

Deber 3 Jose Luis Santillan

Saturday, May 6, 2023 5:08 PM

- 1) Read the following Wireshark tutorial, and use it to capture traffic from the following scenarios. Use screenshots to show your results.

- Run 10 traceroute commands against google.com
- Watch a video from youtube.com. Capture the TCP handshake, and the congestion window.

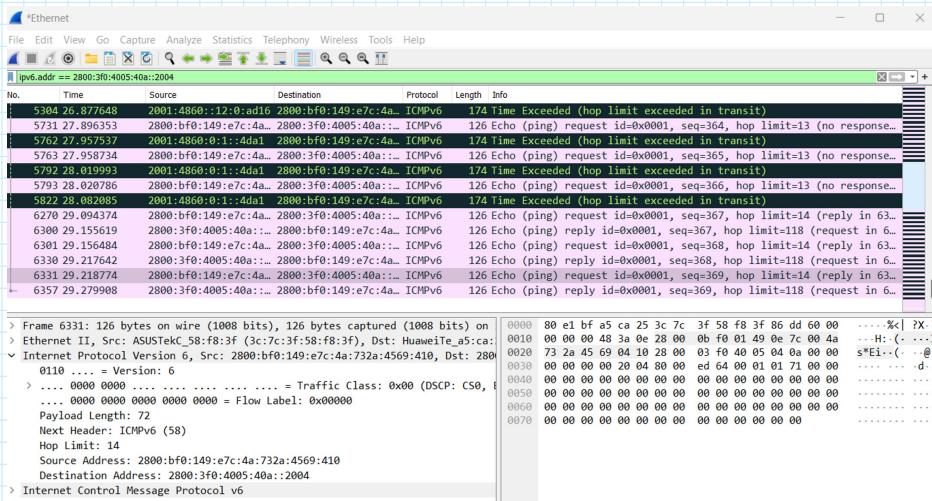
a. $\text{ipv6.addr} == 2800:3f0:4005:409::2004$

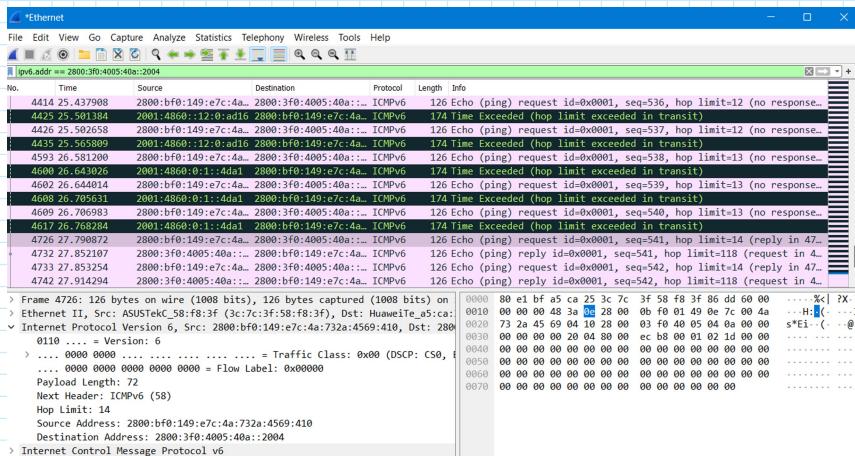
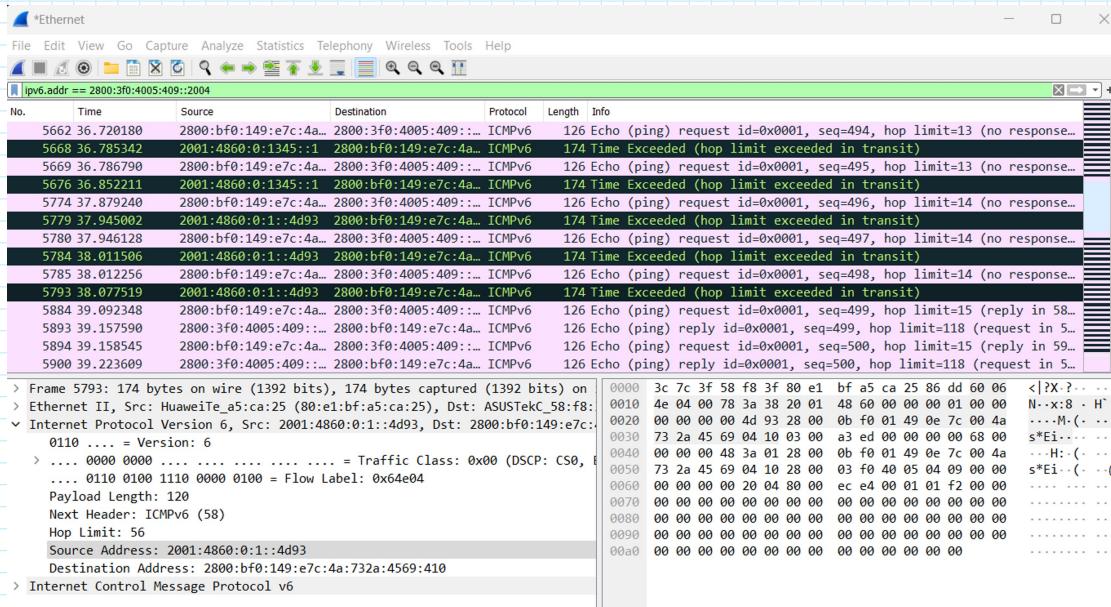
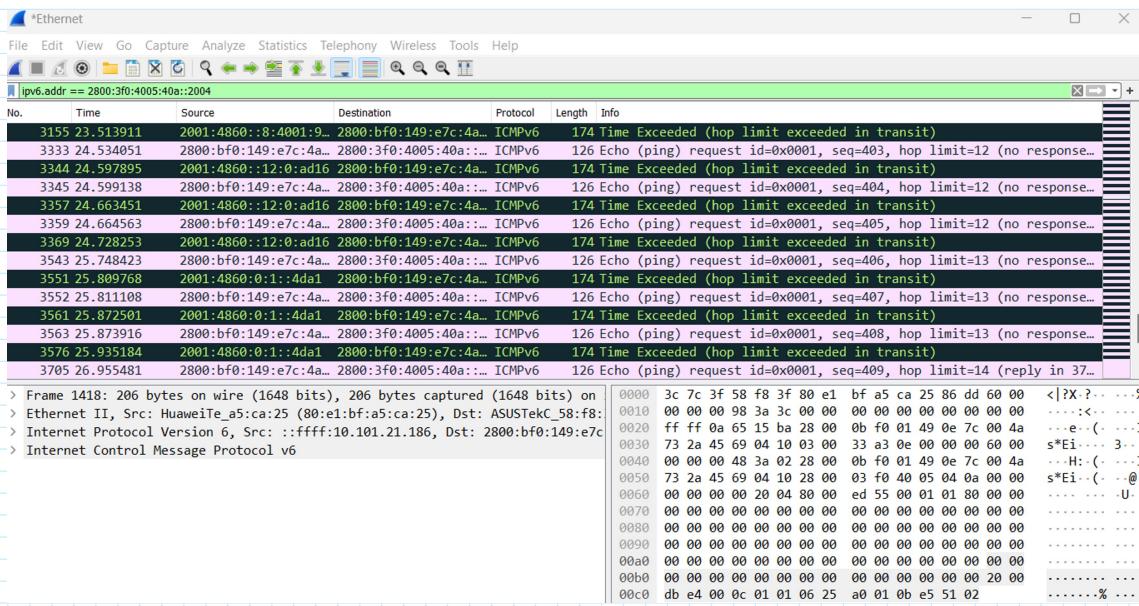
```
Trace complete.
PS C:\Users\jochet> tracert www.google.com

Tracing route to www.google.com [2800:3f0:4005:409::2004]
over a maximum of 30 hops:

 1  <1 ms    <1 ms    <1 ms  2800:bf0:1fff:f548:82e1:bfff:fea5:ca26
 2  8 ms     4 ms     3 ms  2800:bf0:1fff:f548::1
 3  2 ms     2 ms     2 ms  fd00:0:0:8a8::1
 4  2 ms     1 ms     1 ms  ::ffff:10.201.222.36
 5  1 ms     1 ms     1 ms  ::ffff:10.101.21.186
 6  *         *         * Request timed out.
 7  77 ms    76 ms    76 ms  2001:4860:0:1::2d22
 8  73 ms    74 ms    74 ms  2001:4860:0:12e1::f
 9  79 ms    78 ms    79 ms  2001:4860::c:4001:de13
10  67 ms    66 ms    67 ms  2001:4860::1:4000:fd88
11  66 ms    69 ms    86 ms  2001:4860::8:4001:9509
12  65 ms    65 ms    67 ms  2001:4860::8:4001:9504
13  65 ms    65 ms    65 ms  2001:4860::0:1345::1
14  65 ms    65 ms    65 ms  2001:4860:0:1::4d93
15  65 ms    65 ms    65 ms  2800:3f0:4005:409::2004

Trace complete.
```





No.	Time	Source	Destination	Protocol	Length	Info
3924	24.497978	2001:4860::12:0:ad16	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
4042	25.527414	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=580, hop limit=13 (no response..
4043	25.588575	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
4049	25.589579	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=581, hop limit=13 (no response..
4054	25.650846	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
4055	25.651931	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=582, hop limit=13 (no response..
4060	25.713016	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
4249	26.738093	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=583, hop limit=14 (reply in 42..
4272	26.799197	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=583, hop limit=118 (request in 4..
4273	26.800492	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=584, hop limit=14 (reply in 42..
4292	26.861775	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=584, hop limit=118 (request in 4..
4293	26.862801	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=585, hop limit=14 (reply in 43..
4304	26.923965	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=585, hop limit=118 (request in 4..

> Frame 922: 126 bytes on wire (1008 bits), 126 bytes captured (1008 bits) on interface Ethernet II, Src: ASUSTek_58:8f:3f (3c:7c:3f:58:f8:3f), Dst: Huawei_te_5c:a..
> Ethernet II, Src: ASUSTek_58:8f:3f (3c:7c:3f:58:f8:3f), Dst: Huawei_te_5c:a..
> Internet Protocol Version 6, Src: 2800:bf0:149:e7c:4a:732a:4569:410, Dst: 2800:
0110 = Version: 6
> 0000 0000 = Traffic Class: 0x00 (DSCH: CS0, E0..
.... 0000 0000 0000 0000 0000 = Flow Label: 0x00000
Payload Length: 72
Next Header: ICMPv6 (58)
Hop Limit: 4
Source Address: 2800:bf0:149:e7c:4a:732a:4569:410
Destination Address: 2800:3f0:4005:40a::4
> Internet Control Message Protocol v6

No.	Time	Source	Destination	Protocol	Length	Info
3637	24.612292	2001:4860::12:0:ad16	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3777	25.632741	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=622, hop limit=13 (no response..
3784	25.693855	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3786	25.695025	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=623, hop limit=13 (no response..
3795	25.756037	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3799	25.757008	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=624, hop limit=13 (no response..
3801	25.818287	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3958	26.846659	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=625, hop limit=14 (reply in 39..
3967	26.907853	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=625, hop limit=118 (request in 3..
3968	26.908686	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=626, hop limit=14 (reply in 39..
3984	26.969861	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=626, hop limit=118 (request in 3..
3985	26.971209	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=627, hop limit=14 (reply in 39..
3992	27.032296	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=627, hop limit=118 (request in 3..

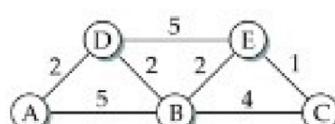
2812 25.994902 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=662, hop limit=12 (no response..
2815 26.057488 2001:4860::12:0:ad16 2800:bf0:149:e7c:4a.. ICMPv6 174 Time Exceeded (hop limit exceeded in transit)
2816 26.058695 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=663, hop limit=12 (no response..
2824 26.122325 2001:4860::12:0:ad16 2800:bf0:149:e7c:4a.. ICMPv6 174 Time Exceeded (hop limit exceeded in transit)
2912 27.139026 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=664, hop limit=13 (no response..
2921 27.200091 2001:4860::1:4da1 2800:bf0:149:e7c:4a.. ICMPv6 174 Time Exceeded (hop limit exceeded in transit)
2922 27.200998 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=665, hop limit=13 (no response..
2927 27.262238 2001:4860::1:4da1 2800:bf0:149:e7c:4a.. ICMPv6 174 Time Exceeded (hop limit exceeded in transit)
2928 27.263760 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=666, hop limit=13 (no response..
2938 27.324907 2001:4860::1:4da1 2800:bf0:149:e7c:4a.. ICMPv6 174 Time Exceeded (hop limit exceeded in transit)
3052 28.367184 2800:bf0:149:e7c:4a.. 2800:3f0:4005:40a:: ICMPv6 126 Echo (ping) request id=0x0001, seq=667, hop limit=14 (reply in 30..
3062 29.427514 2800:3f0:4005:40a:: 2800:bf0:149:e7c:4a.. ICMPv6 126 Echo (ping) reply id=0x0001, seq=667, hop limit=118 (request in 3..

Capturing from Ethernet						
No.	Time	Source	Destination	Protocol	Length	Info
3586	24.883889	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=704, hop limit=12 (no response..
3594	24.947342	2001:4860::12:0:ad16	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3595	24.948296	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=705, hop limit=12 (no response..
3604	25.012304	2001:4860::12:0:ad16	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3746	26.043373	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=706, hop limit=13 (no response..
3750	26.104545	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3751	26.1805628	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=707, hop limit=13 (no response..
3757	26.166904	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3758	26.168035	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=708, hop limit=13 (no response..
3770	26.229326	2001:4860::1:4da1	2800:bf0:149:e7c:4a..	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3912	27.255422	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=709, hop limit=14 (reply in 3912)
3926	27.316504	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=709, hop limit=118 (request in 3912)
3927	27.317364	2800:bf0:149:e7c:4a..	2800:3f0:4005:40a::	ICMPv6	126	Echo (ping) request id=0x0001, seq=710, hop limit=14 (reply in 3934)
3934	27.378512	2800:3f0:4005:40a::	2800:bf0:149:e7c:4a..	ICMPv6	126	Echo (ping) reply id=0x0001, seq=710, hop limit=118 (request in 3927)

No.	Time	Source	Destination	Protocol	Length	Info
3018	24.016998	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=787, hop limit=12 (no response...)
3025	24.080927	2001:4860::12::ad16	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3026	24.081649	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=788, hop limit=12 (no response...)
3036	24.145263	2001:4860::12::ad16	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3038	24.147519	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=789, hop limit=12 (no response...)
3046	24.211261	2001:4860::12::ad16	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3200	25.241257	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=790, hop limit=13 (no response...)
3212	25.302541	2001:4860::1::4da1	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3213	25.303637	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=791, hop limit=13 (no response...)
3222	25.364885	2001:4860::1::4da1	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3225	25.366442	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=792, hop limit=13 (no response...)
3238	25.427640	2001:4860::1::4da1	2800:bf0:149:e7:c4a...	ICMPv6	174	Time Exceeded (hop limit exceeded in transit)
3364	26.470306	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=793, hop limit=14 (reply in 33...
3371	26.531539	2800:3f0:4005:40a...	2800:bf0:149:e7:c4a...	ICMPv6	126	Echo (ping) reply id=0x0001, seq=793, hop limit=118 (request in 3...
3372	26.532539	2800:bf0:149:e7:c4a...	2800:3f0:4005:40a...	ICMPv6	126	Echo (ping) request id=0x0001, seq=794, hop limit=14 (reply in 33...
3381	26.594456	2800:3f0:4005:40a...	2800:bf0:149:e7:c4a...	ICMPv6	126	Echo (ping) reply id=0x0001, seq=794, hop limit=118 (request in 3...

b)

2) Use Dijkstra's to get the routing tables for nodes A, B and E.



Routing Table Node A

```
Nodo:A ----- Costo:0 ----- NextHop:A
Nodo:B ----- Costo:5 ----- NextHop:B
Nodo:C ----- Costo:9 ----- NextHop:B
Nodo:D ----- Costo:2 ----- NextHop:D
Nodo:E ----- Costo:7 ----- NextHop:D
```

Routing Table Node B

```
Nodo:A ----- Costo:5 ----- NextHop:A
Nodo:B ----- Costo:0 ----- NextHop:B
Nodo:C ----- Costo:4 ----- NextHop:C
Nodo:D ----- Costo:2 ----- NextHop:D
Nodo:E ----- Costo:2 ----- NextHop:E
```

Routing Table Node E

```
Nodo:A ----- Costo:7 ----- NextHop:D
Nodo:B ----- Costo:2 ----- NextHop:B
Nodo:C ----- Costo:1 ----- NextHop:C
Nodo:D ----- Costo:5 ----- NextHop:D
Nodo:E ----- Costo:0 ----- NextHop:E
```

- 3) Suppose a host wants to establish the reliability of a link by sending packets and measuring the percentage that are received; routers, for example, do this. Explain the difficulty of doing this over a TCP connection.

Al hacer esto sobre una conexión TCP surgen varias dificultades. La primera de ellas es que no es posible determinar que el paquete enviado por un host haya sido recibido en el primer intento. Es posible que el paquete llegue después del tiempo prescrito o se pierda. En tal caso, el paquete debe ser retransmitido.

Otro problema es que TCP garantiza la entrega en orden de los paquetes. Esto significa que el extremo receptor debe entregar los paquetes a la aplicación receptora en el mismo orden en que se enviaron. Si faltan algunos paquetes o llegan fuera de orden, el extremo receptor debe almacenarlos en búfer hasta que se reciban los paquetes faltantes.

La última dificultad es que durante períodos de congestión de la red, TCP reduce su velocidad de envío para aliviar la congestión, lo que puede influenciar en pérdida de paquetes.

- 4) Consider a simple congestion control algorithm that uses linear increase and multiplicative decrease (no slow start). Assume the congestion window size is in units of packets rather than bytes, and it is one packet initially.

- Give a detailed sketch of this algorithm.
- Assume the delay is latency only, and that when a group of packets is sent, only a single ACK is returned.
- Plot the congestion window as a function of RTT for the situation in which the following packets are lost: 9, 25, 30, 38 and 50. For simplicity, assume a perfect timeout mechanism that detects a lost packet exactly 1 RTT after it is transmitted.

a) $cwnd = 1$

$$\text{On ACK: } cwnd = cwnd + \frac{1}{cwnd}$$

$$\text{On timeout: } cwnd = \min(1, \frac{cwnd}{2})$$

b)	RTT	1	2	3	4
	enviado	1	2-3	4-6	7-10

Paquete 9 perdido. $cwnd$ reducido a 2

RTT 5 6 7 8 9
 enviado 9-10 11-13 14-17 18-22 23-28

Paquete 25 perdido. *cwnd* reducido a 3

RTT 10 11
 enviado 25-27 28-31

Paquete 30 perdido. *cwnd* reducido a 2

RTT 12 13 14
 enviado 30-31 32-34 35-38

Paquete 38 perdido. *cwnd* reducido a 2

RTT 15 16 17 18
 enviado 38-39 40-42 43-46 47-50

Paquete 50 perdido. *cwnd* reducido a 2

RTT 19
 enviado 50

c)

