

Client Server Socket Programming

CN CSL317

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Requirements Install python in your environment if not already installed:

pip install python

Libraries

```
import socket
import errno
import sys
import select
import threading
```

How To Run

- Each of the server files can be run using: `python serverx.py "host" "port"`
- Client files can be run using: `python client.py "host" "port"`

For Example

1. Client.py: `python client.py [ip] [port]`
2. Server1.py: `python server1.py [ip] [port]`
3. Server2.py: `python server2.py [ip] [port]`
4. Server3.py: `python server3.py [ip] [port]`
5. Server4.py: `python server4.py [ip] [port]`

For each server (1/2/3/4), first run the server.py file and then the client.py files

For server1

Server1.py: `python server1.py [ip] [port]`

Client.py: `python client.py [ip] [port]`

Respectively for running server 2, 3,4.

Demo

Server1

server1.py : server program "server1.py " is a single process server that can handle only one client at a time. If a second client tries to chat with the server while some other client's session is already in progress, the second client's socket operations sees an error. After the first client closes the connection, the server should then accept connections from the other clients.

PROBLEMS	OUTPUT	TERMINAL	COMMENTS	DEBUG CONSOLE
		<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 server1.py 127.0.0.1 5000 Server Started Socket binded to port: 5000 Server Listening on 127.0.0.1:5000 Connected to ('127.0.0.1', 40824) Data received from : ('127.0.0.1', 40824) is : 2+4 Response sent to ('127.0.0.1', 40824) = 6 Data received from : ('127.0.0.1', 40824) is : 4-1 Response sent to ('127.0.0.1', 40824) = 3 Data received from : ('127.0.0.1', 40824) is : 5*2 Response sent to ('127.0.0.1', 40824) = 10 Data received from : ('127.0.0.1', 40824) is : 4/2 Response sent to ('127.0.0.1', 40824) = 2.0 Data received from : ('127.0.0.1', 40824) is : 2/0 Response sent to ('127.0.0.1', 40824) = 2.0 Data received from : ('127.0.0.1', 40824) is : 2:: Response sent to ('127.0.0.1', 40824) = 2.0 █</pre>		<pre>7.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 2+4 Sending 2+4 to 127.0.0.1:5000 Received : '6' from 127.0.0.1:5000 Enter a calculation: 4-1 Sending 4-1 to 127.0.0.1:5000 Received : '3' from 127.0.0.1:5000 Enter a calculation: 5*2 Sending 5*2 to 127.0.0.1:5000 Received : '10' from 127.0.0.1:5000 Enter a calculation: 4/2 Sending 4/2 to 127.0.0.1:5000 Received : '2.0' from 127.0.0.1:5000 Enter a calculation: 2/0 Sending 2/0 to 127.0.0.1:5000 You can't divide by 0, try again Enter a calculation: 2:: Sending 2:: to 127.0.0.1:5000 Received : 'SyntaxError2.0' from 127.0.0.1:5000 Enter a calculation: █</pre>

PROBLEMS	OUTPUT	TERMINAL	COMMENTS	DEBUG CONSOLE
		<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 server1.py 127.0.0.1 5000 Server Started Socket binded to port: 5000 Server Listening on 127.0.0.1:5000 Connected to ('127.0.0.1', 40824) Data received from : ('127.0.0.1', 40824) is : 2+4 Response sent to ('127.0.0.1', 40824) = 6 Data received from : ('127.0.0.1', 40824) is : 4-1 Response sent to ('127.0.0.1', 40824) = 3 Data received from : ('127.0.0.1', 40824) is : 5*2 Response sent to ('127.0.0.1', 40824) = 10 Data received from : ('127.0.0.1', 40824) is : 4/2 Response sent to ('127.0.0.1', 40824) = 2.0 Data received from : ('127.0.0.1', 40824) is : 2/0 Response sent to ('127.0.0.1', 40824) = 2.0 Data received from : ('127.0.0.1', 40824) is : 2:: Response sent to ('127.0.0.1', 40824) = 2.0 Data received from : ('127.0.0.1', 40824) is : close Response sent to ('127.0.0.1', 40824) = 2.0 Server Listening on 127.0.0.1:5000 ^C Ctrl C detected, Exiting.. khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ █</pre>		<pre>7.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 2+4 Sending 2+4 to 127.0.0.1:5000 Received : '6' from 127.0.0.1:5000 Enter a calculation: 4-1 Sending 4-1 to 127.0.0.1:5000 Received : '3' from 127.0.0.1:5000 Enter a calculation: 5*2 Sending 5*2 to 127.0.0.1:5000 Received : '10' from 127.0.0.1:5000 Enter a calculation: 4/2 Sending 4/2 to 127.0.0.1:5000 Received : '2.0' from 127.0.0.1:5000 Enter a calculation: 2/0 Sending 2/0 to 127.0.0.1:5000 You can't divide by 0, try again Enter a calculation: 2:: Sending 2:: to 127.0.0.1:5000 Received : 'SyntaxError2.0' from 127.0.0.1:5000 Enter a calculation: ^C Client terminated khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/D</pre>

Left console: server1.py, Right console: first client

```
PROBLEMS OUTPUT TERMINAL COMMENTS DEBUG CONSOLE

Socket binded to port: 5000
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 40824)
Data received from : ('127.0.0.1', 40824) is : 2+4
Response sent to ('127.0.0.1', 40824) = 6
Data received from : ('127.0.0.1', 40824) is : 4-1
Response sent to ('127.0.0.1', 40824) = 3
Data received from : ('127.0.0.1', 40824) is : 5*2
Response sent to ('127.0.0.1', 40824) = 10
Data received from : ('127.0.0.1', 40824) is : 4/2
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : 2/0
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : 2::
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : close
Response sent to ('127.0.0.1', 40824) = 2.0
Server Listening on 127.0.0.1:5000
^C Ctrl C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
ts/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 2+4
Sending 2+4 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 4-1
Sending 4-1 to 127.0.0.1:5000
Received : '3' from 127.0.0.1:5000
Enter a calculation: 5*2
Sending 5*2 to 127.0.0.1:5000
Received : '10' from 127.0.0.1:5000
Enter a calculation: 4/2
Sending 4/2 to 127.0.0.1:5000
Received : '2.0' from 127.0.0.1:5000
Enter a calculation: 2/0
Sending 2/0 to 127.0.0.1:5000
You can't divide by 0, try again
Enter a calculation: 2::
Sending 2:: to 127.0.0.1:5000
Received : 'SyntaxError:2.0' from 127.0.0.1:5000
Enter a calculation: ^C Client terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
ts/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 3+4
Sending 3+4 to 127.0.0.1:5000
Received : '7' from 127.0.0.1:5000
Enter a calculation: 4+5
Sending 4+5 to 127.0.0.1:5000
Received : '9' from 127.0.0.1:5000
Enter a calculation:

> TIMELINE
> OUTLINE
> SERVERS
```

right most - 2nd client terminated

If that doesn't work, there is timeout provided in client, which wait for 4 seconds and if it doesn't receive any response it terminates. Connection is closed when client closes the connection.

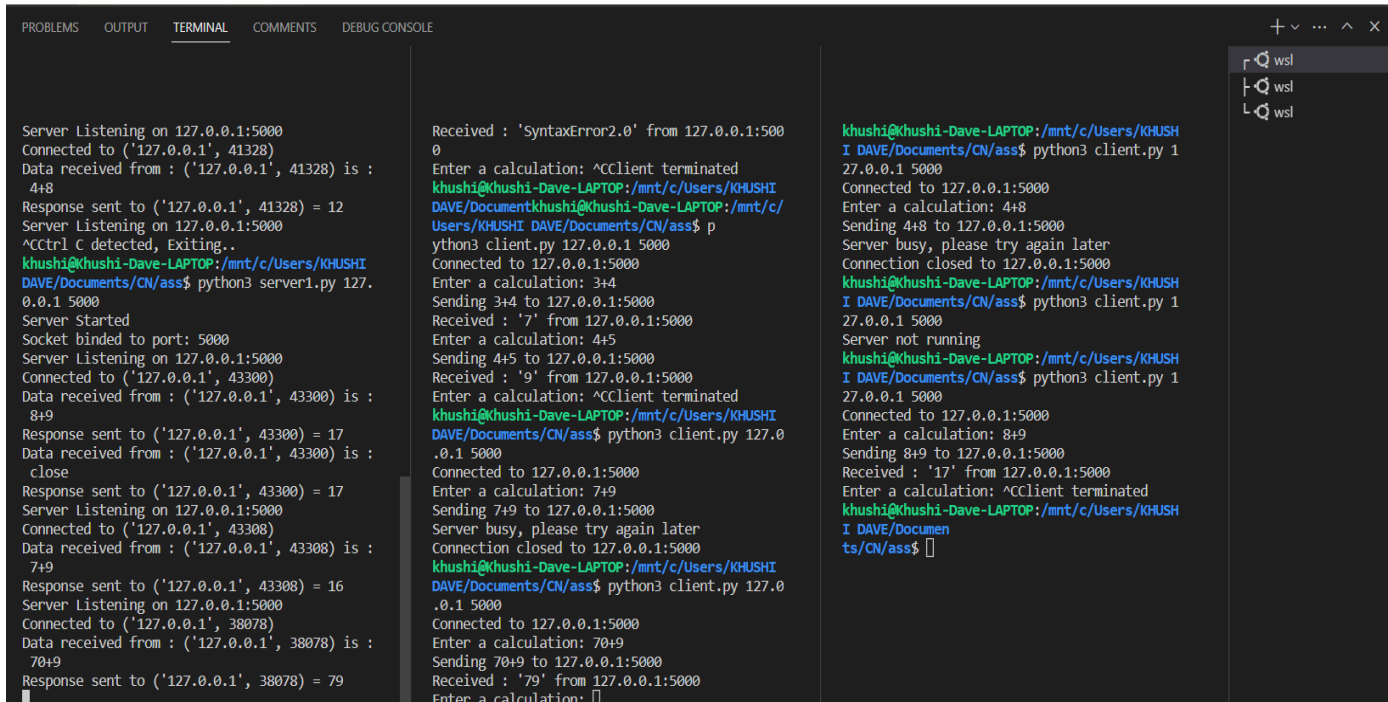
```
45 except (NameError):

PROBLEMS OUTPUT TERMINAL COMMENTS DEBUG CONSOLE

Data received from : ('127.0.0.1', 40824) is : 4/2
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : 2/0
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : 2::
Response sent to ('127.0.0.1', 40824) = 2.0
Data received from : ('127.0.0.1', 40824) is : close
Response sent to ('127.0.0.1', 40824) = 2.0
Server Listening on 127.0.0.1:5000
^C^C^C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
s/CN/ass$ p
yhton3 server1.py 127.0.0.1 5000
Server Started
Socket binded to port: 5000
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 41320)
Data received from : ('127.0.0.1', 41320) is : 3+4
Response sent to ('127.0.0.1', 41320) = 7
Data received from : ('127.0.0.1', 41320) is : 4+5
Response sent to ('127.0.0.1', 41320) = 9
Data received from : ('127.0.0.1', 41320) is : close
Response sent to ('127.0.0.1', 41320) = 9
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 41328)
Data received from : ('127.0.0.1', 41328) is : 4+8
Response sent to ('127.0.0.1', 41328) = 12
Server Listening on 127.0.0.1:5000
^C^C^C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
s/CN/ass$

Sending 2+4 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 4-1
Sending 4-1 to 127.0.0.1:5000
Received : '3' from 127.0.0.1:5000
Enter a calculation: 5*2
Sending 5*2 to 127.0.0.1:5000
Received : '10' from 127.0.0.1:5000
Enter a calculation: 4/2
Sending 4/2 to 127.0.0.1:5000
Received : '2.0' from 127.0.0.1:5000
Enter a calculation: 2/0
Sending 2/0 to 127.0.0.1:5000
You can't divide by 0, try again
Enter a calculation: 2::
Sending 2:: to 127.0.0.1:5000
Received : 'SyntaxError2.0' from 127.0.0.1:5000
Enter a calculation: ^CClient terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
s/CN/ass$ p
yhton3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 3+4
Sending 3+4 to 127.0.0.1:5000
Received : '7' from 127.0.0.1:5000
Enter a calculation: 4+5
Sending 4+5 to 127.0.0.1:5000
Received : '9' from 127.0.0.1:5000
Enter a calculation: ^CClient terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Document
s/CN/ass$
```

The server shows the result of query of client2 on terminating client 1



The screenshot shows a VS Code terminal window with three panels. The left panel shows the server's log, the middle panel shows the first client's interaction, and the right panel shows the second client's interaction.

```
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 41328)
Data received from : ('127.0.0.1', 41328) is :
4+8
Response sent to ('127.0.0.1', 41328) = 12
Server Listening on 127.0.0.1:5000
^Cctrl C detected, Exiting..
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI
DAVE/Documents/CN/ass$ python3 server1.py 127.
0.0.1 5000
Server Started
Socket binded to port: 5000
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 43300)
Data received from : ('127.0.0.1', 43300) is :
8+9
Response sent to ('127.0.0.1', 43300) = 17
Data received from : ('127.0.0.1', 43300) is :
close
Response sent to ('127.0.0.1', 43300) = 17
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 43308)
Data received from : ('127.0.0.1', 43308) is :
7+9
Response sent to ('127.0.0.1', 43308) = 16
Server Listening on 127.0.0.1:5000
Connected to ('127.0.0.1', 38078)
Data received from : ('127.0.0.1', 38078) is :
70+9
Response sent to ('127.0.0.1', 38078) = 79

Received : 'SyntaxError2.0' from 127.0.0.1:500
0
Enter a calculation: ^CClient terminated
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI
DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 3+4
Sending 3+4 to 127.0.0.1:5000
Received : '7' from 127.0.0.1:5000
Enter a calculation: 4+5
Sending 4+5 to 127.0.0.1:5000
Received : '9' from 127.0.0.1:5000
Enter a calculation: ^CClient terminated
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI
DAVE/Documents/CN/ass$ python3 client.py 127.0
.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 7+9
Sending 7+9 to 127.0.0.1:5000
Server busy, please try again later
Connection closed to 127.0.0.1:5000
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI
DAVE/Documents/CN/ass$ python3 client.py 127.0
.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 70+9
Sending 70+9 to 127.0.0.1:5000
Received : '79' from 127.0.0.1:5000
Enter a calculation: ||

khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSH
I DAVE/Documents/CN/ass$ python3 client.py 1
27.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 4+8
Sending 4+8 to 127.0.0.1:5000
Server busy, please try again later
Connection closed to 127.0.0.1:5000
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSH
I DAVE/Documents/CN/ass$ python3 client.py 1
27.0.0.1 5000
Server not running
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSH
I DAVE/Documents/CN/ass$ python3 client.py 1
27.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 8+9
Sending 8+9 to 127.0.0.1:5000
Received : '17' from 127.0.0.1:5000
Enter a calculation: ^CClient terminated
khushi@khushi-Dave-LAPTOP:/mnt/c/Users/KHUSH
I DAVE/Documen
ts/CN/ass$ ||
```

On terminating client1 another client is able to connect

Server2.py

server2.py : server program "server2.py " is a multi-threaded server that created a new thread for every new client request it receives. Multiple clients is being able to simultaneously chat with the serve

PROBLEMS

OUTPUT

TERMINAL

COMMENTS

DEBUG CONSOLE

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ pytho
n3 server2.py 127.0.0.1 5000
Server Started
Socket binded to port: 5000
127.0.0.1:5000 is listening
Connected to: 127.0.0.1:57952
Thread Number: 1
Connected to: 127.0.0.1:57960
Thread Number: 2
Data received: 7+8
Data received: 8-3
Data received: 3*2
Data received: 3-1
Data received: 3+3
Data received: 3)
Data received: 3/0
█

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ pyt
ho
n3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 7+8
Sending 7+8 to 127.0.0.1:5000
Received : '15' from 127.0.0.1:5000
Enter a calculation: 8-3
Sending 8-3 to 127.0.0.1:5000
Received : '5' from 127.0.0.1:5000
Enter a calculation: 3*2
Sending 3*2 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 3)
Sending 3) to 127.0.0.1:5000
Received : 'SyntaxError6' from 127.0.0.1:5000
Enter a calculation: █

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ pyt
hon3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 3-1
Sending 3-1 to 127.0.0.1:5000
Received : '2' from 127.0.0.1:5000
Enter a calculation: 3+3
Sending 3+3 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 3/0
Sending 3/0 to 127.0.0.1:5000
You can't divide by 0, try again
Enter a calculation: █

pwsh

ws

ws

ws

ws

```
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server2.py 127.0.0.1 5000
Server Started
Socket binded to port: 5000
127.0.0.1:5000 is listening
Connected to: 127.0.0.1:57952
Thread Number: 1
Connected to: 127.0.0.1:57960
Thread Number: 2
Data received: 7+8
Data received: 8-3
Data received: 3*2
Data received: 3-1
Data received: 3+3
Data received: 3)
Data received: 3/0
Data received: close
Connection closed by ('127.0.0.1', 57960)
Thread 1 closed
Data received: close
Connection closed by ('127.0.0.1', 57952)
Thread 0 closed
^C^C^C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

```
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Enter a calculation: 7+8
Sending 7+8 to 127.0.0.1:5000
Received : '15' from 127.0.0.1:5000
Enter a calculation: 8-3
Sending 8-3 to 127.0.0.1:5000
Received : '5' from 127.0.0.1:5000
Enter a calculation: 3*2
Sending 3*2 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 3)
Sending 3) to 127.0.0.1:5000
Received : 'SyntaxError6' from 127.0.0.1:5000
Enter a calculation: ^CClient terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

```
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 hon3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 3-1
Sending 3-1 to 127.0.0.1:5000
Received : '2' from 127.0.0.1:5000
Enter a calculation: 3+3
Sending 3+3 to 127.0.0.1:5000
Received : '6' from 127.0.0.1:5000
Enter a calculation: 3/0
Sending 3/0 to 127.0.0.1:5000
You can't divide by 0, try again
Enter a calculation: ^CClient terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

Left:server middle: concurrently connected, Right: concurrently connected,
valid input Each connection spawns it's own thread and engages the client.
Connection is closed when client closes the connection.

<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 server2.py 127.0.0.1 5000 Server Started Socket binded to port: 5000 127.0.0.1:5000 is listening Connected to: 127.0.0.1:37336 Thread Number: 1 Data received: 3+3 Connected to: 127.0.0.1:42598 Thread Number: 2 Data received: 3+0 █</pre>	<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 client.py 127.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 3+3 Sending 3+3 to 127.0.0.1:5000 Received : '6' from 127.0.0.1:5000 Enter a calculation: █</pre>	<pre>ated khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 client.py 127.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 3+0 Sending 3+0 to 127.0.0.1:5000 Received : '3' from 127.0.0.1:5000 Enter a calculation: █</pre>
---	--	---

Server3.py

server3.py : server program "server3.py " is a single process server that uses the "select" method to handle multiple clients concurrently.

PROBLEMS	OUTPUT	TERMINAL	COMMENTS	DEBUG CONSOLE		
		<pre>umekhushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 server3.py 127.0.0.1 5000 Server started Socket binded to port: 5000 Listening at 127.0.0.1:5000 Received request from ('127.0.0.1', 42202) Received request from ('127.0.0.1', 42208) Data received: 3+2 Response sent = 5 Data received: 3-1 Response sent = 2 Data received: 2+34 Response sent = 36 Data received: 3*3 Response sent = 9 Data received: 3/3 Response sent = 1.0 Data received: 3/0 Response sent = ZeroDiv Data received: 1++ Response sent = SyntaxError Data received: 2+ Response sent = SyntaxError Data received: 2_ Response sent = SyntaxError </pre>		<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 client.py 127.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 3+2 Sending 3+2 to 127.0.0.1:5000 Received : '5' from 127.0.0.1:5000 Enter a calculation: 3-1 Sending 3-1 to 127.0.0.1:5000 Received : '2' from 127.0.0.1:5000 Enter a calculation: 3*3 Sending 3*3 to 127.0.0.1:5000 Received : '9' from 127.0.0.1:5000 Enter a calculation: 3/3 Sending 3/3 to 127.0.0.1:5000 Received : '1.0' from 127.0.0.1:5000 Enter a calculation: 1++ Sending 1++ to 127.0.0.1:5000 There is a syntax error, please try again Enter a calculation: 2+ Sending 2+ to 127.0.0.1:5000 There is a syntax error, please try again Enter a calculation: 2_ </pre>		<pre>khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass\$ python3 client.py 127.0.0.1 5000 Connected to 127.0.0.1:5000 Enter a calculation: 2+34 Sending 2+34 to 127.0.0.1:5000 Received : '36' from 127.0.0.1:5000 Enter a calculation: 3/0 Sending 3/0 to 127.0.0.1:5000 You can't divide by 0, try again Enter a calculation: 2_ Sending 2_ to 127.0.0.1:5000 There is a syntax error, please try again Enter a calculation: </pre>

```

PROBLEMS OUTPUT TERMINAL COMMENTS DEBUG CONSOLE
umekhushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ p
ython3 server3.py 127.0.0.1 5000
Server started
Socket binded to port: 5000
Listening at 127.0.0.1:5000
Received request from ('127.0.0.1', 4
Response sent = SyntaxError
Data received: close
Response sent = NameError
Data received: close
Response sent = NameError
^C Ctrl C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ pyt
ho
n3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: ^C Client terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$

Sending 2_ to 127.0.0.1:5000
There is a syntax error, please try again
Enter a calculation: ^C Client terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$

```

left: server2.py middle: concurrently connected client, Right: concurrently connected client,

- Every socket is added to the buffer including server socket.
- Socket is selected using select function.

- If socket is server

- * We accept the connection in it and append it to

buffer.

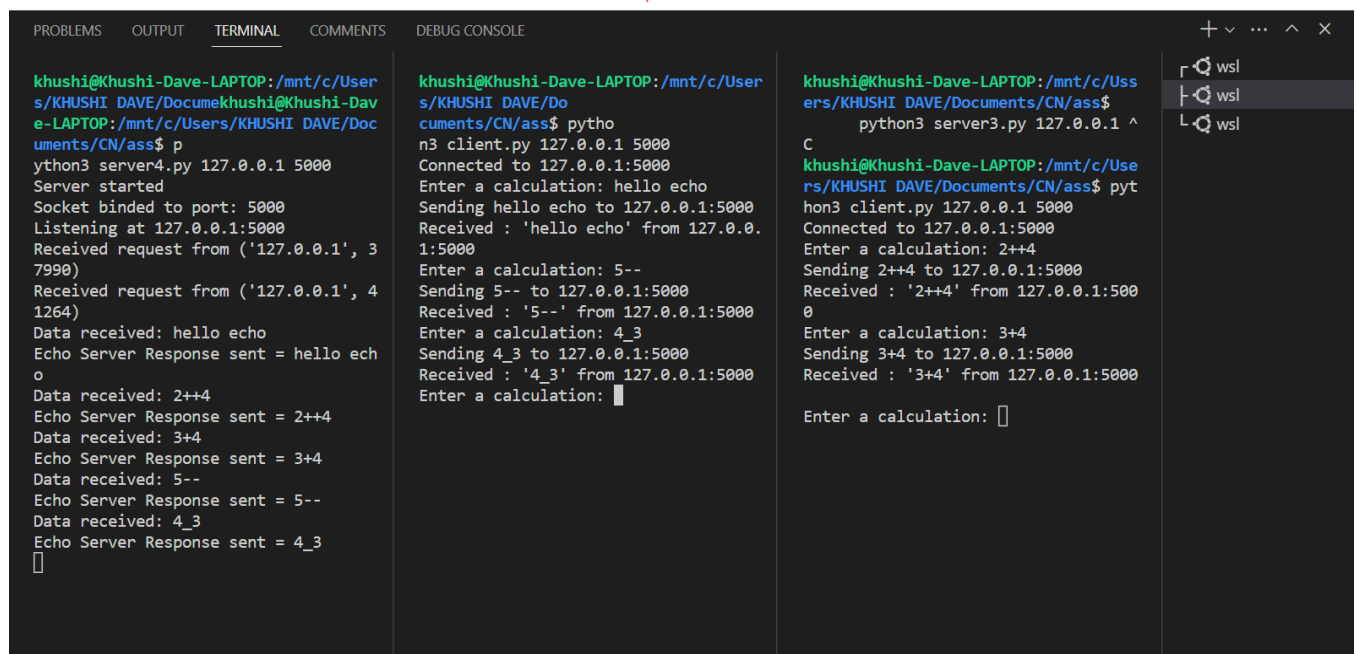
- If socket is client data is taken from the socket

- * If data is present, output is sent,

- * If data is not present then the socket is removed from buffer and connection is closed.

Server4.py

server4.py :Server program "server4.py" is an echo server that replies the same message to the client that was received from the same client, it will be a single process server that uses the "select" method to handle multiple clients concurrently



```
PROBLEMS OUTPUT TERMINAL COMMENTS DEBUG CONSOLE

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server4.py 127.0.0.1 5000
Server started
Socket binded to port: 5000
Listening at 127.0.0.1:5000
Received request from ('127.0.0.1', 37990)
Received request from ('127.0.0.1', 41264)
Data received: hello echo
Echo Server Response sent = hello echo
Data received: 2++4
Echo Server Response sent = 2++4
Data received: 3+4
Echo Server Response sent = 3+4
Data received: 5--
Echo Server Response sent = 5--
Data received: 4_3
Echo Server Response sent = 4_3
[]

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: hello echo
Sending hello echo to 127.0.0.1:5000
Received : 'hello echo' from 127.0.0.1:5000
Enter a calculation: 5--
Sending 5-- to 127.0.0.1:5000
Received : '5--' from 127.0.0.1:5000
Enter a calculation: 4_3
Sending 4_3 to 127.0.0.1:5000
Received : '4_3' from 127.0.0.1:5000
Enter a calculation: []

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server3.py 127.0.0.1 ^C
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 2++4
Sending 2++4 to 127.0.0.1:5000
Received : '2++4' from 127.0.0.1:5000
Enter a calculation: 3+4
Sending 3+4 to 127.0.0.1:5000
Received : '3+4' from 127.0.0.1:5000
Enter a calculation: []

wsl
wsl
wsl
```

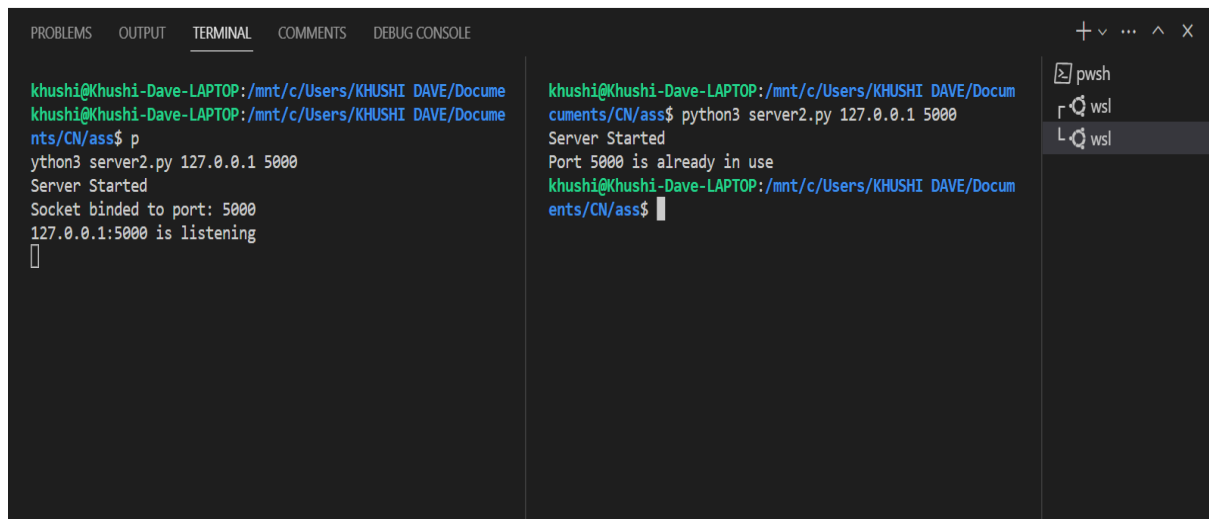
```
PROBLEMS  OUTPUT  TERMINAL  COMMENTS  DEBUG CONSOLE

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server4.py 127.0.0.1 5000
Server started
Socket binded to port: 5000
Listening at 127.0.0.1:5000
Received request from ('127.0.0.1', 37990)
Received request from ('127.0.0.1', 41264)
Data received: hello echo
Echo Server Response sent = hello echo
Data received: 2++4
Echo Server Response sent = 2++4
Data received: 3+4
Echo Server Response sent = 3+4
Data received: 5--
Echo Server Response sent = 5--
Data received: 4_3
Echo Server Response sent = 4_3
Data received: close
Echo Server Response sent = close
Data received: close
Echo Server Response sent = close
^C Ctrl C detected, Exiting..
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: hello echo
Sending hello echo to 127.0.0.1:5000
Received : 'hello echo' from 127.0.0.1:5000
Enter a calculation: 5--
Sending 5-- to 127.0.0.1:5000
Received : '5--' from 127.0.0.1:5000
Enter a calculation: 4_3
Sending 4_3 to 127.0.0.1:5000
Received : '4_3' from 127.0.0.1:5000
Enter a calculation: ^C Client terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$

khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server3.py 127.0.0.1 5000
C
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 client.py 127.0.0.1 5000
Connected to 127.0.0.1:5000
Enter a calculation: 2++4
Sending 2++4 to 127.0.0.1:5000
Received : '2++4' from 127.0.0.1:5000
Enter a calculation: 3+4
Sending 3+4 to 127.0.0.1:5000
Received : '3+4' from 127.0.0.1:5000
Enter a calculation: ^C Client terminated
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

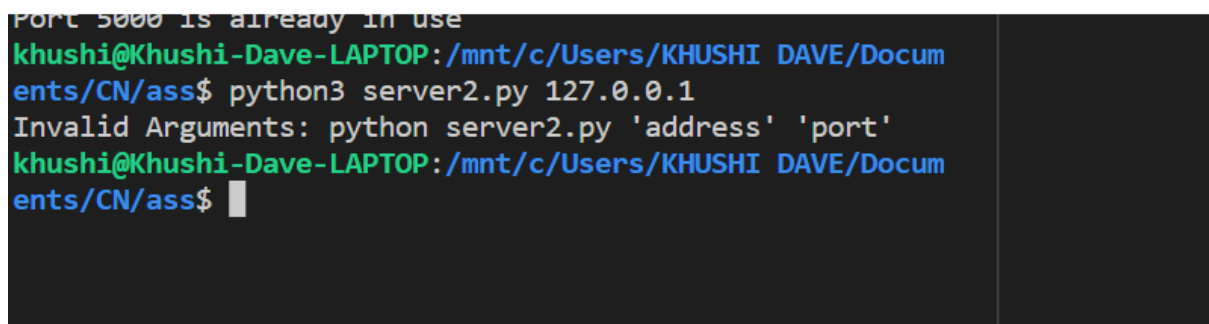
Port already in use handled



A screenshot of a Visual Studio Code terminal window. The terminal has tabs for PROBLEMS, OUTPUT, TERMINAL, COMMENTS, and DEBUG CONSOLE. The TERMINAL tab is active. The prompt is `khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$`. The user enters `python3 server2.py 127.0.0.1 5000`. The output shows: `Server Started`, `Port 5000 is already in use`, and `Socket binded to port: 5000`. The prompt returns. On the right, a sidebar shows a file explorer with `pwsh` and `wsl` folders.

```
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server2.py 127.0.0.1 5000
Server Started
Port 5000 is already in use
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

Invalid Arguments case handled



A screenshot of a Visual Studio Code terminal window. The prompt is `khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$`. The user enters `python3 server2.py 127.0.0.1`. The output shows: `Port 5000 is already in use` (from the previous command), and then `Invalid Arguments: python server2.py 'address' 'port'`. The prompt returns.

```
Port 5000 is already in use
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$ python3 server2.py 127.0.0.1
Invalid Arguments: python server2.py 'address' 'port'
khushi@Khushi-Dave-LAPTOP:/mnt/c/Users/KHUSHI DAVE/Documents/CN/ass$
```

Expression evaluation

For evaluating the mathematical expression the string is simply passed to `eval()` function available with python, so the server is capable to solving any type of equation.