z5147986
Lab6

1.1
Why the throughput achieved by flow tcp2 is higher than tcp1 between time span 6 sec to 8 sec?
[n3 → n2] (10 Mbps) has a larger bandwidth than [n0 → n1 → n2] (2.5 Mbps). [n3 → n2] will have more package and after adjustment [n3 → n2 → n4 → n5] at about 6 sec, the throughput of tcp2 is larger than tcp1

1.2
Why the throughput for flow tcp1 is fluctuating between time span 0.5 sec to 2 sec?
Because of congestion control, it is adjusting its congestion window and starting slow start phase.

1.3
Why is the maximum throughput achieved by any one flow capped at around 1.5Mbps?
n2 will drop incoming packets from n0 and n3, which leads to window size decreasing and starting slow start phase. Since tcp2 enters, it increases the package loss or delay in tcp1 which results in tcp1 not able to achieve a higher throughput and leads to a lower throughput

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2.1
Which data size has caused fragmentation and why? Which host/router has fragmented the original datagram? How many fragments have been created when data size is specified as 2000?
The data size 2000 and 3500 because by default the maximum segment size is 1500 bytes. Any package larger will get fragmented to smaller segments.
The host 192.168.1.103 fragmented the original datagram.
2 fragments have been created when the data size is specified as 2000

2.2
Did the reply from the destination 8.8.8.8. for 3500-byte data size also get fragmented. Why and why not?
Yes, the reply of ping is echoing the input which we will receive 3500 byte size and needed to be fragmented to smaller segments

2.3
Give the ID, length, flag and offset values for all the fragments of the first packet sent by 192.168.1.103 with data size of 3500 bytes?

ID	Length	Flag	Offset
7a7b	1514	0x2000, more fragments	0 → 0
7a7b	1514	0x20b9, more fragments	1480 → 185
7a7b	582	0x0172	2960 → 370

2.4
Has fragmentation of fragments occurred when data of size 3500 bytes has been used? Why and why not?
Yes, fragmentation has occurred because the maximum transmission unit is smaller than the data size.

2.5
What will happen if for our example one fragment of the original datagram from 192.168.1.103 is lost?
When one or more fragments of the IP datagram are lost, the entire IP datagram is discarded after a timeout period. The other end will have to retransmit the whole tcp package.

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3.1
Which nodes communicate with which other nodes? Which route do the packets follow? Does it change over time?
udp0 → n0
udp1 → n2
udp0 → n0 → n1 → n4 → n5
udp1 → n2 → n3 → n5
The routes don't change over time

3.2
What happens at time 1.0 and at time 1.2? Does the route between the communicating nodes change as a result of that?
The link [n1 → n4] is set to be down.
The route between communicating nodes don't change.
As the result udp0 experience package loss

3.3
Did you observe any additional traffic as compared to Step 3 above? How does the network react to the changes that take place at time 1.0 and time 1.2 now?
Yes, the router inform the neighbour about their distance vector. Udp0 reroute traffic from [n0 → n2] since [n1 → n4] is down.

3.4
How does this change affect the routing? Explain why.
For udp0
Since there is an increase of cost (1 → 3) at [n1 → n4]. The total cost [n1 → n4 → n5] is 4 while [n1 → n2 → n3 → n5] is 3. It is cheaper to take the second route by using the distance vector algo, although the first route has less link to travel.
For udp1
It is not affected

3.5
Describe what happens and deduce the effect of the line you just uncommented.
For udp0
Route 1: n0 → n1 → n4 → n5 cost = 4
Route 2: n0 → n1 → n2 → n3 → n5 cost = 5
For udp1
Route 1: n2 → n3 → n5 cost = 4
Route 2: n2 → n1 → n4 → n5 cost = 4
Only udp1 will use route 1 and route 2 to n5 and udp0 will use only route 1 which has the lowest cost to n5