CSC 525 Midterm

Sourav Mangla

TOTAL POINTS

87 / 100

QUESTION 1

20 pts

1.1 5 / 5

✓ **- 0 pts** **Correct**

- 2 pts wrong reason

1.2 5 / 5

✓ **- 0 pts** **Correct**

- 4 pts Click here to replace this description.

- 3 pts Click here to replace this description.

1.3 5 / 5

✓ **- 0 pts** **Correct**

- 3 pts Click here to replace this description.

- 4 pts Click here to replace this description.

- 5 pts Click here to replace this description.

1.4 4 / 5

- 0 pts Correct

✓ **- 1 pts** **Click here to replace this description.**

- 2 pts Click here to replace this description.

- 5 pts Click here to replace this description.

- 3 pts Click here to replace this description.

QUESTION 2

20 pts

2.1 5 / 5

✓ **- 0 pts** **Correct**

- 4 pts Click here to replace this description.

- 2 pts Click here to replace this description.

- 5 pts Click here to replace this description.

2.2 5 / 5

✓ **- 0 pts** **Correct**

- 4 pts Click here to replace this description.

- 3 pts Click here to replace this description.

- 5 pts Click here to replace this description.

- 1 pts Click here to replace this description.

2.3 5 / 5

✓ **- 0 pts** **Correct**

- 2 pts Click here to replace this description.

2.4 5 / 5

✓ **- 0 pts** **Correct**

- 2 pts Click here to replace this description.

- 3 pts Click here to replace this description.

QUESTION 3

20 pts

3.1 5 / 5

✓ **- 0 pts** **Correct**

- 1 pts Click here to replace this description.

- 2 pts Click here to replace this description.

3.2 1 / 5

- 0 pts Correct

✓ **- 4 pts** **Click here to replace this description.**

- 2 pts Click here to replace this description.

- 1 pts Click here to replace this description.

3.3 5 / 5

✓ **- 0 pts** **Correct**

- 5 pts Click here to replace this description.

- 3 pts how many nodes?

3.4 5 / 5

✓ **- 0 pts** **Correct**

- 1 pts two nodes: A and B, to update their distance.

- **5 pts** Click here to replace this description.

QUESTION 4

20 pts

4.1 3 / 7

- **0 pts** Correct

✓ **- 4 pts Click here to replace this description.**

- **2 pts** Click here to replace this description.
- **3 pts** Click here to replace this description.
- **6 pts** Click here to replace this description.
- **5 pts** Click here to replace this description.
- **1 pts** Click here to replace this description.

4.2 6 / 6

✓ **- 0 pts Correct**

- **2 pts** Click here to replace this description.
- **6 pts** Click here to replace this description.
- **4 pts** Click here to replace this description.

4.3 7 / 7

✓ **- 0 pts Correct**

- **3 pts** Click here to replace this description.
- **6 pts** Click here to replace this description.
- **7 pts** Click here to replace this description.
- **4 pts** Click here to replace this description.

QUESTION 5

20 pts

5.1 6 / 6

✓ **- 0 pts Correct**

- **1 pts** Click here to replace this description.

5.2 7 / 7

✓ **- 0 pts Correct**

5.3 3 / 7

- **0 pts** Correct

✓ **- 4 pts Click here to replace this description.**

- **2 pts** Click here to replace this description.
- **5 pts** Click here to replace this description.

CSc 525 Exam
Fall 2022

75 minutes, Closed Books/Papers/Notes

DO NOT TURN TO NEXT PAGE TILL YOU GET PERMISSION

- You may use one sheet (8.5x11) of paper with any notes you like, and a calculator.
- This exam has 7 pages, including this cover page. Do all your work on these exam sheets; use the backs of the pages if needed.
- Be specific and clear in your answers.
- Cross out your scratch work before submitting the exam.

Question	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total:	100	

Name: Sourav Mangla

Problem 1 (20 points) *Answer the following questions briefly.*

(1) To transfer a single large file, which one, packet switching or circuit switching, will end up transmitting more bits on the wire? why? Assuming no failures or losses. (5pts)

Packet switching end up transmitting more bits on the wire because Data of file is divided into Packet which has alot of information inside like src & destination information & other reader values, will end up transmitting more bits.

(2) The Internet was successful in achieving its top 3 design goals. What are they? (5pts)

(1) Survivability :- continued operation despite partial failure

(2) Heterogeneity above IP :- support multiple types of communication service

(3) Heterogeneity below IP :- support variety of networks

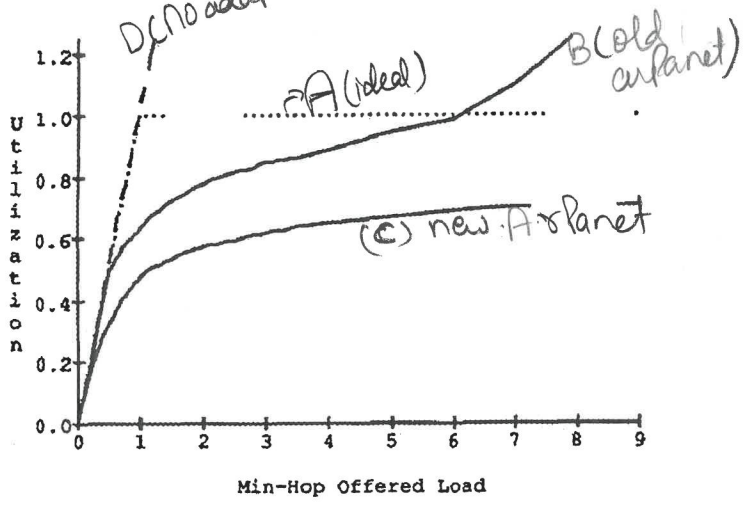
(3) What is the feasibility condition used in the path-finding algorithm? (5pts)

There are two feasibility condition:

(a) if the node we are choosing from neighbour has the minimum distance (feasibility distance)

(b) The feasibility distance should be minimum compared to previous one.

(4) This figure has 4 curves. Each one shows the performance of a specific method to assign link weights. Label the curves by A (ideal), B (old ARPANET), C (new ARPANET), D (no adaptation to traffic load). (5pts)



Problem 2 (20 points) *Answer the following questions briefly.*

(1) What is the degree-based power law in AS-level topology? (5pts)

Given a graph, the CCDF, O_d, of an degree, d, is proportional to the degree to the power of the constant, O.

(2) Root cause notification (RCN) can be used to fix damping and path exploration. What information is carried in an RCN? 5pts)

RCN: root cause notification contains three information
{location, status, seq}
example: {Location = A-B, Status = down, seq = 1}

(3) Comparing BGP Tdown and Tup events, which one usually has longer convergence time, and which one usually generates more routing updates? (5pts)

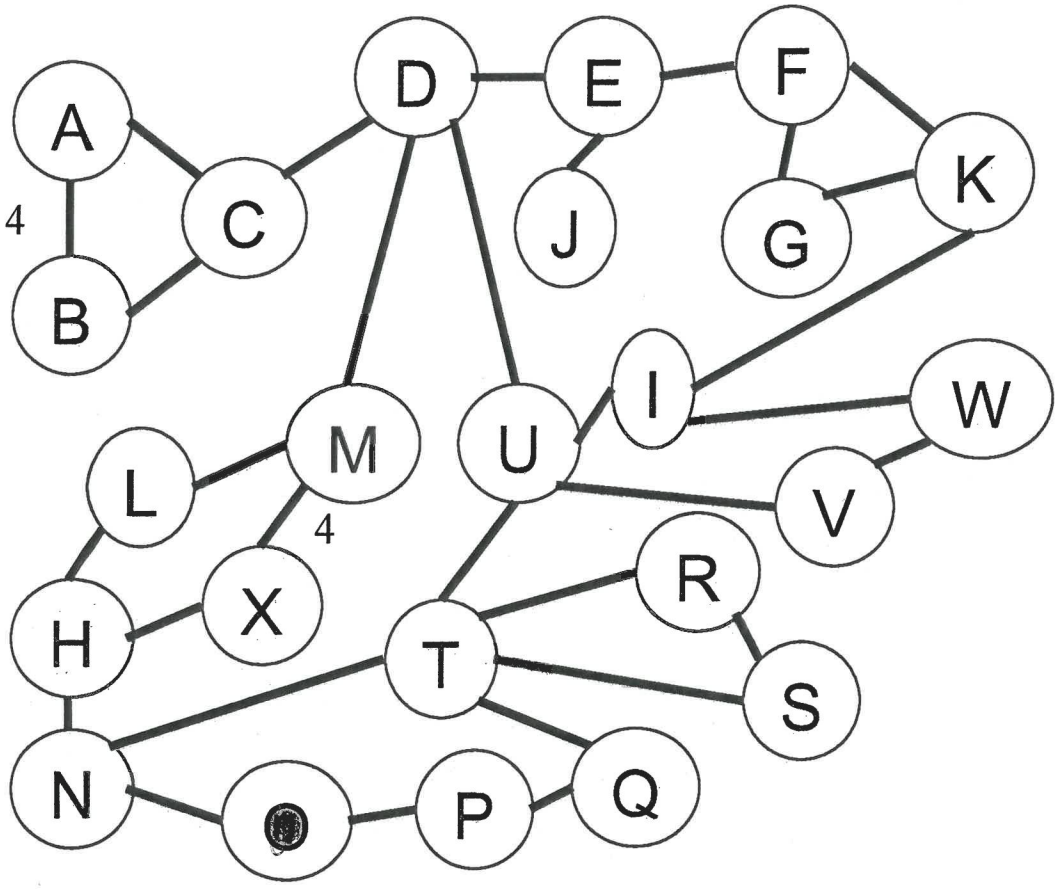
Tdown takes much longer to converge and on average, more updates in comparasion to Tup.

(4) Following the common BGP policies, what type(s) of routes (provider, peer, customer) does an ISP announce to its peers and providers? (5pts)

To increase its Profit a ISP announce its customer Path to everyone. A Peer ISP can share the Path with Peers. but the ISP who is getting traffic from Peer, does not forward it to Provider which is against the Policy, a invalid path. but can tranfer it to its customer.
If a ISP has all the open options, the Priority will be: Customer >> Peer >> Provider.

Problem 3 (20 points)

A sample network topology is shown below. It has 24 nodes and 31 links.



Note that link (M,X) has a cost of 4 and link (A,B) also has a cost of 4. All other links have a cost of 1. Assume that router memory is allocated as follows:

- *It takes 1 byte to store a next hop entry. In other words, it takes 1 byte to store an entry such as NextHop(H,D) = L.*
- *It takes 1 byte to store the cost of a link. In other words, it takes 1 byte to store an entry such as Cost(H,L) = 1.*
- *It takes 1 byte to store a distance or path cost. In other words, it takes 1 byte to store an entry such as Dist(H,D) = 3.*
- *It doesn't take any extra memory to store a destination since it is part of the NextHop( ), Cost( ) and Dist( ) data structure.*

Problem 3 (Continued)

(1) How many bytes of memory will router H need if the basic distance-vector routing algorithm is used? Briefly explain your answer. (5pt)

In distance-vector we are storing 3 things, destination, next hop, cost. Since storing destination does not cost us any memory. It takes 2 bytes to store a record in the table. So, total cost will be 2 bytes multiplied by the number of nodes/destinations in the table

(2) How many bytes of memory will router H need if a link-state routing algorithm is used? Briefly explain your answer. (5pt)

In Link-State, we have the Path information, a single record store Dist( ) & cost( ), same 2 bytes per record. So, Total will 2 bytes multiplied by no. of records/nodes.

(3) If the network uses a link state routing algorithm and link (A,B) fails, how many nodes will need to update entries in their memory? (5pt)

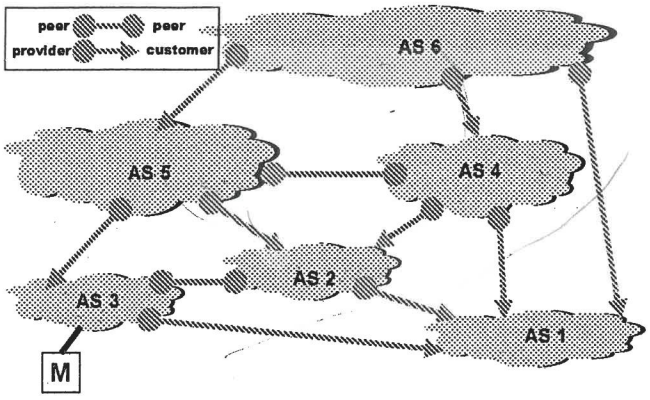
In Link State, we flood same information to everyone because every node contains whole Path to destinatio So, when A-B link fails, every node in the topology gets the update & update in their memory.

(4) If the network uses the basic distance vector routing algorithm and link (A,B) fails, how many nodes will need to update entries in their memory? (5pt)

A-B link only has one direct link E node, which get the update information. After getting update at C node from A & B, C compare its table with A & B's table. Since C is already in optimised state with distance 1-1 from A & B. The update converges at C & does not propagate to others.

Problem 4 (20 points)

This is a sample AS topology annotated with AS relationship. Each AS advertises a single prefix, and the IP ranges of these prefixes do not overlap. M is a monitor station, which is a customer to AS3. M receives BGP updates from AS3 but does not generate any BGP update by itself.



(1) Assume you are using the data collected by M to find out the AS topology. List all the paths that M observes. How many AS nodes and AS links are in the observed topology? (assuming no BGP faults) (7pt)

observed Path:- AS3→AS1, AS3→AS2→AS1, AS3→AS5→AS4→AS1,

AS3→AS5→AS6→AS4→AS1, AS3→AS5→AS2→AS1,

AS3→AS5→AS4→AS2→AS1

All the nodes & links are observed by M by the valid Paths

Invalid Path:- AS3→AS2→AS5→AS4→AS1

AS3→AS2→AS4→AS1

(2) Assume AS1 and all its links are removed from the topology. AS2 is an attacker and wants to **intercept** traffic whose source is AS5 and destination is AS6. It does it by announcing to AS5 a false path [AS2, AS6]. According to the paper's analysis, this does not work. Why? (6pt)

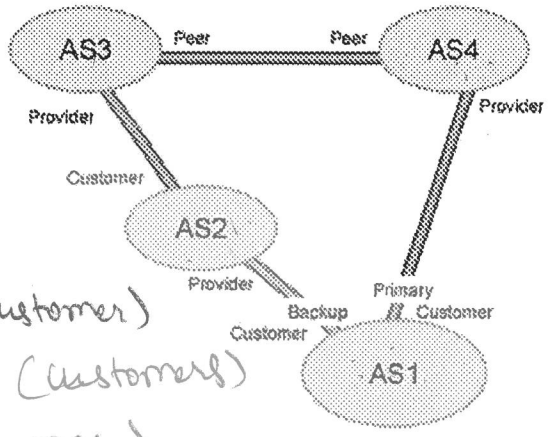
this does not work because it will create a loop, when traffic goes from AS5 to AS2 (attacker), the attacker will send it to AS4 & AS4 to AS5 which makes a loop & this attack does not work.

(3) However, Anton Kapela at a NANOG meeting showed that AS2 can be successful in the attack described in the previous question by being a little bit creative in its routing announcement. What path can AS2 announce to which neighbor in order to succeed in its interception attack? (Hint: BGP loop detection) (7pt)

If AS2 announce a Path [AS2, AS4, AS6] to AS5 then the attack can be successful. because AS2 is a customer to AS5 & AS5 Prefer AS2 & it has a valid Path to AS6. This can be a possible attack Path.

Problem 5 (20 points)

This scenario is adapted from an article, *BGP Wedgies,* by Tim Griffin and Geoff Huston.
(Hint: BGP uses poison reverse)



(1) Under common BGP policies described in our lectures and papers, what paths would AS4, AS3, and AS2 use to reach AS1? (6pts)

AS4 : AS4 → AS1 (Direct customer)
AS3 : AS3 → AS2 → AS1 (Customers)
AS2 : AS2 → AS1 (Customer)

Now AS1 wants link [1-4] be the primary and link [1-2] the backup. In other words, when link [1-4] is up, all traffic from any AS should use [1-4] to enter AS1. Only when link [1-4] is down should traffic enter AS1 using link [1-2]. In order to realize this, AS2 adopts a special policy based on its agreement with AS1: path [2, 1] is assigned the lowest local preference by AS2, even lower than that of provider routes.

Assume we start with links [1-2] and [1-4] are both down, consider the following two scenarios:

(2) Scenario A: AS1 brings link [1-4] up first, wait for routing convergence, then brings link [1-2] up. What paths do AS4, AS3, and AS2 use to reach AS1? Briefly explain AS2's decision. (7pts)

AS4 : AS4 → AS1
AS3 → AS3 → AS4 → AS1
AS2 → AS2 → AS3 → AS4 → AS1
AS2 won't take the direct link to AS1 because that link has the lowest priority & the other path is valid
So AS2 takes AS2 - AS3 → AS4 → AS1

(3) Scenario B: AS1 brings link [1-2] up first, wait for network convergence, then brings link [1-4] up. What paths do AS4, AS3, and AS2 use to reach AS1? Briefly explain AS2's decision. (7pts)

After having link [1-4] up, network still takes time to converges till than all AS takes path through AS2 means
AS4 : AS4 → AS3 → AS2 → AS1
AS3 : AS3 → AS2 → AS1
AS2 : AS2 - AS1

After link [1-4] converge, they all take as follows
AS4 : AS4 → AS1
AS3 : AS3 → AS4 → AS1
AS2 : AS2 → AS3 → AS4 → AS1

Problem 3

part 2 :

31 (number of links) + 23(nodes/destination)

Question 4:
Part 1:
Explain only the best to reach every BGP node from AS3.

Question 5:
Part3:
After link 1-4 get up, AS3 best path is still via AS2, AS3 won't update its table after link 1-4 is up because via AS2 is best path for AS3.