Assignment 3

1. Write two socket programs in `ClientPacketGen.c/cpp` and `ServerPacketFwd.c/cpp`, which together communicate using Datagram Sockets (UDP).

   Each datagram generated by client must contain

   a) A sequence number which identifies the packet,
   b) A timestamp with microsecond level precision which indicates the time at which the packet is first transmitted,
   c) An even non-negative integer called the time-to-live field (TTL) with initial value T. Let us assume that the packet is of size P bytes.

   Packet Format

Sequence Number (2 bytes)	Timestamp (4 bytes)	TTL (1 byte)	Payload (P bytes)

   The client application should be executed using the following command:

   `./clientPacketGen  <ServerIP> <ServerPort> <P> <TTL> <NumPackets>`

   Here `NumPackets` could be anything between 1 to 50 and for each packet, and corresponding sequence number should be generated.

   When server receives a datagram from client, it immediately decrements the TTL value by one in the datagram and sends the same datagram (with the new TTL) back to client.

   The server application should be executed using the following command:

   `./serverPacketfwd  <ServerPort>`

   On reception of the packets at client back from the server, calculate the Round Trip Time (RTT) delay for each packet and calculate the average RTT delay across the packets.

   Make sure server and client applications are running in two different physical computers. Also note that P should be within the range 100 to 1300 bytes, and T between 2 and 20 (and must be even).

2. Modify the `ClientPacketGen.c/cpp` code to have following extra capabilities:

The Client program on receiving a datagram from Server, decrements the TTL value, and checks if this new value is zero. If the new TTL is greater than zero, then Client sends the datagram (with the new TTL) back to Server. However, if TTL is zero, then Client prints to a file (on a new line) the difference between the current time and the timestamp field in the datagram. Call this time the cumulative RTT. A new datagram is then generated by Client with TTL set to T. The value of P and T and the output file name for storing the cumulative RTT should be entered on the command line when executing the ClientPacketGen.c/cpp. The P should be within the range 100 to 1300 bytes, and T between 2 and 20 (and must be even). The Client program totally sends out 50 datagrams and then quits.

For T = 2 and different values of P = 100, 200, . . . , 1000, run Client. Plot a scatter-plot (using any suitable software, such as matlab, gnuplot etc.) of cumulative RTT for all 50 datagrams vs. P for the different values of P when T = 2.

What do you observe? What information does the slope of the graph contain? Repeat when T = 8 and 16.