1. (10 points) Consider a DNS server that receives a request within a UDP segment and responds to that request using a UDP segment. If a client with IP address X spoofs its address with address Y, where will the server send its response? **X**, **Y**, or **Neither**? Explain.

   The response will be sent to address Y. A UDP socket will accept all UDP traffic arriving at the port.

2. (10 points) Consider a client X connected to an HTTP server downloading a Webpage over a non-pipelined open persistent connection. When the client sends an HTTP request over the already open connection for a particular object, it inserts a spoofed source IP address and port number for client Y. Which client will receive the object **X**, **Y**, or **Neither**? Explain.

   Neither
   The server has no socket associated with the spoofed IP address and port number, so the request segment is never recognized as belonging to the already open TCP connection.

3. (20 points total) Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 400. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 30 and 40 bytes of data, respectively. In the first segment, the sequence number is 401, the source port number is 880, and the destination port number is 80. Host B sends an acknowledgement whenever it receives a segment from Host A.

   (a) (4 points) In the second segment from Host A to Host B, what are the sequence number, source port number, and destination port number?

   In the second segment from Host A to B, the sequence number is 431, the source port number is 880 and the destination port number is 80.

   (b) (4 points) If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, what is the acknowledgement number?

   If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, the acknowledgement number is 401, indicating that it is still waiting for bytes 401 and onwards.

   (c) (4 points) If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgement number, the source port number, and the destination port number?

   If the first segment arrives before the second, in the acknowledgement of the first arriving segment, the acknowledgement number is 431, the source port number is 80 and the destination port number is 880.

   (d) (8 points) Suppose the two segments sent by A arrive in order at B. The first acknowledgement is lost and the second acknowledgement arrives after the first timeout interval. Assuming there is no additional packet loss, list *in order*, each segment and acknowledgement received. Provide the sequence number and the number of bytes of data for each segment. For each acknowledgement, provide the acknowledgement number. (You may draw a timing diagram to help show the ordering)
   See diagram: