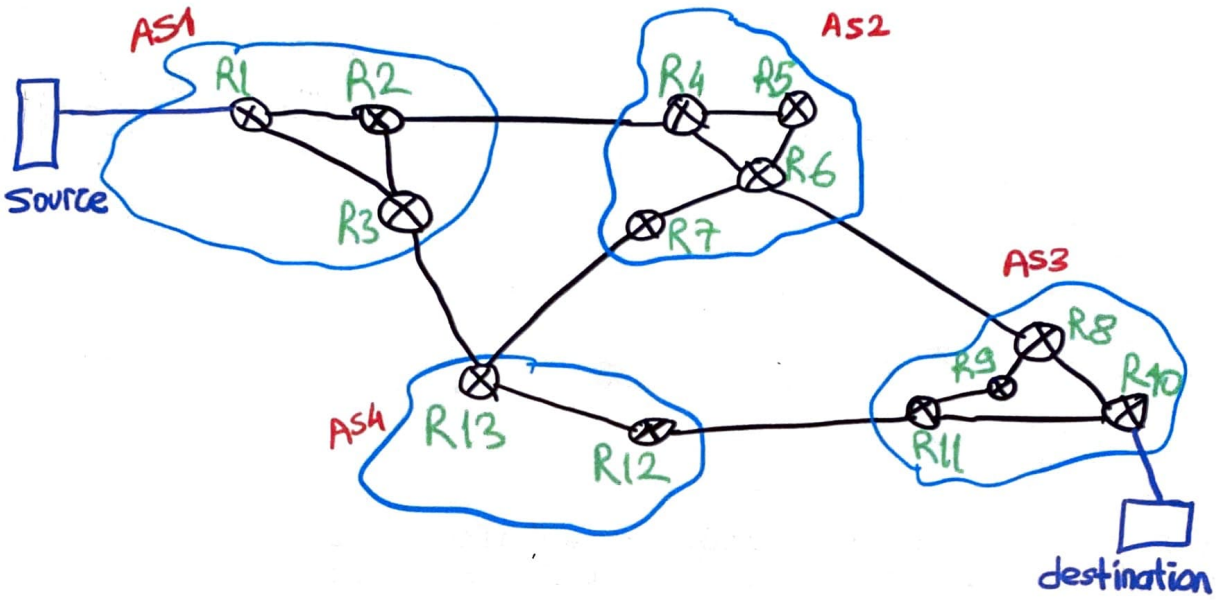
(b)[4 points] If a message is originated from A and a destination is B. Which path does it take? What is the path cost?

A-D-F-B. Cost = 10

(c)[4 points] If a message is originated from C and a destination is B. Which path does it take? What is the path cost?

C-E-B. Cost = 6

(Q5) [27 points]



Assume that we have a network topology which contains 4 Autonomous Systems, AS1, AS2, AS3, and AS4. Assume that all business relations between ASes are peer-to-peer.

a-) [16 points]
For given topology, show all BGP path advertisements for destination X in **each BGP speaking routers**.
Only show AS-PATH and NEXT-HOP attributes. You can use R1, R2, R3 etc. as IP address of the router.
Note: You don't need to redraw the topology. Verbal answer is fine.
E.g. From R1 – R2 => AS-PATH = {ASx, ASy, ASz} Next-hop = {Rx}
Write all BGP path advertisement like this.
HINT: BGP protocol is destination based, not source based.

R1 - R2 - R4 - R5 - R6 - R8 - R10 - Destination

R1 - R3 - R3 - R13 - R12 - R11 - R10 - Destination

R1 - R2 - R4 - R5 - R6 - R7 - R13 - R12 - R11 - R10 - Destination

R1 - R2 - R4 - R6 - R8 - R10 - Destination

b-) [5 points] Explain what can be the reason for choosing the "AS1-AS2-AS3" path instead of the "AS1-AS4-AS3" path.

Spanning tree protocol.

AS1-AS2-AS3 also has a higher precedence because of BGP.

c-) [6 points] Show which links use eBGP and which links use iBGP.
Note 1: You can assign labels to each links and show your results.
E.g. R1 – R2 => label1, uses iBGP or eBGP.
Note: You can redraw the topology figure here.
Note 2: If you prefer, you can use - - - for iBGP and --- for eBGP. Choose the one which is easier for you (Note 1 or Note 2)

R1-R2 : BGP
R2-R3 : iBGP
R1-R3 : iBGP
R2-R4 eBGP
R3-R13 eBGP
R4-R5 : iBGP
R5-R6 : iBGP
R6-R7 : iBGP
R4-R6 : iBGP
R7-R13 eBGP
R8-R9 : iBGP
R9-R11 : iBGP
R10-R11 : iBGP
R10-R8 : iBGP
R6-R8 eBGP
R13-R12 : iBGP
R11-R12 eBGP