Ex1:

Question 1. Which nodes communicate with which other nodes? Which route do the packets follow? Does it change over time? Note: You can also answer the above question by examining the simulation setting in the script file.

Node 0 communicated with Node 1 and Node 1 communicated with Node 4 and Node 4 communicated Node 5. On the other hand, Node 2 communicate with Node 3 and Node 3 communicated with Node 5. 0-1-4-5 and 2-3-5. Also it did not change over time.

Question 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?

Time 1.0 and time 1.2 the route between 1 and 4 turn red, it link down 1-4 and link up 4-1. It changes the route between the communicating nodes change as a result.

Question 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, there are a lot of slash transferred between Nodes. The slashes are transfer between Node1 and Node4 then the red line are disappear.

Question 4: How does this change affect the routing? Explain why.

The routing changes from 0-1-4-5 and 2-3-5 to 0-1-2-3. Since the command set cost of link from $n1 to $n4 to 3.It changes the line from 0-1-4 to 0-1-2-3 because the default cost of link is 1 and 0-1-4 cost the same as 0-1-2-3 but 0-1-2-3 reaches more nodes in cost 3 hence it changes the route.

Question 5: Describe what happens and deduce the effect of the line you just uncommented.

The transfer flow is changes to 0-1-4-5 and 2-3-5 then 0-1-4-5 and 2-1 alternate.

$ns cost $n1 $n4 2 set cost line from n1 to n4 to 2

$ns cost $n3 $n5 3 set cost line from n3 to n5 to 3

Node set multiPath_ 1 All new nodes in the simulation use multiPaths where applicable

It communicate all the nodes together use multiPath.

Ex2:

Question 1) Why the throughput achieved by flow tcp2 is higher than tcp1 between time span 6 sec to 8 sec?

During 6 sec to 8 sec, queueing delay is happened in Node 2. Since tcp1 is passing through edge from node 1 and node 2 and tcp2 is straight from node 1 to node 5 through node 2 and node 4. Since the node from node 1 to node 2 has slower pipe compare to the edge from node 3 to node2. Therefore the throughput achieved by flow tcp2 is higher than tcp1 between time span 6 sec to 8 sec.

Question 2) Why the throughput for flow tcp1 is fluctuating between time span 0.5 sec to 2 sec?

Because flow tcp1 is in a initial state in span 0.5 sec to 2 sec, it will cause fluctuating by slow start.

Question 3) Why is the maximum throughput achieved by any one flow capped at around 1.5Mbps?

Since they are using TCP and TCP implemented slow start and if packet loss is happened the throughput will be reduced. Hence the maximum throughput will not be reached the actual maximum throughput. Therefore the throughput will not be over 2.5Mbps also because they are sharing the network so 1.5Mbps will be maximum.

Ex3:

Question 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?

Data size over 1468 bytes caused fragmentation which means in 2000-byte data size request will result fragmentation in this case and because the original file is too large for the MTU, hence it need to break into a series smaller packets to transmit. 192.168.1.103 has the fragmented the original datagram. 9 fragments have been created when data size is specified as 2000.

Question 2: Did the reply from the destination 8.8.8.8. for 3500-byte data size also get fragmented? Why and why not?

Yes. Under IPv4, a router that receives a packet larger than the next hop's MTU has two options: drop the packet and send an ICMP message which indicates the condition packet too big or fragment the packet and send it over the link with a smaller MTU. In this case, the flag more fragments is set hence it choose to fragment the packet.

Question 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?

No.41 request, length 3492 byte, flag: Reserved bit: Not set; Don’t fragment: Not set; More fragments: Not set; Fragment offset: 2960;

Question 4: Has fragmentation of fragments occurred when data of size 3500 bytes has been used? Why and why not?

Yes, it has 3 IPv4 Fragments since it the file too large.

Question 5: What will happen if for our example one fragment of the original datagram from 192.168.1.103 is lost?

The entire packet cannot be reassembled, so the entire packet will have to be resent.