**COMP9121 Assignment 2 2024 S2**

In this assignment, some questions are student number dependent; you will get zero in that question if you use another student's number.

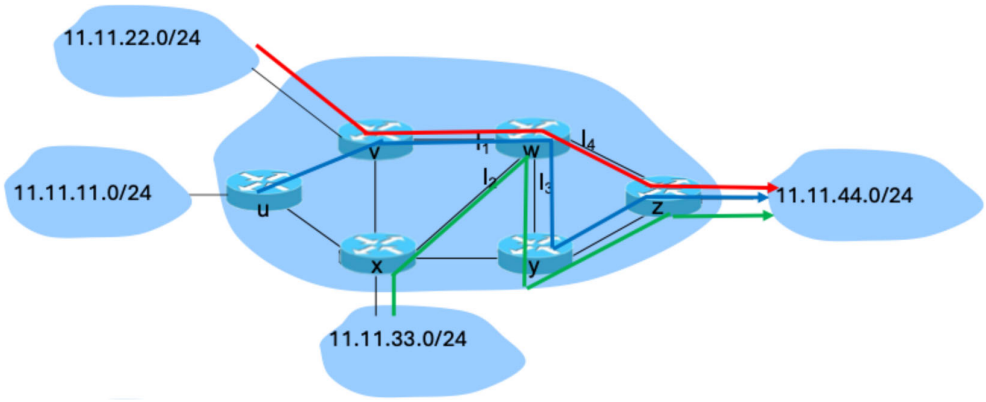
The due date is 27 Oct 2024 at 23:59 and we will open the submission site on Canvas one week before the due date.

**Submission instructions.** In the "main file submission", you can only upload your answers in a single pdf file. In the "supplementary file submission", zip all your codes in a single zip file and submit. For Q9: you must submit your code; otherwise Q9 will not be marked. Q6: you must submit your code if you did any programming; otherwise your will not get full progress mark. This is one assignment with multiple pieces to submit. Your submission time equals to the submission time of the last piece. Late penalty will be calculated based on this submission time.

Normal

**1. SDN.**

In the following network, the network administrator should achieve the load balancing function: If the traffic is from 11.11.11.0/24 to 11.11.44.0/24, the blue path should be used; If the traffic is from 11.11.22.0/24 to 11.11.44.0/24, the red path should be used; If the traffic is from 11.11.33.0/24 to 11.11.44.0/24, the green path should be used;




(1) Can this load balancing function be achieved by traditional non-SDN routers? Why or why not?

(2) If SDN is used in the network, please specify the SDN switch table at w. The four interfaces (ports) of the SDN switch are labelled as $I_1$—$I_4$ respectively.

Please write necessary entries based on the following flow table format.

| Ingress Port | Source MAC | Dest MAC | Eth Type | VLAN ID | Source IP | Dest IP | IP Protocol | Source Port | Dest Port | Action |
|---|---|---|---|---|---|---|---|---|---|---|

(1) NO, traditional non-SDN routers implemented in routers, and individual routing algorithm components in each and every router interact in the control plane (week 7 lecture P3)

As you may notice, every router will use their own algorithm to decide the path. Namely, they do not have a global view, so it cannot deal with load balancing function above since the path is not unique for every router

(2)

| Ingress Port | Source MAC | Dest MAC | Eth Type | VLAN ID | Source IP | Dest IP | IP Protocol | Source Port | Dest Port | Action |
|---|---|---|---|---|---|---|---|---|---|---|
| $I_1$ (Red) | * | * | * | * | 11.11.22.0 /24 | 11.11.44.0 /24 | * | * | * | forward $I_4$ |
| $I_1$ (Blue) | * | * | * | * | 11.11.11.0 /24 | 11.11.44.0 /24 | * | * | * | forward $I_3$ |
| $I_2$ (green) | * | * | * | * | 11.11.33.0 /24 | 11.11.44.0 /24 | * | * | * | forward $I_3$ |

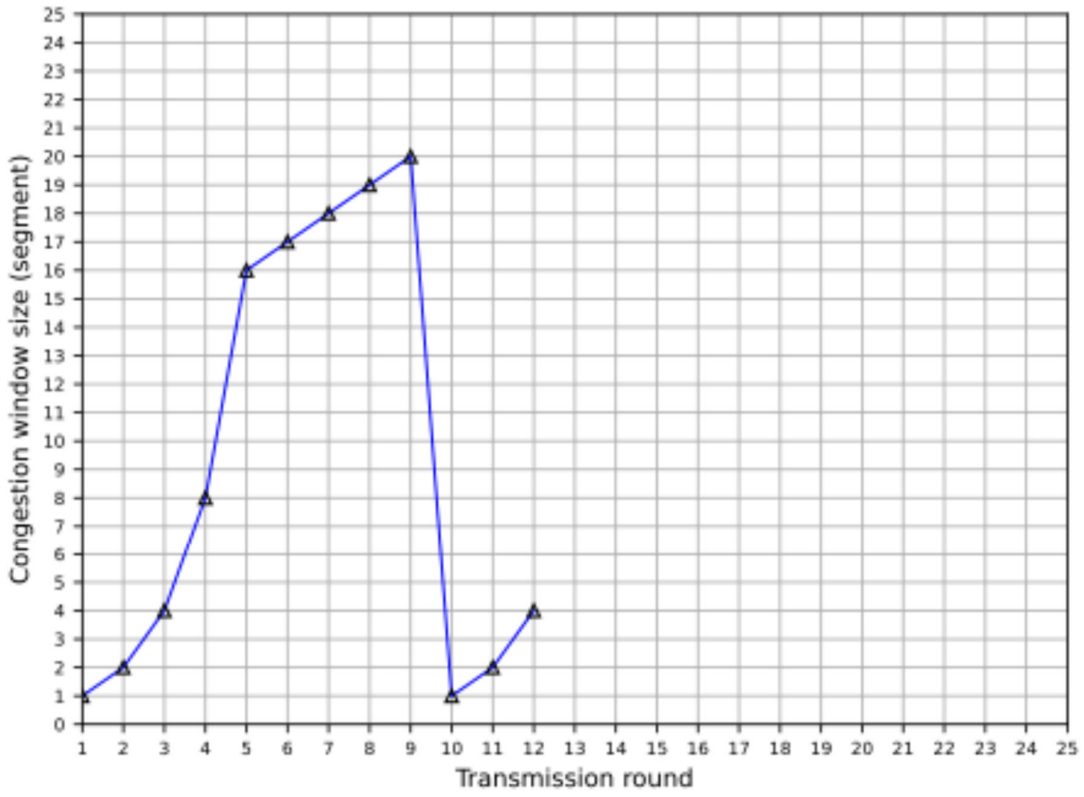
**2. TCP** 10

Consider the figure below. Assume TCP Reno is the protocol experiencing the behaviour, and the TCP session has a large number of packets to send. Answer the following questions (1)—(3). There is only one single TCP session in this figure.

(1) The congestion window size is decreased to 1 (segment) at round 10. Is it caused by three duplicate ACKs or timeout? Why?

(2) What is ssthresh at round 1? Why?

(3) Suppose there is no packet loss after round 10. In the figure, what are the congestion window sizes from round 12 to round 25?



Key points: ① TCP RENO
② One TCP SESSION

Normal

(1) Since it's TCP RENO, so only when Timeout happens, cwnd will be reset to 1.

3 Duplicate ACKs will cause me half the cwnd (fast recovery)

(2) The ssthresh is 16.

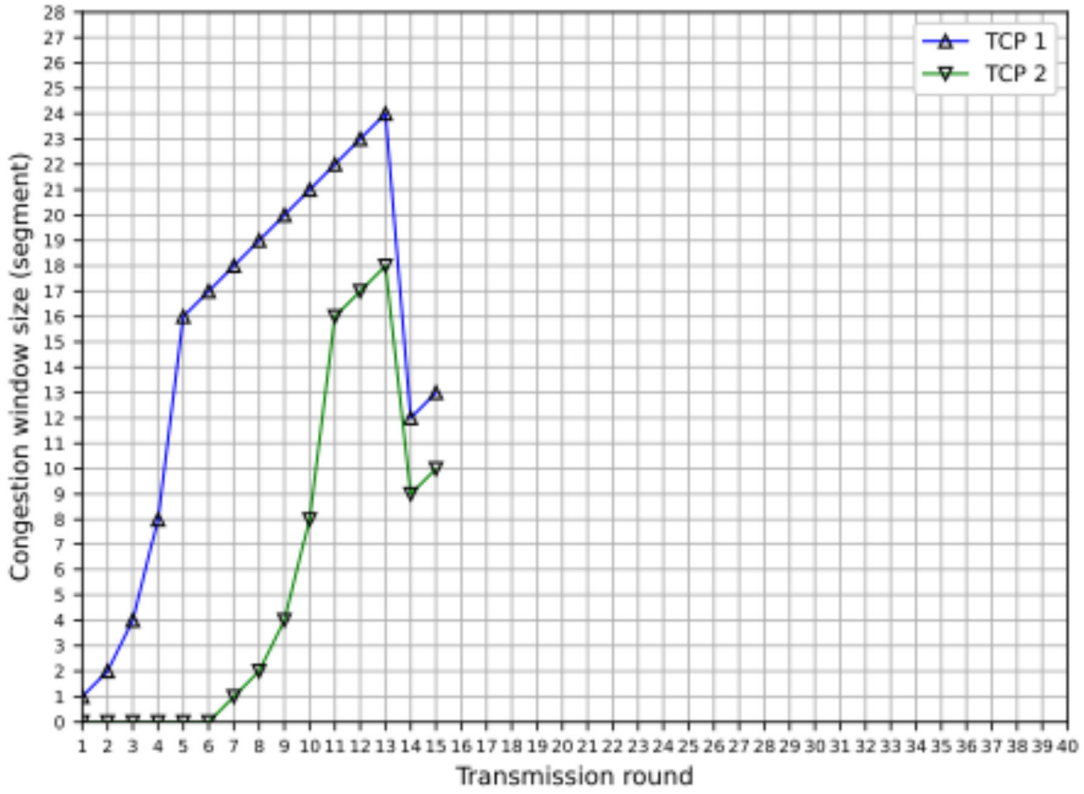
As you can see, the slow start will stop at round 5, and it correspond to cwnd with size 16

(3) there is a Timeout happend at round 9,
at that time, the size of cwnd is 20,
so the new ssthresh should be 20/2 = 10

| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| cwnd | 4 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| ssthresh | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

hard

(4) In Figure below. Two TCP (Reno) sessions are sharing the same link and the link capacity is limited by 42 segments. Whenever the sum of the congestion window sizes reaches (or exceeds) 42, a packet is lost for each TCP session and the packet loss is detected by three duplicate ACKs. TCP session 2 starts later than TCP session 1. What are the congestion window sizes of the two sessions from round 15 to round 40? If the congestion window size is not an integer (in segment), you need to round it down.




- same link: limited by 42 segments
  - ↳ namely when the sum of cwnds reach 42, will lead to package loss
- loss — 3 Duplicate ACKs,

| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TCP1 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 11 | 12 | 13 |
| TCP2 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 10 | 11 | 12 |
| | | | | | | | | | | | 43 | | | |

| | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TCP1 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 11 | 12 | 13 |
| TCP2 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 10 | 11 | 12 |

43

Normal 10

**3. Estimated RTT.**

Consider the TCP procedure for estimating RTT. Let $EstimatedRTT_0$ = 100 ms be the estimated RTT when a TCP is initialised. Then, the TCP sender receives 5 ACKs and sample RTTs are measured as $SampleRTT_1$, $SampleRTT_2$, $SampleRTT_3$, $SampleRTT_4$, and $SampleRTT_5$. All of them are 110 ms. Let $EstimatedRTT_i$ denote the estimated RTT right after the $i$th ACK. We assume $\alpha = 0.125$ in this question.

(1) Calculate $EstimatedRTT_4$ and $EstimatedRTT_5$.

(2) Generalise your solution to $n$ sample RTTs. The TCP sender receives $n$ ACKs, with $i$th sample RTT $SampleRTT_i$. We assume all $SampleRTT_i$ are 110 ms. Express $EstimatedRTT_n$ as a function of n.

(3) For the formula in part (2), let $n$ approach infinity. What is $EstimatedRTT_n$? Comment on why this averaging procedure is called an exponential moving average.

$\alpha = 0.125$ $ERTT_0 = 100$ ms

Formula: $EstimatedRTT_i = (1-\alpha) \times EstimatedRTT_{i-1} + \alpha \times SampleRTT_i$

(1) For simplicity, I will write Estimated RTT as ERTT
Sample RTT as SRTT

$ERTT_1 = (1-0.125) \times ERTT_0 + \alpha \times SRTT_1 = 0.875 \times 100 + 0.125 \times 110$
$= 101.25$

$ERTT_2 = 0.875 \times ERTT_1 + 0.125 \times 110 = 0.875 \times 101.25 + 0.125 \times 110$
$= 102.34375$

$ERTT_3 = 0.875 \times ERTT_2 + 0.125 \times 110 = 0.875 \times 102.34375 + 0.125 \times 110$
$= 103.300781$

$ERTT_4 = 0.875 \times ERTT_3 + 0.125 \times 110 = 0.875 \times 103.300781 + 0.125 \times 110$
$= 104.13818359375$

$ERTT_5 = 0.875 \times ERTT_4 + 0.125 \times 110 = 0.875 \times 104.13818359375 + 0.125 \times 110$

$= 104.8709106445312 5$

(2) $ERTT_n = 0.875 \times ERTT_{n-1} + 0.125 \times 110$

$= 0.875 \left[ 0.875 \times ERTT_{n-2} + 0.125 \times 110 \right] + 0.125 \times 110$

$= 0.875^2 \times ERTT_{n-2} + 0.875 \times 0.125 \times 110 + 0.125 \times 110$

$= 0.875^2 \times ERTT_{n-2} + 0.125 \times 110 (0.875 + 1)$

$= 0.875^2 \left[ 0.875 \times ERTT_{n-3} + 0.125 \times 110 \right] + 0.125 \times 110 (0.875 + 1)$

$= 0.875^3 \times ERTT_{n-3} + 0.125 \times 110 \times 0.875^2 + 0.125 \times 110 (0.875 + 1)$

$= 0.875^3 \times ERTT_{n-3} + 0.125 \times 110 (1 + 0.875 + 0.875^2)$

$\hookrightarrow 0.875^0 + \cdots + 0.875^{n-1}$

Using above formula, I find the pattern below

$$ERTT_n = 0.875^n \times ERTT_0 + 0.125 \times 110 \times \sum_{i=0}^{i=n-1} 0.875^i$$

$$= 0.875^n \times 100 + 0.125 \times 110 \times 8 \times (1 - 0.875^n)$$

Let's check:

when $n=5$, use python

```
>>> import math
>>> pow(0.875,5) x 100 + 0.125x110x8(1-pow(0.875,5))
104.87109064453125
```

(3) $$\lim_{n \to \infty^+} 0.875^n \times 100 + 0.125 \times 110 \times 8 \times (1 - 0.875^n)$$

$$= 0 + 0.125 \times 110 \times 8 \times (1 - 0)$$

$$= 110$$

notice that n can only be positive number

It's called exponential moving average because when $SRTT_i$ is fixed, the influence of $SRTT_i$ become smaller and smaller. As you can see, in (1)'s formula, the most recent ERTT and SRTT have the biggest influence (i.e. weight) and you can find former ERTT and SRTT influence decrease

exponentially (see the $(1-\alpha)ERTT_{i-1}$ term). That's why it is called exponential moving average.

# mainly refer to week 8 lecture P29

Hard

4. **HTTP and TCP.**

Client C requests a webpage from Server A. We assume that RTT between Client C and Server A is 10 ms. After obtaining the main page, Client C finds that there are 2 objects to be fetched. Both objects are also in Server A.

Client C starts to request for object 1 when the main page has been successfully downloaded. It starts to request for object 2 when object 1 has been successfully downloaded. The size of the main web page is small. It fits into 1 TCP segment. Each object fits into *n* TCP segments, where *n* is the last 3 digits of your student number plus 1000. For example, if you last three digits are 123, then *n* = 1123. We have ssthresh=64 segments at the beginning of a TCP session. *Non-persistent HTTP is used*. TCP termination delay is ignored. There is no packet loss.

How long in total does it take for Client C to successfully obtain the webpage (including the main page and two objects).

ignore last reply

webpage: using HTTP protocol

- main web page has 1 TCP segment
- Each object fits into 1481 TCP segments
- Ssthresh = 64
- Using Non-persistent: can send at most one object over TCP connection
- no package loss: cnwd can increase unlimited
- Transmission delay ignored

- $1+2+4+8+16+32+64+65+66+67$ cwnd size summation
  $+68+69+70+71+72+73+74+75$
  $+76+77+78+79+80+81+82 = 1450$ ✓

小於 1481

- $3 \times 7 + 1 + 2 + 1 = 25$

- So we need to set 25 connections for each object (non-persistent connection can at most send one "object")

(1) get main page: 2RTT ✓

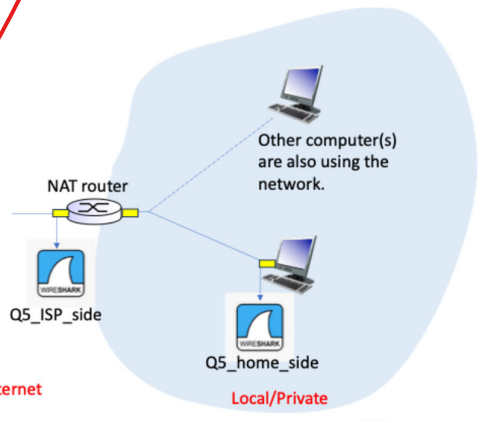
(2) get object 1: 1RTT + ~~2RTT~~ 26
connection transfer

(3) get object 2: 1RTT + ~~2RTT~~ 26

(1)+(2)+(3): $2+1+26+1+26 = 56$ RTT
$= 56 \times 10$
$= 560$ ms

10

**Q5. Wireshark (NAT).** In this question, we investigate packets of one client PC in a home network. The PC is communicating with a remote server. The home network router provides an NAT service. The figure below shows our Wireshark trace collection scenario.




We collected Wireshark trace file (you can find them at modules – assignment 2) on the client PC in the local home network. The file is called Q5_home_side. Meanwhile, we also collected a second trace file at the interface of the home router connecting to the public Internet, as shown in the figure above. The file is called Q5_ISP_side.

(1) Use the trace files and investigate them carefully. Please write down the NAT translation table entries in the NAT router for the traffic you can find in Q5_home_side and Q5_ISP_side. Find as many entries as possible. For each entry, please give screenshots to justify your answer. (If your table has more than 5 entries, just give the screenshots for the first 5 entries in your table.) Please note that some other computers are also using the local network, and their traffic may also appear in Q5_ISP_side but not in Q5_home_side. You should ignore them when you figure out the NAT translation table.

(2) What is the MAC address of the client PC? What are the MAC addresses at the two interfaces of the NAT router? Please give you screenshots.

LAN: IP Addr of client: 192.168.137.20

55645
55646
55647
55648
55650
55651
55652

NAT IP addr of NAT: 10.66.30.63

63677 Local
63678 Local
63679 Local
63683 other
63684 other
63685 other
63686 Local
63688 Local
63689 Local
63690 other
63692 other
63693 other
63694 Local

not green part should be ignored in (1)

WAN IP Addr of server: 129.78.67.134 80

Pc IP　　Pc port　　NAT IP　　NAT Port

(1)

| # | Internal IP | Internal Port | External IP | External Port |
|---|---|---|---|---|
| 1 | 192.168.137.20 | 55645 | 10.66.30.63 | 63677 |
| 2 | 192.168.137.20 | 55646 | 10.66.30.63 | 63678 |
| 3 | 192.168.137.20 | 55647 | 10.66.30.63 | 63679 |
| 4 | 192.168.137.20 | 55648 | 10.66.30.63 | 63686 |
| 5 | 192.168.137.20 | 55650 | 10.66.30.63 | 63688 |
| 6 | 192.168.137.20 | 55651 | 10.66.30.63 | 63689 |
| 7 | 192.168.137.20 | 55652 | 10.66.30.63 | 63694 |

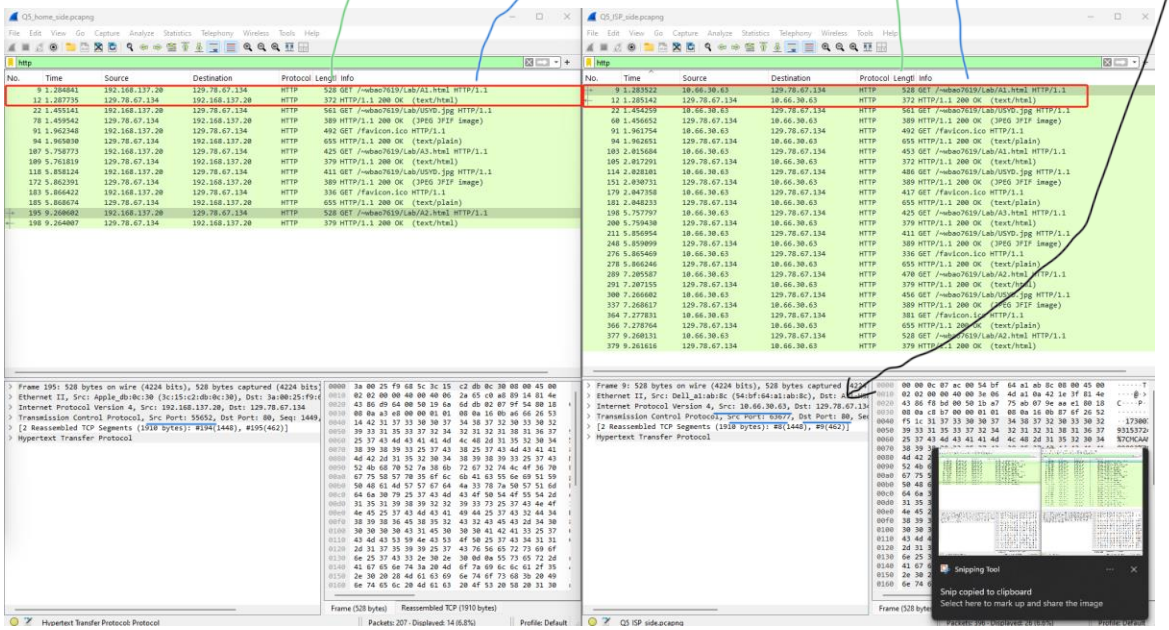
. See below blue lines, it tells NAT router info

(1)

- Length are the same
- Info are same

#1

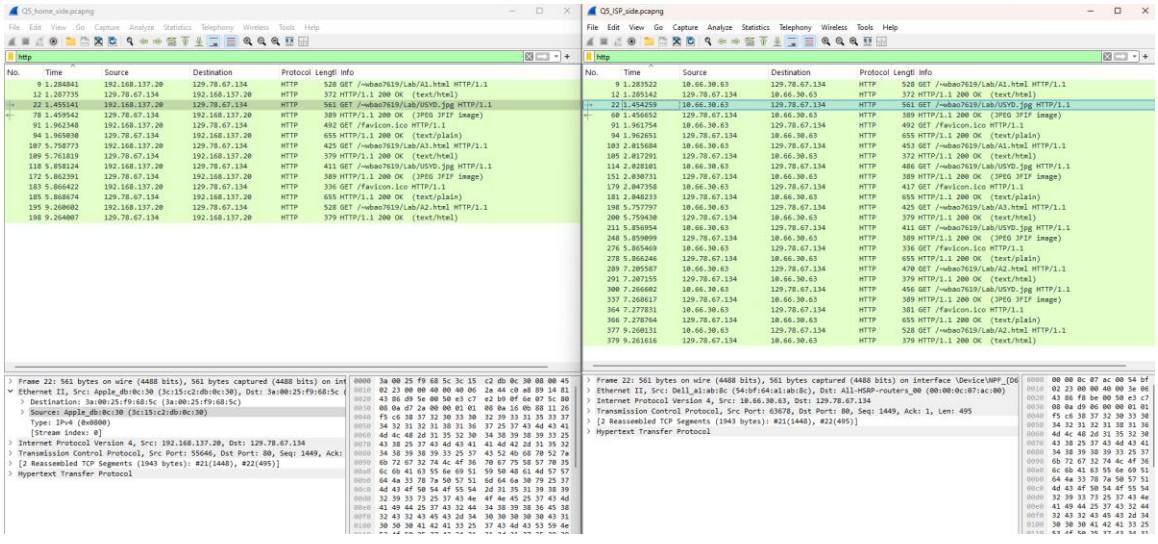
63677



Below Images have same reason

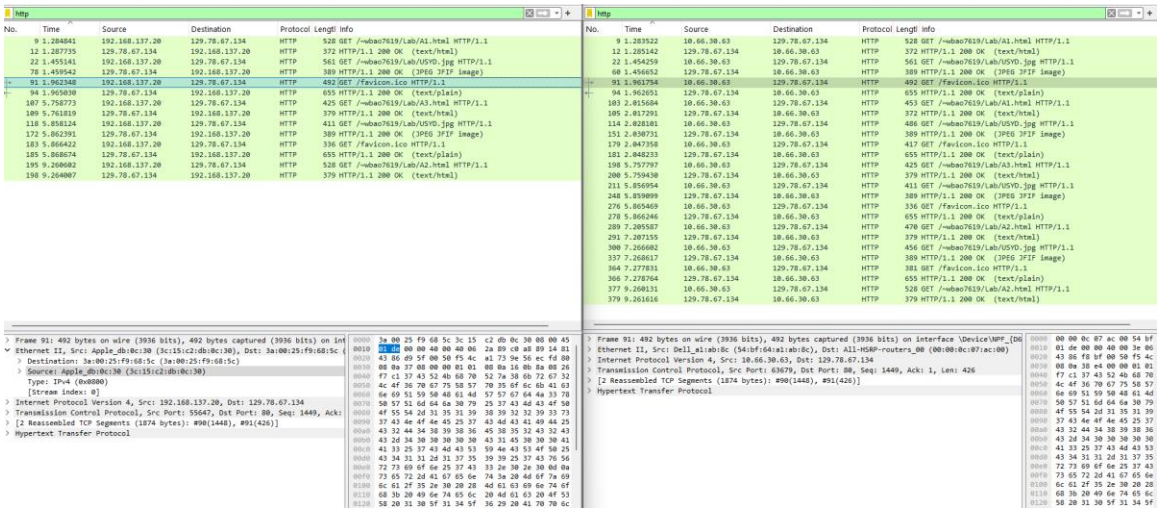
63678

#2



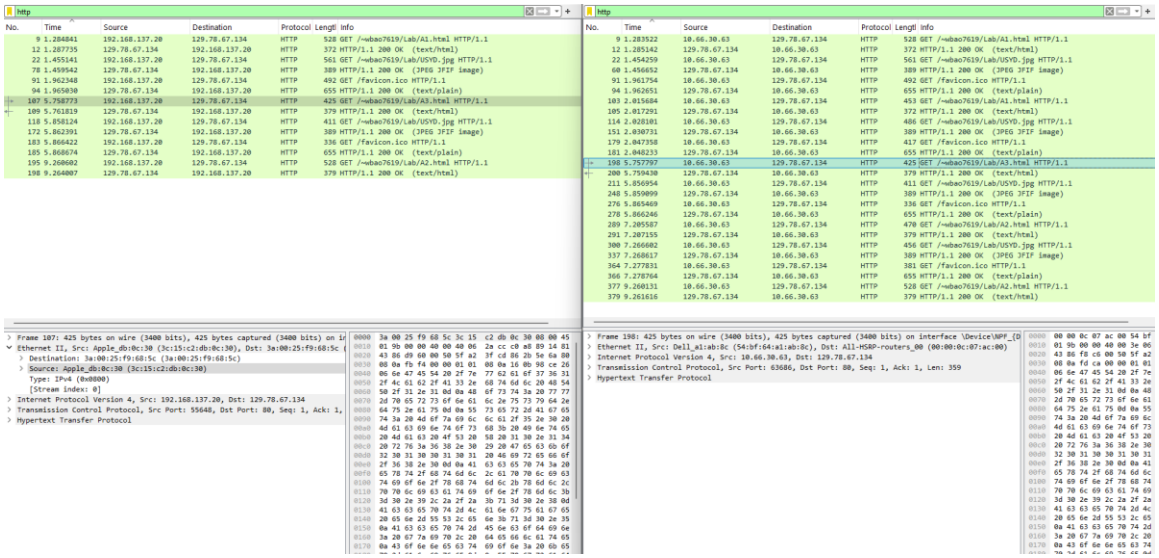
63679

#3



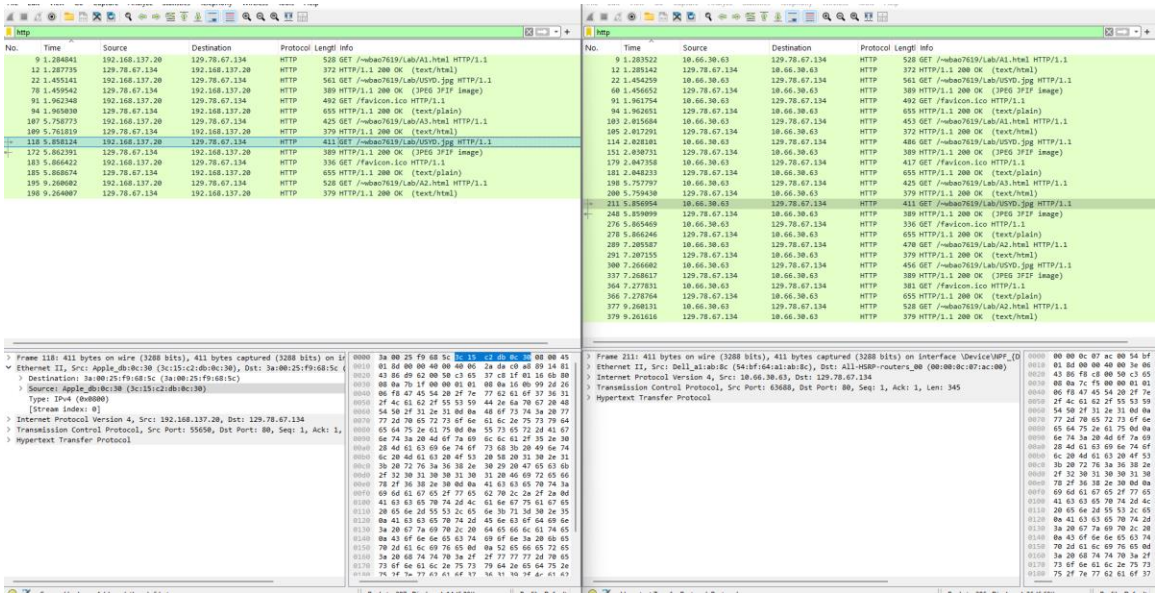
63686

#4



63688

#5



(2) MAC address of the client PC:

3C:15:C2:db:0C:3D

MAC address of LAN side interface of NAT

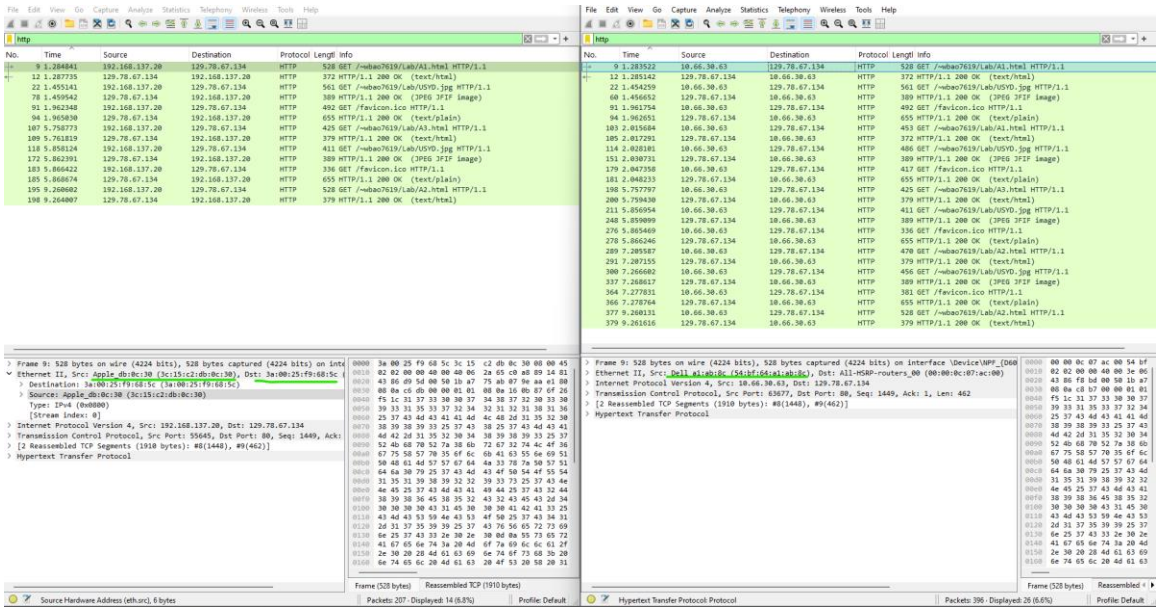
3a:00:25:f9:68:5C

MAC address of WLAN side interface of NAT

54:bf:64:a1:9b:8C

see below image green line

(2)



hard 10

**6. P2P.** A server distributes a file with the size of $10^9$ bytes to $n$ hosts. The upload rate of the server is 3.5 Mbps. The $i$-th host ($i = 1,2,\ldots,n$) has a download rate of $0.5i$ Mbps. For all hosts, the upload rate is 1 Mbps. Calculate the minimum distribution time as a function of $n$ for P2P distribution and client-server distribution, and plot the two curves. ($n = 1,2,\ldots,100$). You should submit your code if you did any programming to complete this task.

- server upload rate: 3.5 Mbps = $U_s$
- $i$-th host download rate: $0.5i$ Mbps
- host upload rate: 1 Mbps = $U_i$

- $F = 10^9$ byte $= 8 \times 10^9$ bits
- $d_{min} = 0.5$ Mbps where $i = 1$

server – client:

$D_{c-s} \geq \max\{$ server upload speed, client download speed $\}$

$D_{c-s} \geq \max\{$ $NF/U_s$ , $F/d_{min}$ $\}$

$\geq \max\left\{ n \cdot \frac{8\times10^9}{3.5\times10^6}, \frac{8\times10^9}{0.5\times10^6} \right\}$

$$D_{c-s} = \begin{cases} n \times 2285.714286 & n > 7 \\ 16000 & n \leq 7 \end{cases}$$

- Client – client :

$$D_{P2P} \geq \max\left\{ \frac{F}{U_s}, \frac{F}{d_{min}}, \frac{NF}{U_s + \sum U_i} \right\}$$

$$\geq \max\left\{ \frac{8\times10^9}{3.5\times10^6}, \frac{8\times10^9}{0.5\times10^6}, \frac{n\times 8\times10^9}{3.5\times10^6 + n\times1\times10^6} \right\}$$

$$\Downarrow$$

$$D_{P2P} = \begin{cases} \frac{8\times10^9}{0.5\times10^6} = 16000, & \text{otherwise} \\ \frac{n\times 8\times10^9}{10^6(3.5+n)} = \frac{n\times8\times10^3}{3.5+n} & -7 \leq n \leq -4 \end{cases}$$

← I got this by using desmos

simplify it, we get,

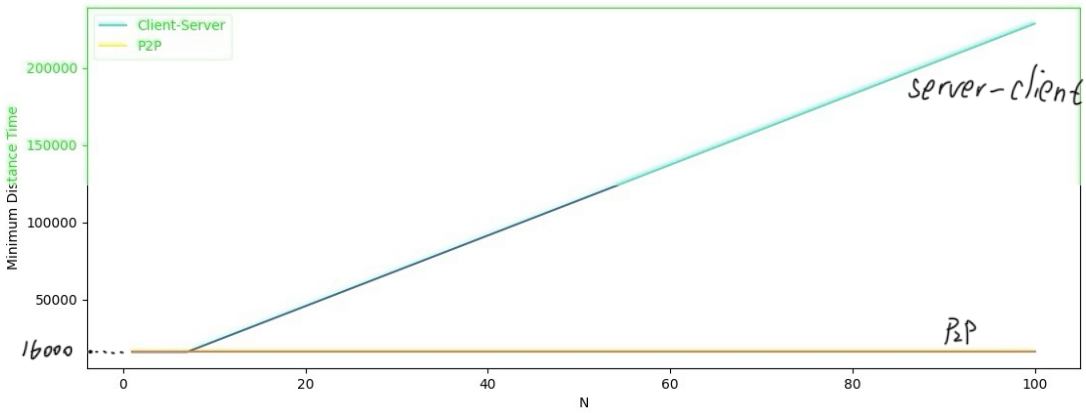
, with download speed 0.5Mbps,

$$D_{P2P} = 16000$$

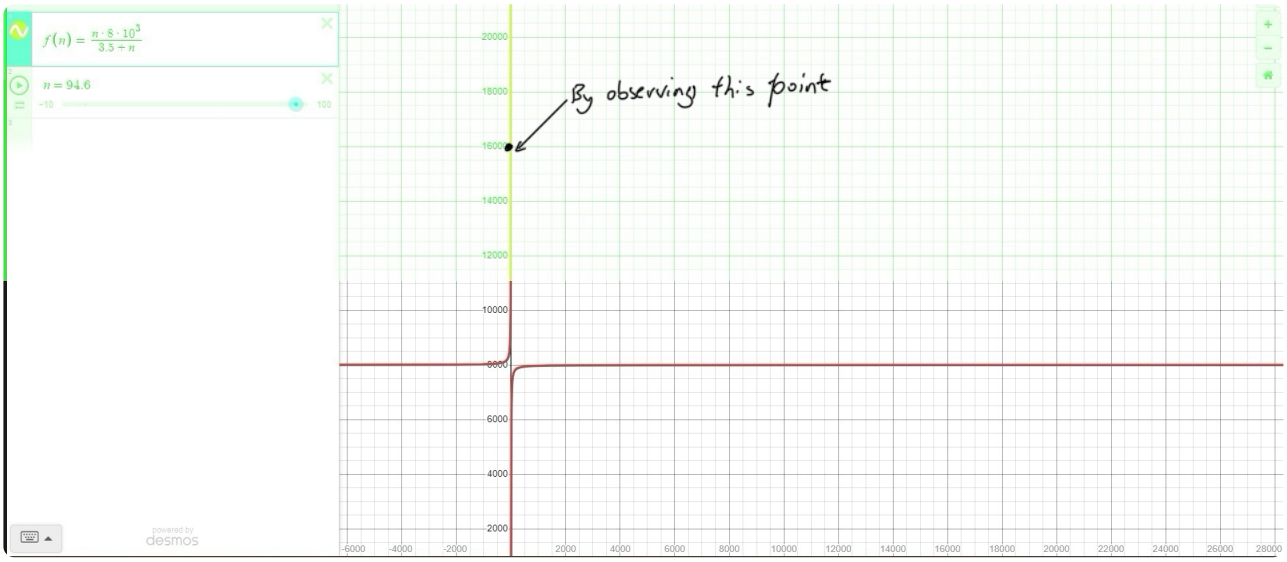
# it seems the 1st client lower the distribution time ✓

since n cannot be negative

plot If you think below image is unclear, please run my python code




Desmos




if $3.5+n > 0$ calculate $\frac{n \times 8 \times 10^3}{3.5+n} > 16000$

if $3.5+n < 0$ calculate $\frac{n \times 8 \times 10^3}{3.5+n} > 16000$

$\Rightarrow -7 < n < -3.5$

Very hard

**7. Cross layer: Routing, UDP/TCP, DNS/HTTP**

Consider the network shown below. In the figure, AA is the Authoritative DNS server for Web Servers A and B, and LC is the local DNS server for Client C. Client C wishes to see a webpage on Server A. The IP address of Server A is not cached in the client. The address resolution is done iteratively, i.e., all levels of DNS servers (root, TLD, and AA) should be consulted.

Assume that the one-way delay through each link inside AS1, and one-way delay through each AS outside AS1 is labeled in the figure, in ms. We assume that all dashed links have zero delay. For example, the one-way delay from Router C to AA is 30 ms. The one-way delay from Router E to Root via AS4 AS5 is 45 ms. OSPF routing protocol is used within AS1 (link cost is equivalent to one-way delay inside AS1). BGP is used among the ASes.

After resolving the IP address, Client C can visit Server A. After obtaining the main page, Client C finds that there are 2 objects to be fetched. One object is stored in Server A, but the other object is stored in Server B. Unfortunately, Client C does not know the IP address of Server B, so that Client C has to resolve the IP again.

The size of the main web page is small. It fits into 1 TCP segment. Each object is also small and fits into 1 TCP segment. No packet is lost. Persistent HTTP is used.

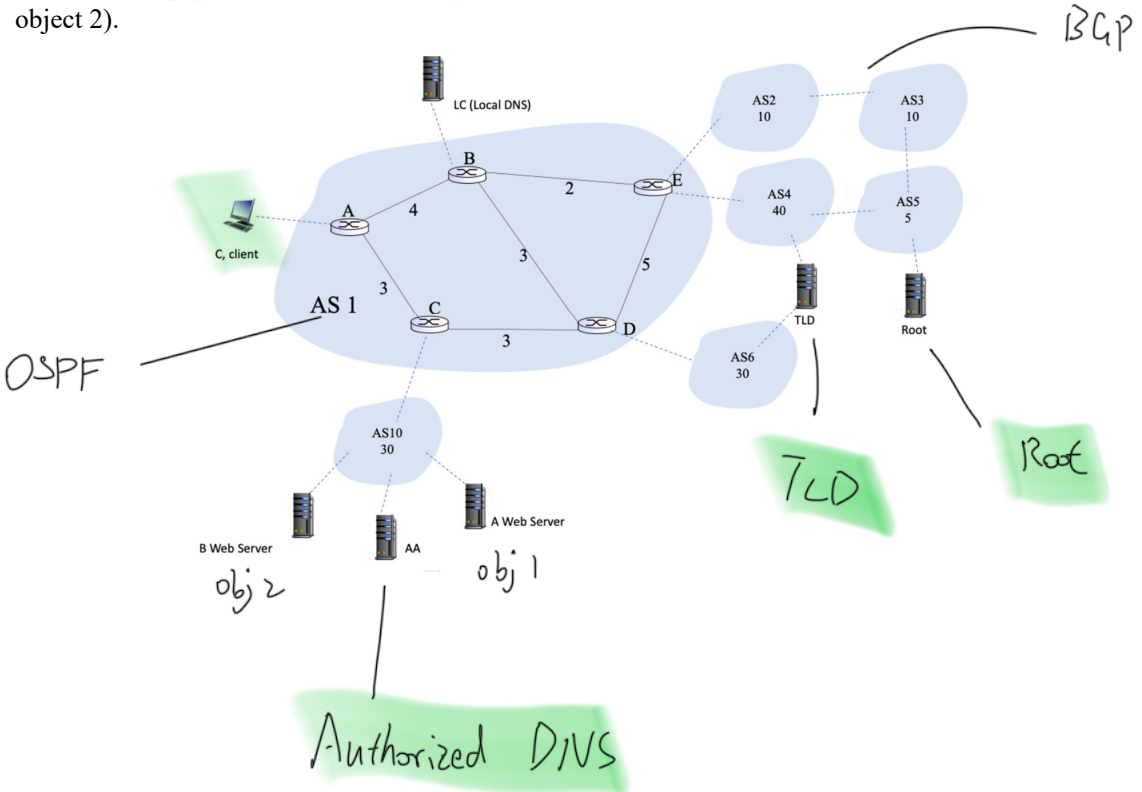
Assumption 1: All inter-AS paths are allowed, and these inter-AS paths have been known by all routers in all ASes.

Assumption 2: All levels of DNS servers should be consulted iteratively for address resolution.

Assumption 3: Client C starts to request the IP address of object 2 when object 1 has been successfully downloaded.

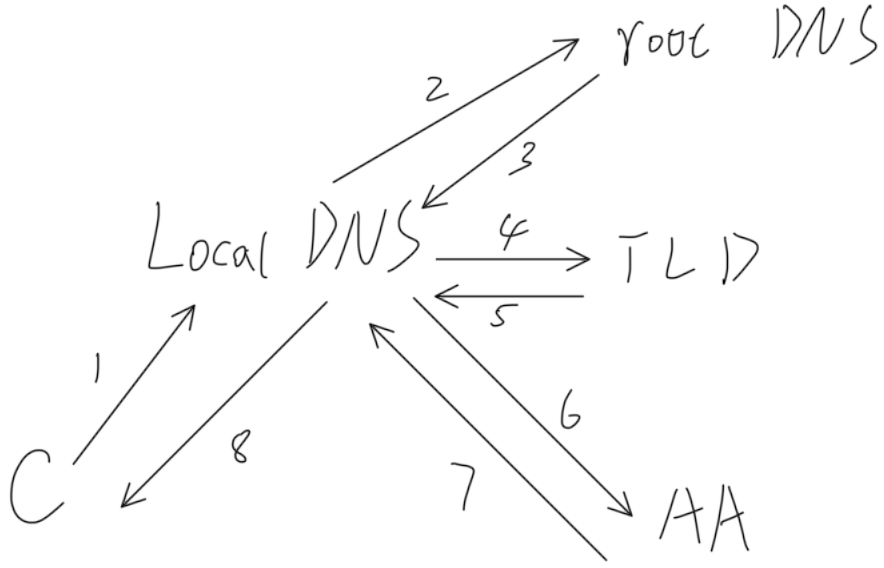
Assumption 4: TCP termination delay is ignored.

Question: How long in total does it take for Client C to successfully obtain the webpage (including: DNS of main paper, download of main page, download of object 1, DNS of object 2, and download of object 2).



Step 1: Find A web server IP

- UDP is used for DNS
- TCP is used for HTTP




1: A→B takes 4 ms ✓

2 B→E→AS2→AS3→AS5 takes 27 ms 47

AS4 least hops for inter-AS

3 takes 27 ms 47

4 B→ E AS4 takes 32 ms 42

1-lot potato for intra AS

5 takes 32 ms 42

least cost

6 B→D→C→AS10 takes 36 ms ✓

1 lot potato + diff

7 takes 36 ms ✓

8 takes 4 ms ✓

In total, we got $4x2 + 27x2 + 33x2 + 36x2 =$ ~~200~~ 258 ms

Step 2: Fetch main page from A web server

A → C → A s10 takes 33 ms

Get main page need 2RTT: RTT 133 ~~66~~

2 x ~~33~~ = ~~66~~ 132 ms

Step 3: Fetch object 1 from A web server

need 1 RTT: since persistent connection

33 ms 66 for RTT

Step 4: Find B web server IP

takes ~~26~~ 258 ms

Step 5: Fetch object 1 from B web server

takes 2 RTT: ~~66 ms~~ 132

In total, we have

200 + 66 + 33 + 200 + 66 = 565 ms

10

**Q8. RSA.** Use RSA algorithm to answer the following questions. You should use decimal numbers instead of binary numbers in this question. Correct solution is not unique.

(1) Select proper values of $p$ and $q$, larger than 10 but less than 20. Then, calculate $n$ and $z$.

(2) Select proper values of $e$ and $d$. Then, encrypt the last two digits of your student number.

(3) Decrypt your answer for Part (2), and verify if the last two digits of your student number can be recovered.

(4) Trudy (the intruder), eavesdropped on the encrypted number and the public key ($n$, $e$), how can she decrypt the number in this example? In reality, $p$ and $q$ value are very large numbers; if Trudy eavesdropped on the encrypted number and the public key, can she still decrypt the number? Why or why not?

(1). Since we need to use large p, q, so I decided to use

$p = 17 \quad q = 19$

- $n = pq = 17 \times 19 = 323$

$z = (p-1)(q-1) = 288$

(2). $\gcd(e, z) = 1$ and $288 = 2^5 \times 3^2$

Hence we can chose $e = 5$

- $ed \bmod z = 1$

$5d \bmod 288 = 1$

By using Euclidean Function, we can get

$$5x + 288y = 1$$

$$288 = 5 \times 57 + 3$$

$$5 = 3 \times 1 + 2$$

$$3 = 2 \times 1 + 1$$

$$2 = 1 \times 2 + 0$$

$$1 = 3 - 1 \times 2 = 3 - 1 \times (5 - 1 \times 3) = 2 \times 3 - 1 \times 5$$

$3 = 288 - 5 \times 57$ ⟶ $= 2 \times (288 - 5 \times 57) - 1 \times 5$

$$= 5 \times (-115) + 288 \times 2$$

so we get $d = -115$

we want to use positive number

$$d = 288 - 115 = 173$$

- Now let's encrypt 81 # last 2 digits of student number

$$C = 81^{e} \bmod n = 81^{5} \bmod 323 = 47$$

$$\# \; 81^5 = 47 + k \cdot 323$$

(3) $m = c^d \bmod n$

$= 47^{173} \bmod 323$

$= 81$ ✓

(4). Trudy knows $n = 323$

$e = 5$

$c = 47$

- she can try to find all possible prime $p'$ and $q'$ which $p'q' = 323$
- It's possible because the number of prime less than 323 is very few
- Then she can use $\gcd\left[(p'-1)(q'-1), e\right] = 1$ to find the true value of $p$ and $q$ from those $p'$ and $q'$

- After finding true p and q, she can easily get d by guess and check
- Namely she get the private key
- However, if p and q is very large, Trudy cannot factor big number, so she cannot get private key. (see Week11 P28 lecture PPT)

10

**Q9. Hash.** In this question, we aim to use SHA384 hash algorithm to find the nonce of the following magic sentence so that the hash has 6 leading zeros (24-bit zeros) in the beginning. Easy Python programming (less than 15 lines) will be needed in this question.

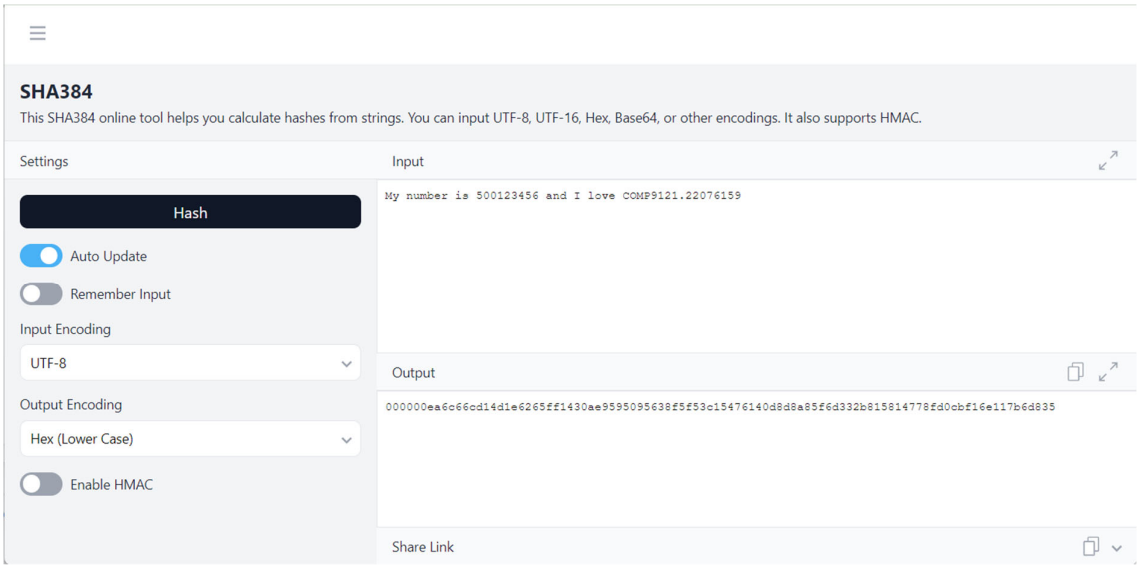
Magic sentence: 49005148

*My number is ******** and I love COMP9121.########*

Here ******** indicates your student number (so this should be different for everyone) and ######## is the "nonce" you need to find. ######## is a string, which can be with any length. For example, the magic sentence below is the outcome (the answer is not unique). Please note, there is no limitations on the length of the nonce.

*My number is 500123456 and I love COMP9121.22076159*

You can verify it at many websites, such as, https://emn178.github.io/online-tools/sha384.html, where you can see that the hash has 6 zeros in the beginning.




Please note that in the "input" in the above screenshot, there should be no carriage return or line feed. Otherwise, the hash will be different.

You need to use Python3 to find a nonce. (Since the answer is not unique, you only need to find one answer.) You may use hashlib and use a correct function in this library. For example, the following program will generate SHA384 of "*My number is 500123456 and I love COMP9121.*"

```
import hashlib
s="My number is 500123456 and I love COMP9121."
s=bytes(s,'utf-8')
hashresult=hashlib.sha384(s).hexdigest()
```

(1) Write down your magic sentence and submit Python 3 code as supplementary material.

(2) How long does it take to find the nonce?

(3) In this case we find the nonce generating for 6 leading zeros. Comment on what will happen if you are required to find a nonce that generates a hash with 20 leading zeros. (This is what miners of bitcoins should do!)

(1) My number is 490051481 and I love COMP9121.1425490

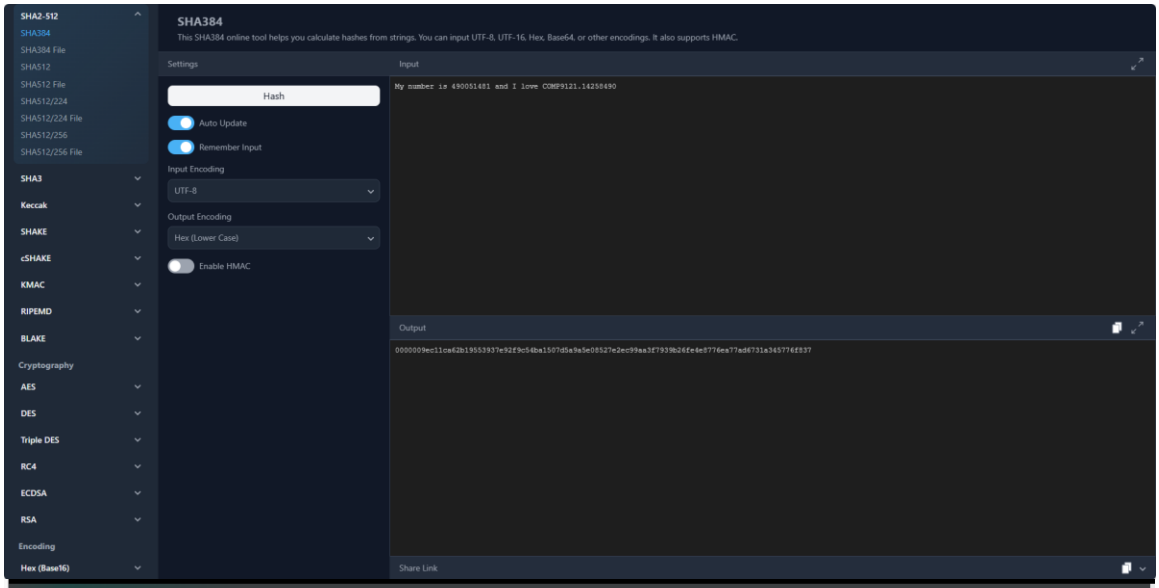
(2) 18.068902730941 77 seconds

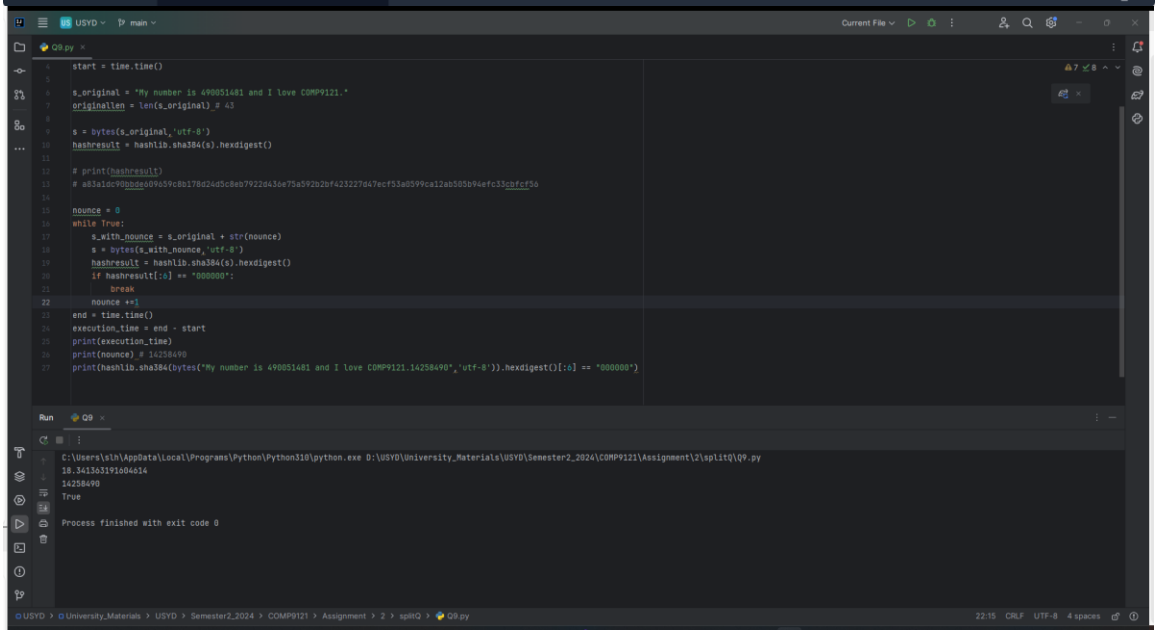
(3) It will take more time for my computer to calculate it.

The worst case we need to find nonce that could lead to 20 leading 0's need $2^{20}$ times of guess.

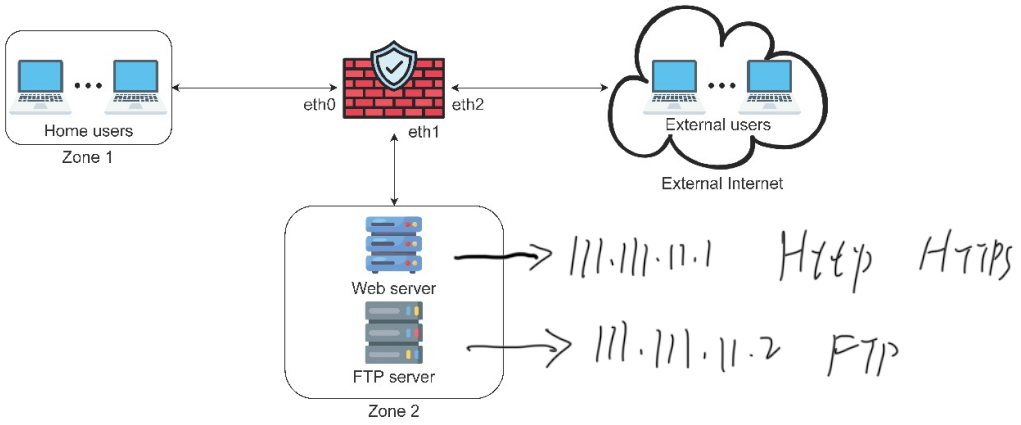
The successful probability if you guess once is:

$$\frac{1}{2^{20}}$$


SHA2-512
SHA384
SHA384 File
SHA512
SHA512 File
SHA512/224
SHA512/224 File
SHA512/256
SHA512/256 File
SHA3
Keccak
SHAKE
cSHAKE
KMAC
RIPEMD
BLAKE
Cryptography
AES
DES
Triple DES
RC4
ECDSA
RSA
Encoding
Hex (Base16)
SHA384
This SHA384 online tool helps you calculate hashes from strings. You can input UTF-8, UTF-16, Hex, Base64, or other encodings. It also supports HMAC.
Settings
Hash
Auto Update
Remember Input
Input Encoding
UTF-8
Output Encoding
Hex (Lower Case)
Enable HMAC
Input
My number is 490051481 and I love COMP9121.14258490
Output
0000009ec11ce62b19553937e92f9c54ba1507d5a9a5e08527e2ec99aa3f7939b26fe4e8776ea77ad6731a345776f837
Share Link


USYD
main
Current File
Q9.py
start = time.time()
s_original = "My number is 490051481 and I love COMP9121."
originallen = len(s_original) # 43
s = bytes(s_original,'utf-8')
hashresult = hashlib.sha384(s).hexdigest()
# print(hashresult)
# a83a1dc90bbdde009659c8b178d24d5c8eb7922d43e75a592b2bf423227d47ecf53a0599ca12ab505b94efc33cbfcf56
nounce = 0
while True:
s_with_nounce = s_original + str(nounce)
s = bytes(s_with_nounce,'utf-8')
hashresult = hashlib.sha384(s).hexdigest()
if hashresutt[:6] == "000000":
break
nounce +=1
end = time.time()
execution_time = end - start
print(execution_time)
print(nounce) # 14258490
print(hashlib.sha384(bytes("My number is 490051481 and I love COMP9121.14258490",'utf-8')).hexdigest()[:6] == "000000")
Run
Q9
C:\Users\slh\AppData\Local\Programs\Python\Python310\python.exe D:\USYD\University_Materials\USYD\Semester2_2024\COMP9121\Assignment\2\splitQ\Q9.py
18.341363191606614
14258490
True
Process finished with exit code 0
USYD > University_Materials > USYD > Semester2_2024 > COMP9121 > Assignment > 2 > splitQ > Q9.py
22:15
CRLF
UTF-8
4 spaces

**10. Firewall.** We will develop the firewall configuration. The figure below shows the configuration we want to achieve. The home users reside in Zone 1. The external users reside in the External Internet. A Web server (111.111.11.1) and an FTP server (111.111.11.2) are located in Zone 2. The Web server supports both http and https requests.




The security policy is as follows:

1) The home users can freely access any Web service, anywhere, but only if they initiate the connection themselves.

2) The home users and the external users can establish the telnet session with each other.

3) Everyone (home users and external users) can access the web server in Zone 2.

4) Only the home users can access the FTP server in Zone 2.

5) Block all other incoming and outgoing traffics.

Complete the table to define a stateless firewall configuration for the given scenario. You can refer to the IP ranges (source and destination) by their "zone name". Use "Ext" to indicate external Internet. Use "*" to indicate "all".

| Interface | Source IP | Destination IP | Source Port | Destination Port | ACK | Action |
|---|---|---|---|---|---|---|
| | | | | | | |

| Interface | Source IP | Destination IP | Source Port | Destination Port | ACK | Action |
|---|---|---|---|---|---|---|
| eth0 | zone1 | * | * | 80, 443 | Any | Allow |
| eth1 | zone2 | zone1 | 80, 443 | * | Set | Allow |
| eth2 | Ext | zone1 | 80, 443 | * | Set | Allow |
| | | | | | | |
| eth0 | zone1 | Ext | * | 23 | Any | Allow |
| eth2 | Ext | zone1 | 23 | * | Set | Allow |
| eth2 | Ext | zone1 | * | 23 | Any | Allow |
| eth0 | zone1 | Ext | 23 | * | Set | Allow |
| | | | | | | |
| eth2 | Ext | 111.111.11.1 | * | 80, 443 | Any | Allow |
| eth1 | zone1 | Ext | 80, 443 | * | Set | Allow |
| | | | | | | |
| eth0 | zone1 | 111.111.11.2 | * | 20, 21 | Any | Allow |
| eth1 | 111.111.11.2 | zone1 | 20, 21 | * | Set | Allow |
| | | | | | | |
| * | * | * | * | * | * | Deny |