Used dpkt package to create and parse packets.

Functions Used:

packetinit(ts,buf):
Firsttwovalues(listofpackets) # 1-a
EffectiveThroughput(listofpackets) #1-b
LossRate(listofuniqueports, listofpackets) #1-c
#1-d
MessageSent(listofuniqueports, listofpackets)
MessageRecieved(listofuniqueports, listofpackets)
TheoreticalThroughput(listofRTT, listofLossRate)

STEP 1:

We receive a byte stream as input. We need to parse the input to understand the meaning.

We pass the byte stream to packetinit(). The packetinit() parses the bytes using int.from_bytes() and returns as with a list named packet.

packet[Sourceport, Destinationport, SequenceNumber,AckNumber, Flags, Length, Windowsize, Timestamp].

Now we have all the packets from the assignment2.pcap file inside our packet.

STEP 2:

Now we need to split these packets based on the port numbers and find the flow between them.

There were 3 flows from Client to Server, 43498 <-> 80, 43500 <->80, 43502 <-> 80.

We create a list called listofpackets which help in segregating the messages of each flow.

Listofpackets[0] = 43498 <-> 80 #Messages between Client 43498 and Sever 80
Listofpackets[1] = 43500 <-> 80 #Messages between Client 43500 and Sever 80
Listofpackets[2] = 43502 <-> 80 #Messages between Client 43502 and Sever 80

STEP 3:

To find the first two packets for each flow, we iterate through listofpackets and print the first two messages being sent.

STEP 4:

To find the Effective Throughput, for each flow,

$$\frac{\text{SUM of Length of packet}}{\text{Endingtime - startingtime}}$$

Output:

The Empirical Throughput for Flow 1 is 5386947.153013443
The Empirical Throughput for Flow 2 is 1323227.218791271
The Empirical Throughput for Flow 3 is 1522172.358708612

STEP 5:

To find the Loss rate, for each flow, skipped through the starting and ending packets, loss rate is

$$\frac{\text{Number of packets not received}}{\text{Number of packets sent}}$$

To find the number of packets not received, used a dictionary to find the sequence number retransmission at the Client side. When a message gets retransmitted from the Client-side, it means the packet did not receive at the receiver.

Output:

The loss rate for Flow 1 is 0.0004301691998852882
The loss rate for Flow 2 is 0.013305024769992922
The loss rate for Flow 3 is 0

Analysis:

For flow 3, the no of packets retransmitted is 0, therefore, no loss rate has occurred.

STEP 6:

To Find RTT, I first found the List of unique messages sent from the client-side and similarly found the List of unique messages sent from the server-side. For each flow, Roundtrip time is the time that is required for a sent message from the client-side to be acknowledged by the server-side.

Average RTT = TotalRoundTripTime/ Totaltime

Output:

Average RTT for Flow 1 is 0.07318831157795606
Average RTT for Flow 2 is 0.16726213445430232
Average RTT for Flow 3 is 0.07237729312039683

STEP 7:

To Find Theoretical Throughput, MSS = 1460, for each packet,

Theoretical Throughput = sqrt(3)/sqrt(2) *(1/sqrt(lossrate))* (MSS/RTT)

Output:

The Theoretical Throughput for Flow 1 is 1177977.7872619194
The Theoretical Throughput for Flow 2 is 92681.48997727415
The Theoretical Throughput for Flow 3 is Infinity

Analysis:

Theoretical Throughput for Flow 3 is infinity as the loss rate is 0(1/0 is Infinity).

Output:

The Number of flow initiated is 3
CLIENT FLOW SERVER
43498 <----------> 80
43500 <----------> 80
43502 <----------> 80
For Port 43498
Sender Message
Source: 43498 Destination : 80 Sequence Number : 705669103 Ack Number : 1921750144
Window Size: 3
Source: 43498 Destination : 80 Sequence Number : 705669127 Ack Number : 1921750144
Window Size: 3
Destination Message
Source : 80 Destination 43498 Sequence Number 1921750144 Ack Number 705669127
Window size: 3
Source : 80 Destination 43498 Sequence Number 1921750144 Ack Number 705670575
Window size: 3

For Port 43500
Sender Message
Source: 43500 Destination : 80 Sequence Number : 3636173852 Ack Number : 2335809728
Window Size: 3
Source: 43500 Destination : 80 Sequence Number : 3636173876 Ack Number : 2335809728
Window Size: 3
Destination Message
Source : 80 Destination 43500 Sequence Number 2335809728 Ack Number 3636173876
Window size: 3

Source : 80 Destination 43500 Sequence Number 2335809728 Ack Number 3636175324
Window size: 3

For Port 43502
Sender Message
Source: 43502 Destination : 80 Sequence Number : 2558634630 Ack Number : 3429921723
Window Size: 3
Source: 43502 Destination : 80 Sequence Number : 2558634654 Ack Number : 3429921723
Window Size: 3
Destination Message
Source : 80 Destination 43502 Sequence Number 3429921723 Ack Number 2558634654
Window size: 3
Source : 80 Destination 43502 Sequence Number 3429921723 Ack Number 2558636102
Window size: 3

The Empirical Throughput for Flow 1 is 5386947.153013443
The Empirical Throughput for Flow 2 is 1323227.218791271
The Empirical Throughput for Flow 3 is 1522172.358708612

The loss rate for Flow 1 is 0.0004301691998852882
The loss rate for Flow 2 is 0.013305024769992922
The loss rate for Flow 3 is 0

Average RTT for Flow 1 is 0.07318831157795606
Average RTT for Flow 2 is 0.16726213445430232
Average RTT for Flow 3 is 0.07237729312039683

The Theoretical Throughput for Flow 1 is 1177977.7872619194
The Theoretical Throughput for Flow 2 is 92681.48997727415
The Theoretical Throughput for Flow 3 is Infinity