NAME - RIYA MAHANTA

SBU ID - 112640206

CSE 310 - PROGRAMMING ASSIGNMENT 2

PART A

1. Started by counting the number of successful handshakes. This represents the number of TP connections or flows that were initiated by the sender. It is the same as the number of (syn, ack) packets = 3

2. For each TCP flow
    a. I first print out the source port, source IP, destination port, and destination IP.
    This is shown in lines 7 to 11 and 16 to 19 in Connection 1
    b. For the first two transactions after the TCP connection is set up (from sender to receiver), the values of the Sequence number, Ack number, and Receive Window size.
    For Connection 1 - lines 12 to 14 and 20 to 22
        - This means that in the first transaction for connection 1, the sender sends a segment that starts at the 705669103rd byte and I estimate that the next byte starts at 1921750144
        - The receiver in the on the other hand has sent a segment starting at the 1921750144th byte and the next byte I expect starts at 705669127
        - Similarly for connections 2 and 3

    For Connection 2 - lines 41 to 43 and 49 to 51
    For Connection 3 - lines 70 to 72 and 78 to 80
    c. The sender throughput. I am defining throughput as the total amount of bytes sent by the sender over a period. The period is the time between sending the first byte to receiving the last acknowledgement.

Estimated throughput = (total packet size) / total time taken

Approximate throughputs for:

Connection 1 - 42.0108 Mbps

Connection 2 - 10.2833 Mbps

Connection 3 - 11.8513 Mbps

PART B

1. Print the first 3 congestion window sizes (or till the end of the flow, if there are less than 3 congestion windows).
   Connection 1: lines 30 to 33 - Initial congestion window size is 18980 and the sizes grow by a multiplicative factor of [1.53, 2.05, 1.17]
   Connection 2: lines 59 to 62 - Initial congestion window size is 16060 and the sizes grow by a multiplicative factor of [2.63, 1.52, 1.11]
   Connection 3: lines 88 to 91 - Initial congestion window size is 18980 and the sizes grow by a multiplicative factor of [2, 1.42, 1.38]

2. The number of times a retransmission occurred due to triple duplicate ack and the number of times a retransmission occurred due to timeout.
   The retransmissions due to triple duplicate are calculated after using two sets of dictionaries, one to calculate the number of packets with the same sequence number and the other to calculate the number of packets with the same acknowledgement number. For every sqn in the sequence dictionary if also found in the acknowledgement dictionary, and received more than twice, the counter is incremented.
   The retransmission due to Timeout calculated by subtracting the the number of retransmissions due to triple duplicate ACK from the total number of packets lost.
   Connection1:
   - Retransmissions due to Triple duplicate ACK = 2
   - Retransmissions due to Timeout = 2

Connection2:

- Retransmissions due to Triple duplicate ACK = 36
- Retransmissions due to Timeout = 59

Connection3:

- Retransmissions due to Triple duplicate ACK = 0
- Retransmissions due to Timeout = 1