

## SET-A

### Question 1:

1. Create a topology of 6 nodes, two client Node1 and Node2 at one side and server nodes Node3 and Node4 on the other side of the topology. Let Node5 and Node6 form the bridge. Use point to point links. [10 marks]
2. Install a TCP socket instance on Node1 that will connect to Node3. [1 marks]
3. Install a UDP socket instance on Node2 that will connect to Node4. [1 mark]
4. Start the TCP application at time 1s. [1 mark]
5. Start the UDP application at time 20s at rate Rate1 such that it clogs half the dumbbell bridge's link capacity. [3 marks]
6. Increase the UDP application's rate at time 40s to rate Rate2 such that it clogs the whole of the Node5- Node6 link capacity. [3 marks]
7. Use the ns-3 tracing mechanism to record changes in congestion window size of the TCP instance over time and compute throughput and packet loss (if any) [4+1+1=6 marks]

### Question 2:

Examine the 1.pcap and find answers to the following questions:

- A. This packet capture file contains two TCP handshakes. Find the first handshake and specify the exchanged sequence numbers. [2 marks]
- B. In this session, a client machine initiated a connection to a server and then downloaded a file. What is the client's IP address? [1 mark]
- C. How many HTTP GET request packets are there? [1 mark]
- D. Find the first HTTP GET request packet. What was the server's IP address? (The server is the Destination). [2 marks]
- E. Verify the IP header checksum. [4 marks]

For congestion window, you can refer to the programs in ns-3-dev/src/test/ns3tcp

## SET B:

### Question 1:

1. Create a topology of 6 nodes, two client Node1 and Node2 at one side and server nodes Node3 and Node4 on the side of the topology. Let Node5 and Node6 form the bridge. Use point to point links. [10 marks]
2. Add drop tail queues of size QueueSize5 and QueueSize6 to Node5 and Node6, respectively. [2 marks]
3. Install a TCP socket instance on Node1 that will connect to Node3. [1 marks]
4. Install a TCP socket instance on Node2 that will connect to Node3. [1 marks]
5. Install a TCP socket instance on Node2 that will connect to Node4. [1 marks]
6. Start Node1--Node3 flow at time 1s, then measure its throughput. How long does it take to fill link's entire capacity? [4 marks]
7. Start Node2--Node3 and Node2--Node4 flows at time 20s, measure their throughput, packet loss and cwnd size. [1+1+4=6 marks]

### Question 2:

Examine the 2.pcap and find answers to the following questions:

1. What HTTP version is your browser running? What version of HTTP is the server running? [2 marks]
2. Multiple devices are connected to the local network. What are their MAC and IP addresses? [1 marks]
3. How many different times TCP handshakes are performed and what are associated flags? What are the involved IP addresses? [2 marks]
4. Has this IP datagram been fragmented? Explain how you determined whether or not the datagram has been fragmented. Verify the IP header checksum. [1+4=5 marks]

For congestion window, you can refer to the programs in ns-3-dev/src/test/ns3tcp