CSLR 52
Networks Lab
Assignment 1

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Questions

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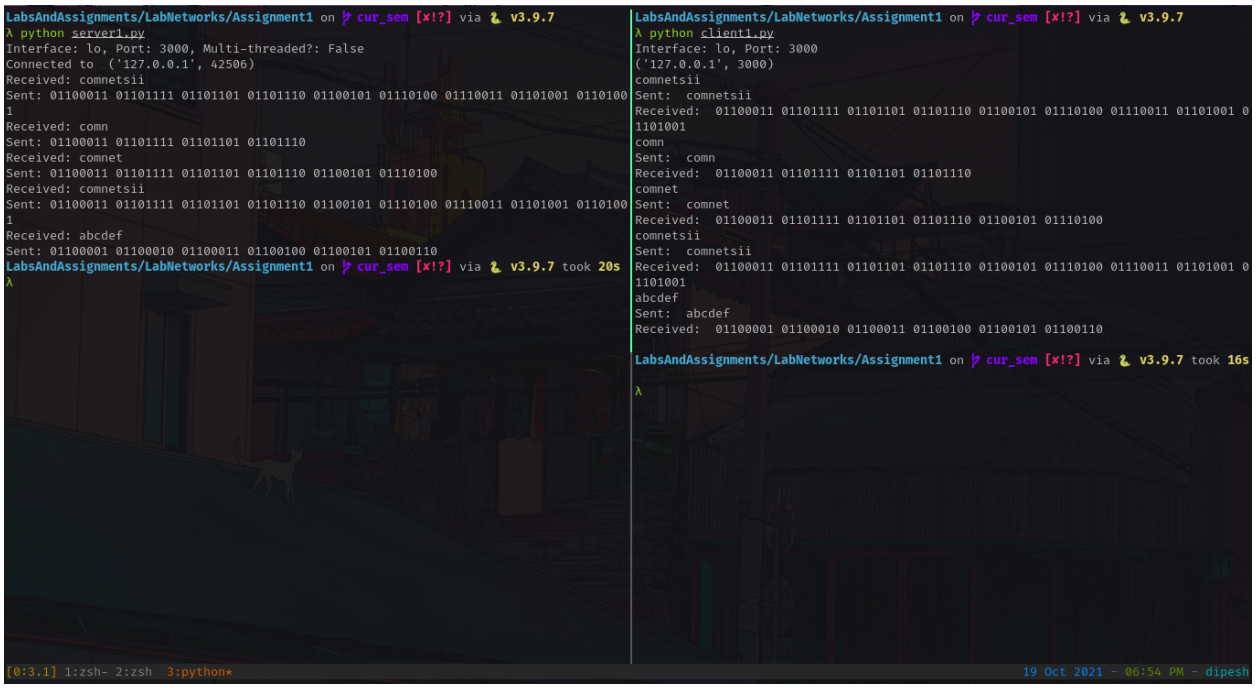
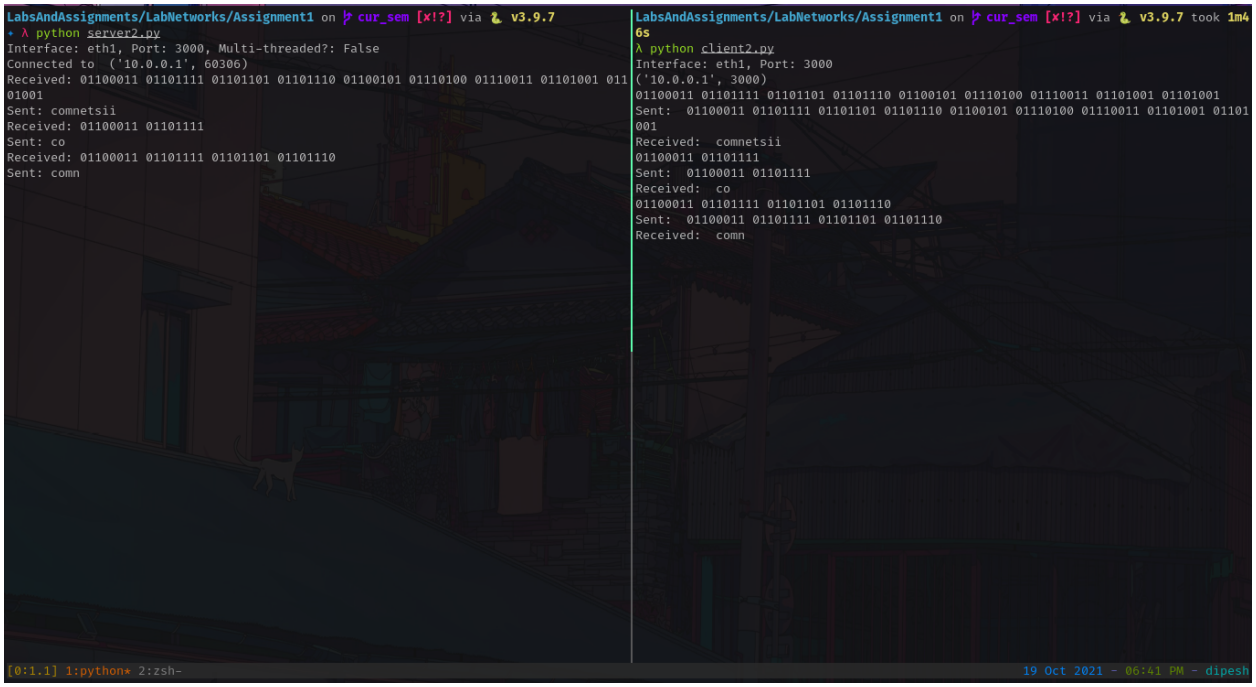
1) Write a server program for TCP using Python to do the following:
    a. Server returns the binary value of the text sent by the client. Example: for a text string "comnetsii", the client should receive "01100011 01101111 01101101 01101110 01100101 01110100 01110011 01101001 01101001"
    b. The server should be running at the localhost interface
    c. You are free to choose any port
2) The Binary Decoding Server: Write another server running on eth1 interface to do the following:
    a. Server returns the string value of a binary input. Example: the binary string "01100011 01101111 01101101 01101110 01100101 01110100 01110011 01101001 01101001" sent from the client should return "comnetsii"
3) Write two client programs one for each of the server.
    a. What happens if the client aborts (e.g., when the input is CTRL/D)?
    b. Can you run two clients against the same server? Why or why not? Hint: Multithreaded socket server in Python
    c. What happens when you try to connect client1 to server2 by passing a wrong network address (e.g., connecting to localhost instead of eth1 IP)?

Output(Single Threaded)

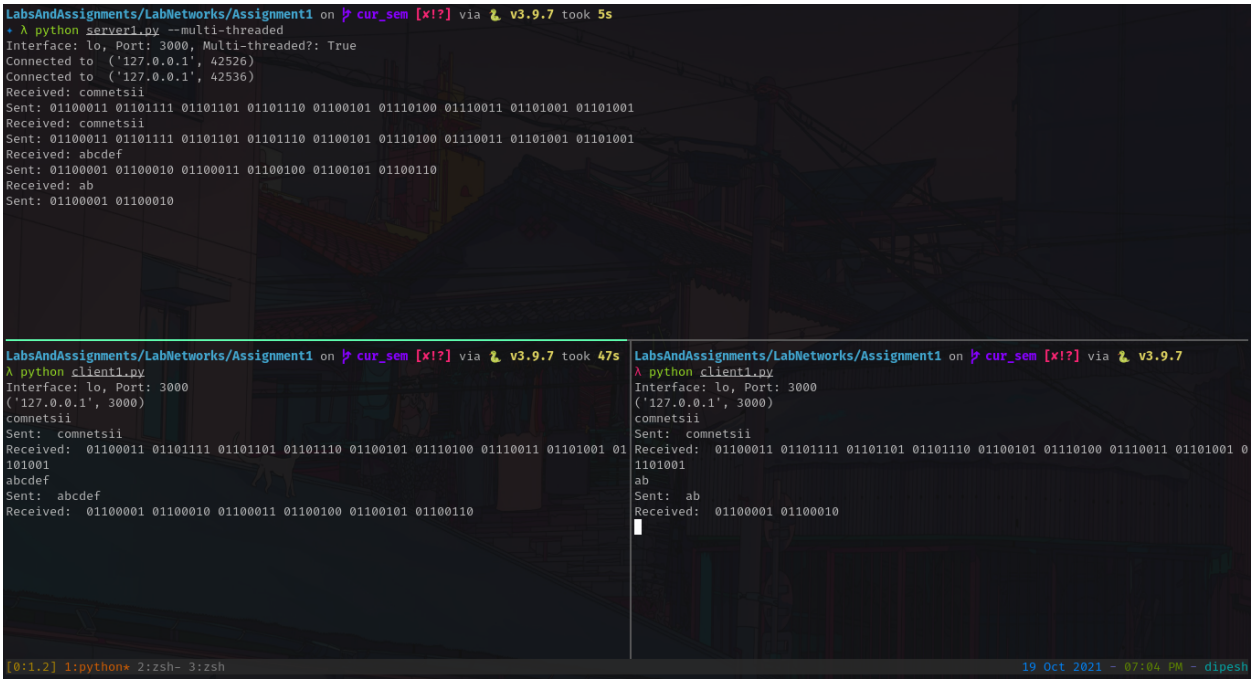


-Running server1.py and client1.py side by side

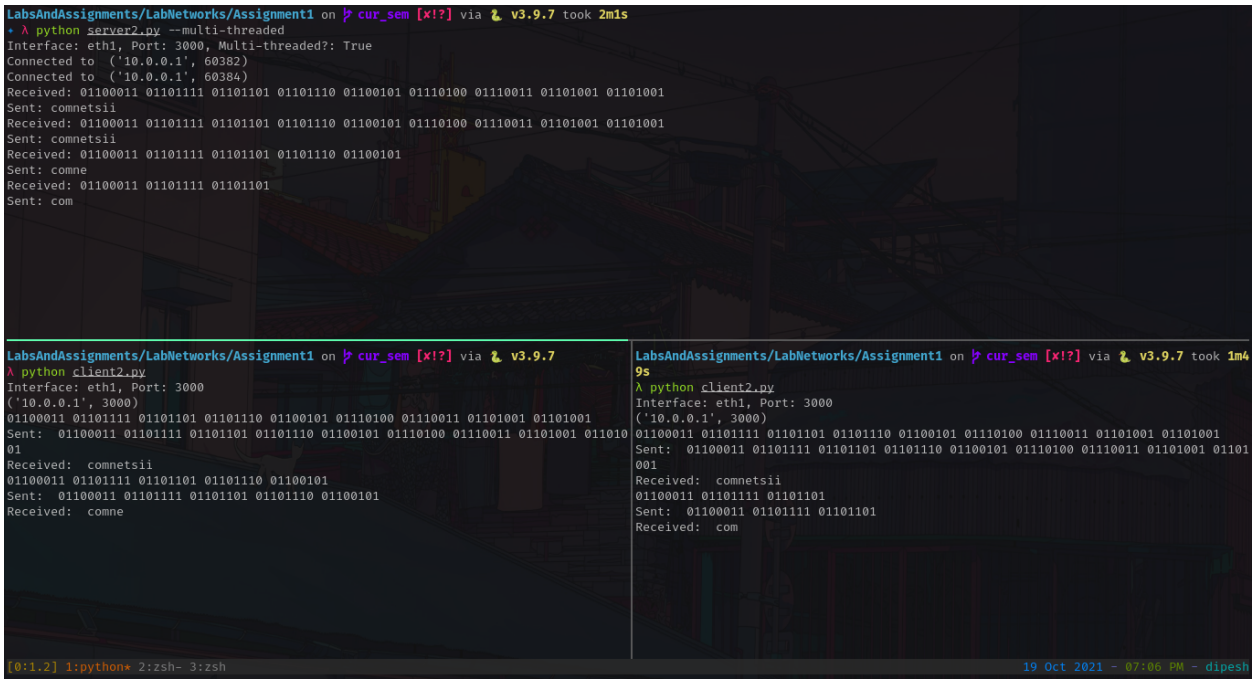


- Running server2.py and client2.py

Output (Multi Threaded)



- Multiple client1.py connecting to server1.py



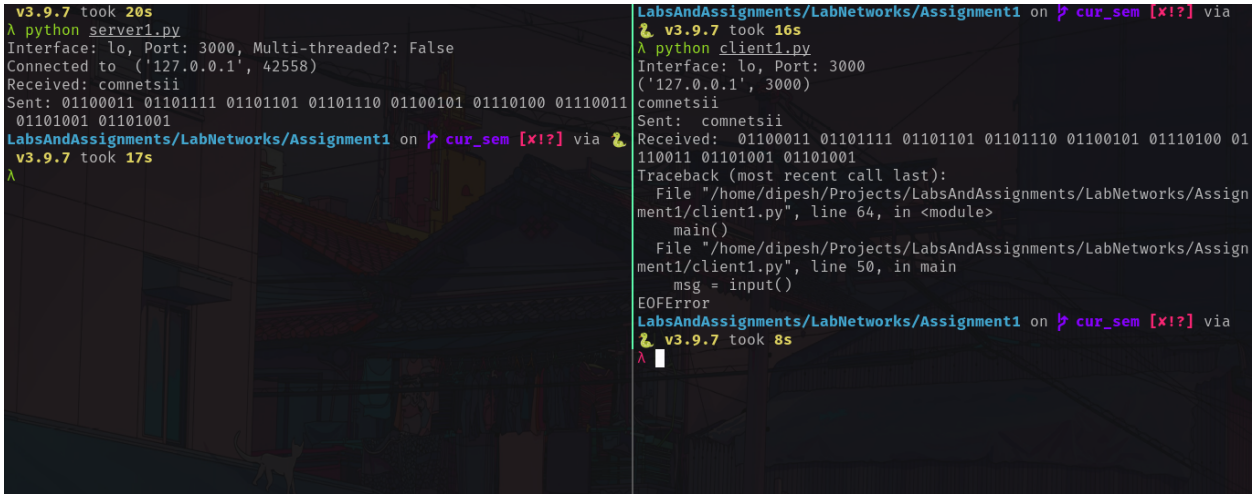
- Multiple client2.py connecting to server2.py

Question 3.a

-> What happens if the client aborts (e.g., when the input is CTRL/D)?

Ans:

When we press Ctrl+D, the client will throw EOFError and exit. The server will see that the client has exited (because the connection will be cut off between them) and hence it is exiting as well .



- On Ctrl D input

Question 3.b

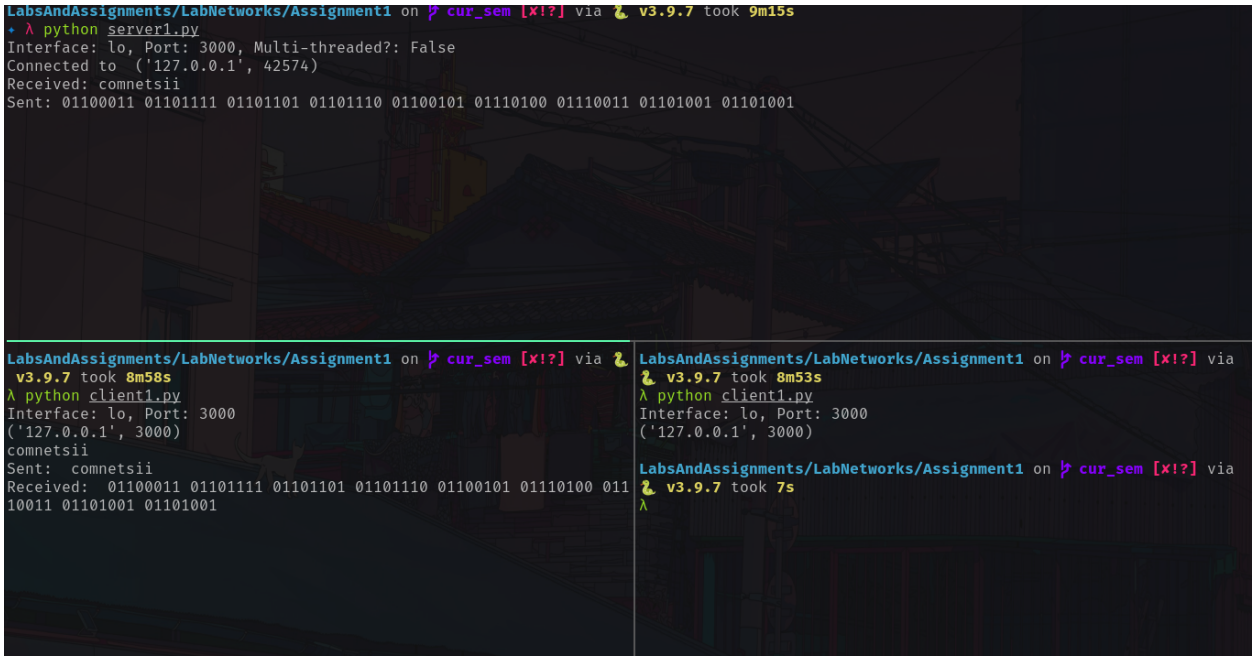
-> Can you run two clients against the same server? Why or why not? Hint: Multithreaded socket server in Python

Ans:

This will depend on how we have written the server code. I had written in such a way that we can optionally make the server multi threaded by passing '--multi-threaded' flag while running server1.py or server2.py. If those options are not passed however, it wont have multi-threading.

In the image attached below, we can see that the second instance of client1.py is connecting to the server1.py but the server1.py is not accepting the connection(had it accepted it would've printed it). The same thing would happen for server2.py and client2.py.

If the multi-threaded mode is turned on however, it will handle multiple connections by spawning a thread to handle each connection. It can be seen happening clearly in the Output image for multi-threaded that I have put above in **Output(Multi Threaded)** section above.



- Multiple clients trying to connect to single threaded server1.py

Question 3.c

-> What happens when you try to connect client1 to server2 by passing a wrong network address (e.g., connecting to localhost instead of eth1 IP)?

Ans:

There can be two things that might happen.

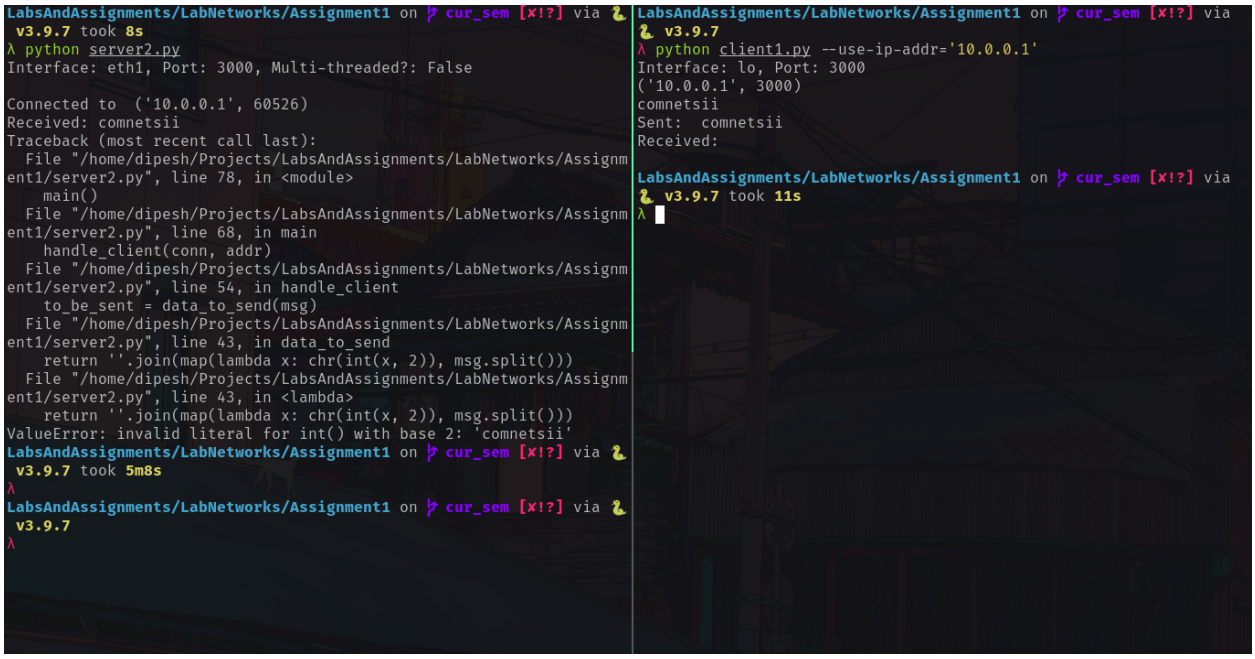
Case 1:

If we have server2.py running and we run client1.py , client1.py will try to connect to localhost but localhost wouldnt be running(only eth1 ip would be connectable because server2.py is running). In this case, the result can be seen in the image attached below.

- Case 1

Case 2:

If we pass the eth1 ip to client1.py instead and try to connect to server2.py, the behaviour will be weird because the format in which server2.py expects its message will be different from what its getting. server2.py expects space separated bit strings of length less than or equal to 8 but its getting random ascii strings, so server2.py wont be able to decode those letters and crash as a result.



- Case 2

Question 1

Code

server1.py

```
import socket
import optparse
import struct
import threading

MAX_QUEUE = 10

'''
This is the part where I am doing
command line argument parsing, so that
the server is more configurable

- The default port is 3000
- The default interface is lo(localhost)
- All these can be overriden through command line args
- To override port number, pass --port <port_no>
- To override interface, pass --interface <interface_name>
'''
parser = optparse.OptionParser()
parser.add_option('-p', '--port', dest='port', default=3000,
                  type="int", help='Port to run the server on')
parser.add_option('-I', '--interface', dest='interface',
                  default='lo', help='Network interface to run the server
on')
parser.add_option('-M', '--multi-threaded', action='store_true',
                  dest='multi_threaded', default=False, help='Tells weather
multi threading should be done to handle multiple requests')


(options, args) = parser.parse_args()
INTERFACE = options.interface
PORT = options.port
MULTI_THREADED = options.multi_threaded
print("Interface: {}, Port: {}, Multi-threaded?: {}".format(INTERFACE,
PORT, MULTI_THREADED))


def pad_to_8chars(c: str) -> str:
```

```
    '''
    Given a string of length less than
    or equal to 8, this will pad it to
    8 characters putting 0s in front of it
    '''
    assert(len(c) <= 8)
    return '0'*(8-len(c))+c


def send_int(x: int, conn):
    conn.send(struct.pack("i", socket.htons(x)))


def recv_int(conn) -> int:
    return int.from_bytes(conn.recv(4), byteorder='big')


def data_to_send(msg: str):
    return ''.join((map(lambda x: pad_to_8chars(
        bin(ord(x))[2:])+' ', msg)))


def handle_client(conn, addr):
    print("Connected to ",  addr)
    while True:
        data_size = recv_int(conn)
        if(data_size == 0):
            break
        msg = conn.recv(data_size).decode('utf-8')
        print("Received: {}".format(msg))
        to_be_sent = data_to_send(msg)
        send_int(len(to_be_sent), conn)
        conn.send(to_be_sent.encode('utf-8'))
        print("Sent: {}".format(to_be_sent))


def main():
    with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as sock:
        sock.setsockopt(socket.SOL_SOCKET, 25, INTERFACE.encode())
        sock.bind(('0.0.0.0',  PORT))
```

```
        sock.listen(MAX_QUEUE)
        while True:
            if not MULTI_THREADED:
                conn, addr = sock.accept()
                handle_client(conn, addr)
                break
            else:
                conn, addr = sock.accept()
                thrd = threading.Thread(
                    target=handle_client, args=[conn, addr])
                thrd.start()
                continue


main()
```

Question 2

Code

server2.py

```
import socket
import optparse
import struct
import threading


MAX_QUEUE = 10

'''
This is the part where I am doing
command line argument parsing, so that
the server is more configurable

- The default port is 3000
- The default interface is eth1
- All these can be overriden through command line args
- To override port number, pass --port <port_no>
```

```
- To override interface, pass --interface <interface_name>
'''
parser = optparse.OptionParser()
parser.add_option('-p', '--port', dest='port', default=3000,
                  type="int", help='Port to run the server on')
parser.add_option('-I', '--interface', dest='interface',
                  default='eth1', help='Network interface to run the server
on')
parser.add_option('-M', '--multi-threaded', action='store_true',
                  dest='multi_threaded', default=False, help='Tells weather
multi threading should be done to handle multiple requests')
(options, args) = parser.parse_args()
INTERFACE = options.interface
PORT = options.port
MULTI_THREADED = options.multi_threaded
print("Interface: {}, Port: {}, Multi-threaded?: {}".format(INTERFACE,
PORT, MULTI_THREADED))


def send_int(x: int, conn):
   conn.send(struct.pack("i", socket.htons(x)))


def recv_int(conn) -> int:
   return int.from_bytes(conn.recv(4), byteorder='big')


def data_to_send(msg: str):
   return ''.join(map(lambda x: chr(int(x, 2)), msg.split()))


def handle_client(conn, addr):
   print("Connected to ",  addr)
   while True:
       data_size = recv_int(conn)
       if(data_size == 0):
           break
       msg = conn.recv(data_size).decode('utf-8')
       print("Received: {}".format(msg))
       to_be_sent = data_to_send(msg)
```

```
        send_int(len(to_be_sent), conn)
        conn.send(to_be_sent.encode('utf-8'))
        print("Sent: {}".format(to_be_sent))


def main():
    with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as sock:
        sock.setsockopt(socket.SOL_SOCKET, 25, INTERFACE.encode())
        sock.bind(('0.0.0.0',  PORT))
        sock.listen(MAX_QUEUE)
        while True:
            if not MULTI_THREADED:
                conn, addr = sock.accept()
                handle_client(conn, addr)
                break
            else:
                conn, addr = sock.accept()
                thrd = threading.Thread(
                    target=handle_client, args=[conn, addr])
                thrd.start()
                continue


main()
```

Question 3

Code

client1.py

```
import socket
import optparse
import struct


'''
This is the part where I am doing
```

```
command line argument parsing, so that
the server is more configurable

- The default port is 3000
- The default interface is lo(localhost)
- All these can be overriden through command line args
- To override port number, pass --port <port_no>
- To override interface, pass --interface <interface_name>
'''
parser = optparse.OptionParser()
parser.add_option('-p', '--port', dest='port', default=3000,
                  type="int", help='Port to run the server on')
parser.add_option('-I', '--interface', dest='interface',
                  default='lo', help='Network interface to run the server
on')
parser.add_option('-a', '--use-ip-addr', dest='ip_addr', default='',
                  help='Connect through IP instead of using the interface')


(options, args) = parser.parse_args()
INTERFACE = options.interface
PORT = options.port
IP_ADDR = options.ip_addr
print("Interface: {}, Port: {}".format(INTERFACE, PORT))


def send_int(x: int, conn):
   conn.send(struct.pack("i", socket.htons(x)))


def recv_int(conn) -> int:
   return int.from_bytes(conn.recv(4), byteorder='big')


def main():
   with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as sock:
       if(IP_ADDR == ''):
           sock.setsockopt(socket.SOL_SOCKET, 25, INTERFACE.encode())
           sock.connect(('0.0.0.0',  PORT))
       else:
```

```
            sock.connect((IP_ADDR, PORT))
        print(sock.getpeername())
        while True:
            msg = input()
            if(msg == ""):
                sock.close()
                break
            msg = msg.strip()
            length_as_bytes = struct.pack("i", socket.htonl(len(msg)))
            sock.send(length_as_bytes)
            sock.send(msg.encode('utf-8'))
            print("Sent: ", msg)
            msg_sz = recv_int(sock)
            recvd_msg = sock.recv(msg_sz).decode('utf-8')
            print("Received: ", recvd_msg)


main()
```

client2.py

```
import socket
import optparse
import struct


'''
This is the part where I am doing
command line argument parsing, so that
the server is more configurable

- The default port is 3000
- The default interface is eth1
- All these can be overriden through command line args
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'''
```

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parser = optparse.OptionParser()
parser.add_option('-p', '--port', dest='port', default=3000,
                  type="int", help='Port to run the server on')
parser.add_option('-I', '--interface', dest='interface',
                  default='eth1', help='Network interface to run the server
on')
parser.add_option('-a', '--use-ip-addr', dest='ip_addr', default='',
                  help='Connect through IP instead of using the interface')

(options, args) = parser.parse_args()
INTERFACE = options.interface
PORT = options.port
IP_ADDR = options.ip_addr
print("Interface: {}, Port: {}".format(INTERFACE, PORT))


def send_int(x: int, conn):
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def recv_int(conn) -> int:
   return int.from_bytes(conn.recv(4), byteorder='big')


def main():
   with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as sock:
       if(IP_ADDR == ''):
           sock.setsockopt(socket.SOL_SOCKET, 25, INTERFACE.encode())
           sock.connect(('0.0.0.0',  PORT))
       else:
           sock.connect((IP_ADDR, PORT))
       print(sock.getpeername())
       while True:
           msg = input()
           if(msg == ""):
               sock.close()
               break
           msg = msg.strip()
           length_as_bytes = struct.pack("i", socket.htonl(len(msg)))
           sock.send(length_as_bytes)
```

```
            sock.send(msg.encode('utf-8'))
            print("Sent: ", msg)
            msg_sz = recv_int(sock)
            recvd_msg = sock.recv(msg_sz).decode('utf-8')
            print("Received: ", recvd_msg)


main()
```