

Computer Networks CSL317

Client Server Socket Programming

Name: Kaushal Lodd

Enrollment No: BT19CSE052

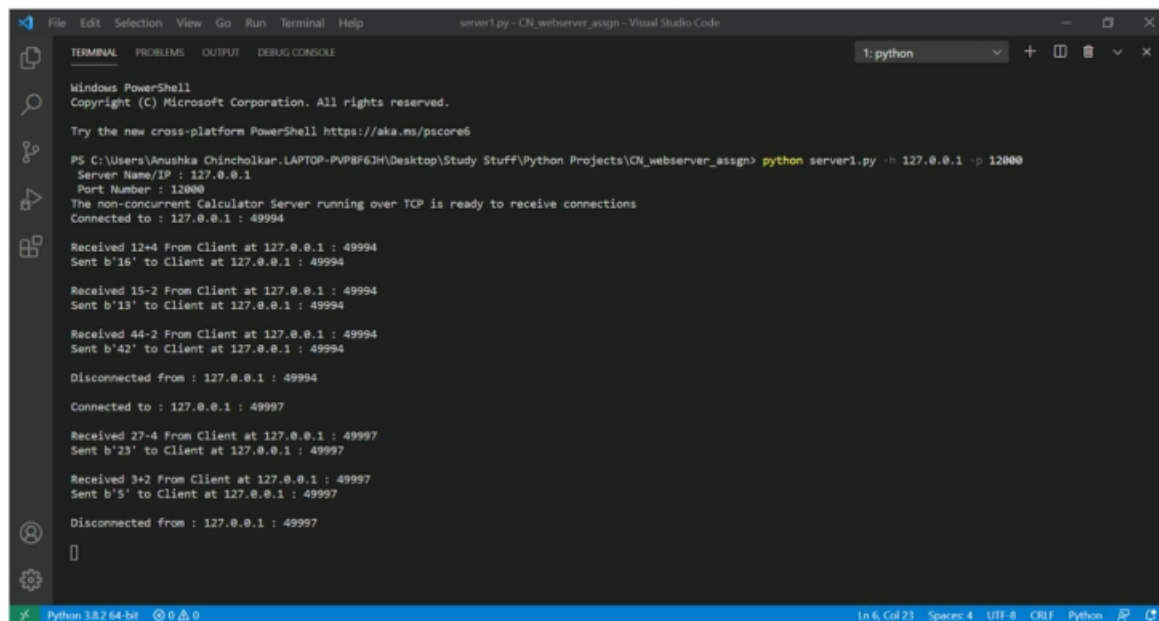
Instructions to run the code:

1. Set the current working directory as the directory where the files are stored
2. Ensure that all 6 files (client.py, server1.py, server2.py, server3.py, server4.py, helper.py) are in the same folder.
3. The client and server files can be run using the following syntax:
`python3 <filename>.py -h <hostname> -p <port>`
For example, each of the files can be run as:
`python3 client.py -h 127.0.0.1 -p 12000`
`python3 server1.py -h 127.0.0.1 -p 12000`
`python3 server2.py -h 127.0.0.1 -p 12000`
`python3 server3.py -h 127.0.0.1 -p 12000`
`python3 server4.py -h 127.0.0.1 -p 12000`
4. Once the client is running, any input can be given at the prompt. If the input is invalid, the server will return an error message, but not close the connection, so another request can be sent.

Basic testcases for each server:

Server 1: Non-concurrent server

Server side:



```
server1.py - CN_webserver_assign - Visual Studio Code
1: python
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python server1.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
The non-concurrent Calculator Server running over TCP is ready to receive connections
Connected to : 127.0.0.1 : 49994

Received 12+4 From Client at 127.0.0.1 : 49994
Sent b'16' to Client at 127.0.0.1 : 49994

Received 15-2 From Client at 127.0.0.1 : 49994
Sent b'13' to Client at 127.0.0.1 : 49994

Received 44-2 From Client at 127.0.0.1 : 49994
Sent b'42' to Client at 127.0.0.1 : 49994

Disconnected from : 127.0.0.1 : 49994

Connected to : 127.0.0.1 : 49997

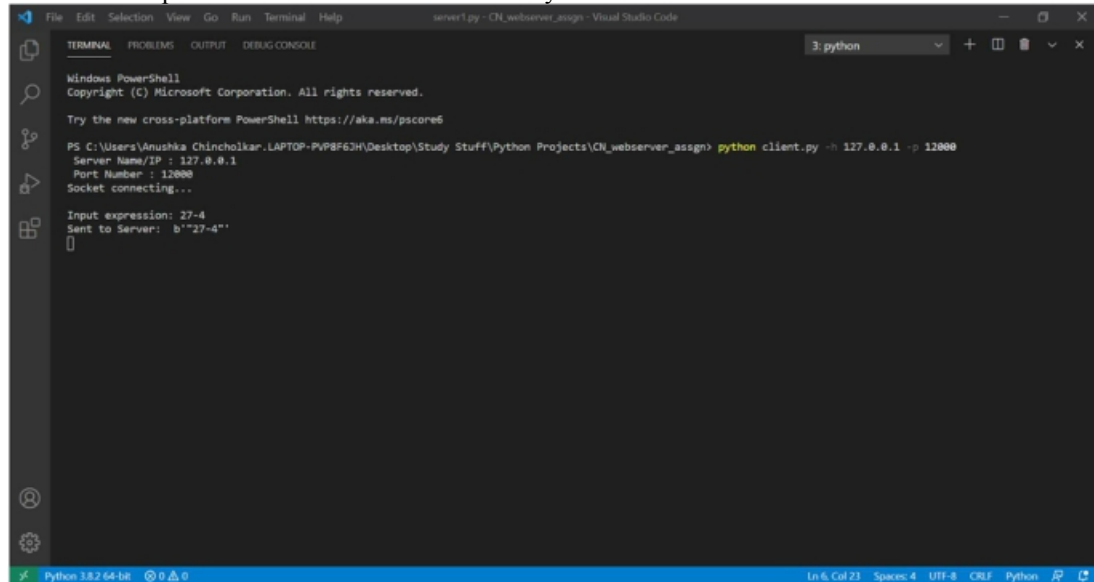
Received 27-4 From Client at 127.0.0.1 : 49997
Sent b'23' to Client at 127.0.0.1 : 49997

Received 3+2 From Client at 127.0.0.1 : 49997
Sent b'5' to Client at 127.0.0.1 : 49997

Disconnected from : 127.0.0.1 : 49997

Python 3.8.2 64-bit 0 0 0 ln 6, Col 23 Spaces: 4 UTF-8 ORLF Python
```

Client 2 attempts to connect when server is already connected to Client 1:



The screenshot shows a Visual Studio Code terminal window with the title 'server1.py - CN_webserver_assign - Visual Studio Code'. The terminal is running a Python script. The output shows the server's initial state and the connection attempt from Client 2.

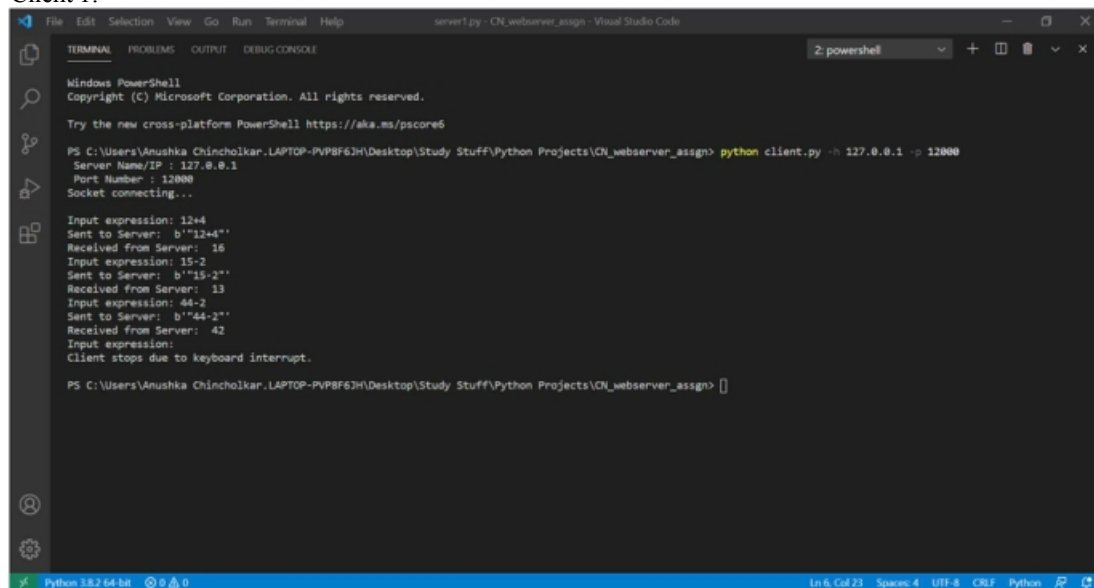
```
Windows PowerShell
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PS C:\Users\Anushka.Chincholkar.LAPTOP-PVPBF63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 27-4
Sent to Server: b"27-4"
[]
```

Client 1:



The screenshot shows a Visual Studio Code terminal window with the title 'server1.py - CN_webserver_assign - Visual Studio Code'. The terminal is running a Python script. The output shows the server's initial state and the connection attempt from Client 1, followed by several interactions.

```
Windows PowerShell
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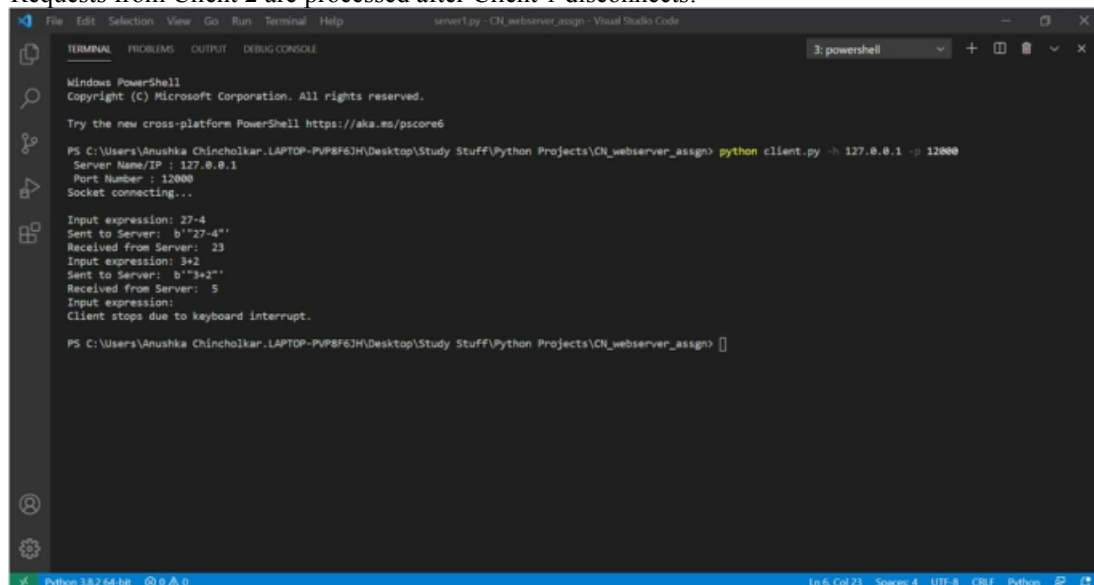
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PS C:\Users\Anushka.Chincholkar.LAPTOP-PVPBF63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 12+4
Sent to Server: b"12+4"
Received from Server: 16
Input expression: 15-2
Sent to Server: b"15-2"
Received from Server: 13
Input expression: 44-2
Sent to Server: b"44-2"
Received from Server: 42
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVPBF63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

Requests from Client 2 are processed after Client 1 disconnects:



The screenshot shows a Visual Studio Code terminal window with the title 'server1.py - CN_webserver_assign - Visual Studio Code'. The terminal is running a Python script. The output shows the server's initial state and the connection attempt from Client 2, followed by several interactions.

```
Windows PowerShell
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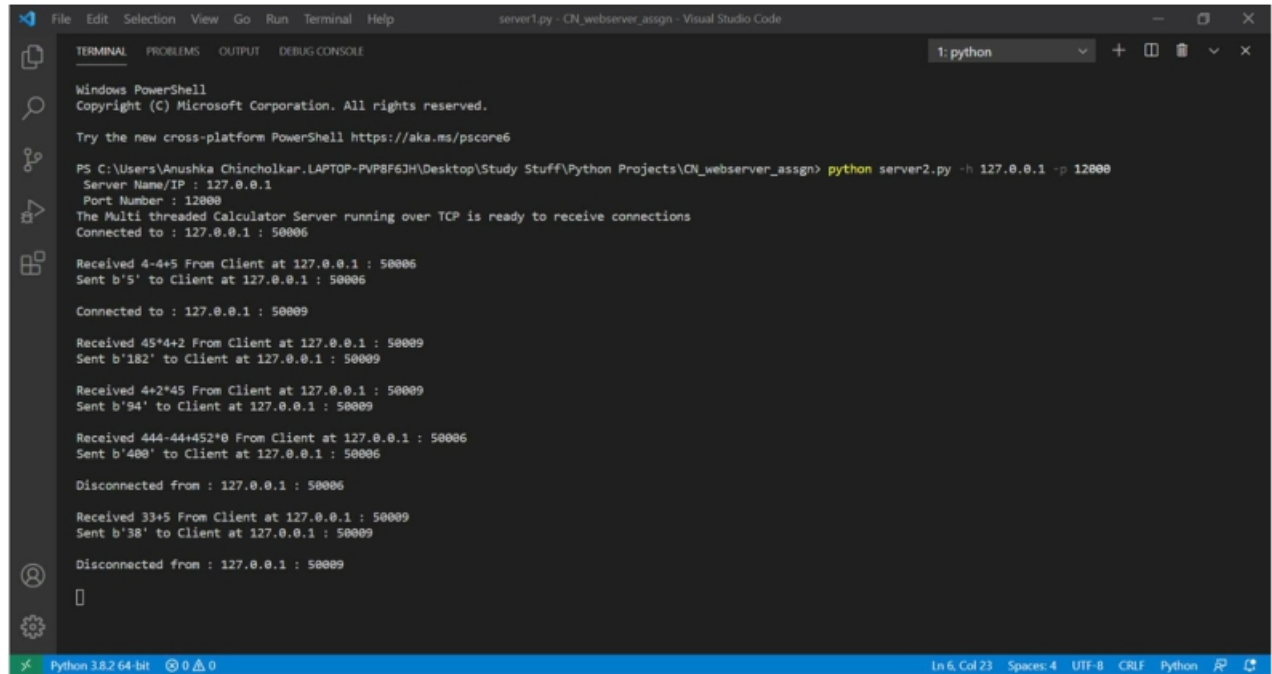
PS C:\Users\Anushka.Chincholkar.LAPTOP-PVPBF63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 27-4
Sent to Server: b"27-4"
Received from Server: 23
Input expression: 3+2
Sent to Server: b"3+2"
Received from Server: 5
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVPBF63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

Server2:

Server Side:



```
server1.py - CN_webserver_assign - Visual Studio Code
1: python
Windows PowerShell
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PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python server2.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
The Multi threaded Calculator Server running over TCP is ready to receive connections
Connected to : 127.0.0.1 : 50006

Received 4-4+5 From Client at 127.0.0.1 : 50006
Sent b'S' to Client at 127.0.0.1 : 50006

Connected to : 127.0.0.1 : 50009

Received 45*4+2 From Client at 127.0.0.1 : 50009
Sent b'182' to Client at 127.0.0.1 : 50009

Received 4+2*45 From Client at 127.0.0.1 : 50009
Sent b'94' to Client at 127.0.0.1 : 50009

Received 444-44+452*0 From Client at 127.0.0.1 : 50006
Sent b'400' to Client at 127.0.0.1 : 50006

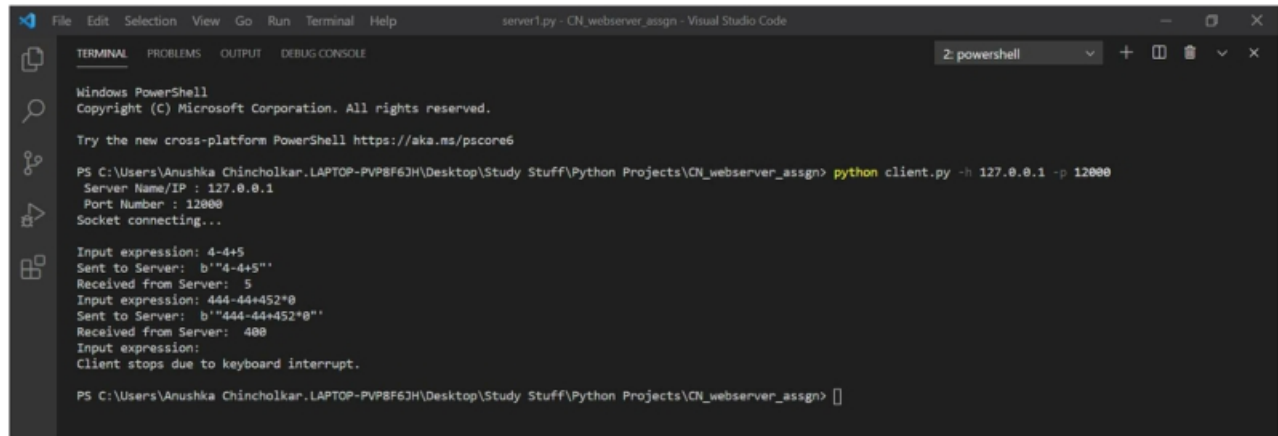
Disconnected from : 127.0.0.1 : 50006

Received 33+5 From Client at 127.0.0.1 : 50009
Sent b'38' to Client at 127.0.0.1 : 50009

Disconnected from : 127.0.0.1 : 50009

Python 3.8.2 64-bit 0 0 0 In 6, Col 23 Spaces: 4 UTF-8 CRLF Python
```

Client 1:



```
server1.py - CN_webserver_assign - Visual Studio Code
2: powershell
Windows PowerShell
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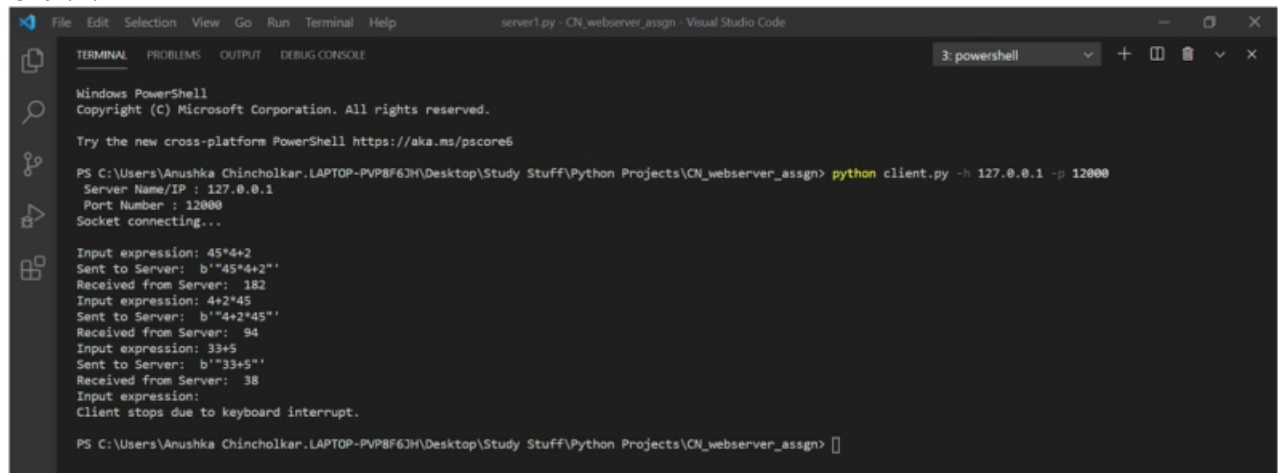
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PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 4-4+5
Sent to Server: b'"4-4+5"'
Received from Server: 5
Input expression: 444-44+452*0
Sent to Server: b'"444-44+452*0"'
Received from Server: 400
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign>
```

Client 2:



```
server1.py - CN_webserver_assign - Visual Studio Code
3: powershell
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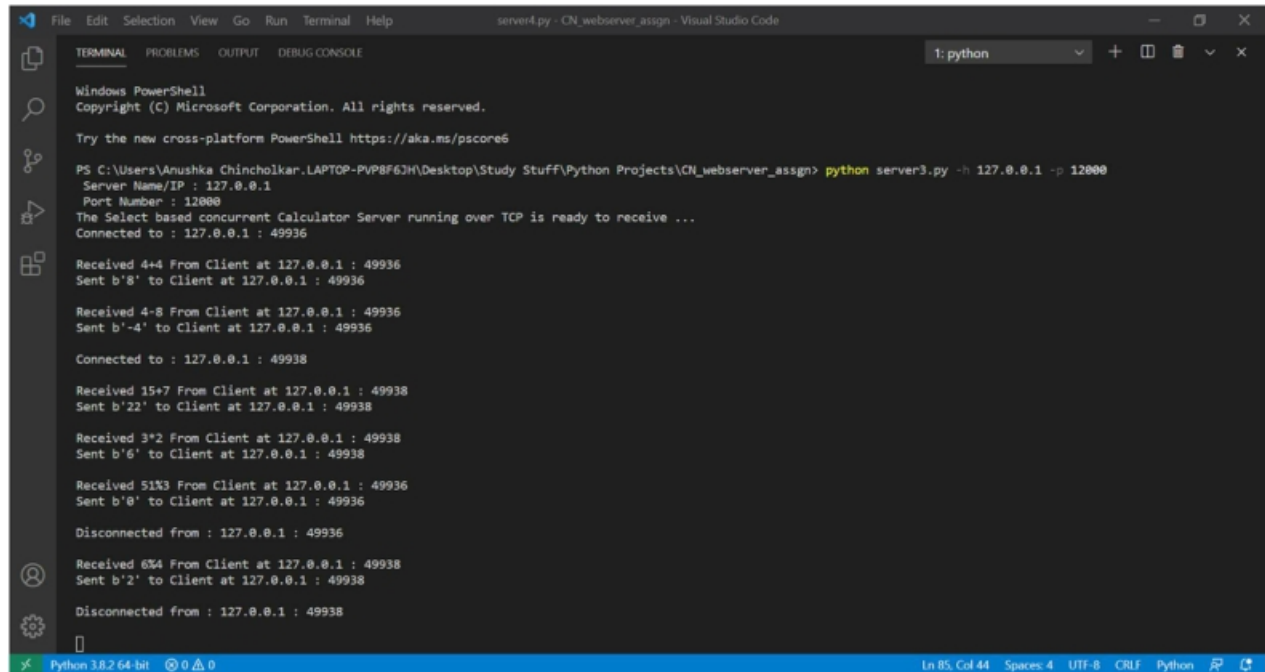
PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 45*4+2
Sent to Server: b'"45*4+2"'
Received from Server: 182
Input expression: 4+2*45
Sent to Server: b'"4+2*45"'
Received from Server: 94
Input expression: 33+5
Sent to Server: b'"33+5"'
Received from Server: 38
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign>
```

Server3:

Server Side:



```
File Edit Selection View Go Run Terminal Help server4.py - CN_webserver_assign - Visual Studio Code
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE 1: python
Windows PowerShell
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PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python server3.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
The Select based concurrent Calculator Server running over TCP is ready to receive ...
Connected to : 127.0.0.1 : 49936

Received 4+4 From Client at 127.0.0.1 : 49936
Sent b'8' to Client at 127.0.0.1 : 49936

Received 4-8 From Client at 127.0.0.1 : 49936
Sent b'-4' to Client at 127.0.0.1 : 49936

Connected to : 127.0.0.1 : 49938

Received 15+7 From Client at 127.0.0.1 : 49938
Sent b'22' to Client at 127.0.0.1 : 49938

Received 3*2 From Client at 127.0.0.1 : 49938
Sent b'6' to Client at 127.0.0.1 : 49938

Received 51*3 From Client at 127.0.0.1 : 49936
Sent b'0' to Client at 127.0.0.1 : 49936

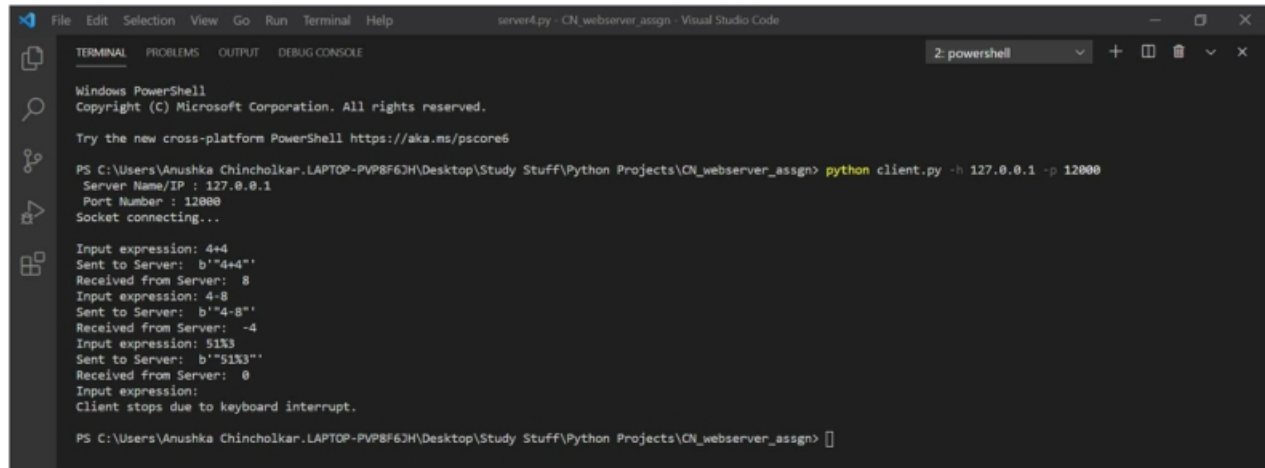
Disconnected from : 127.0.0.1 : 49936

Received 6*4 From Client at 127.0.0.1 : 49938
Sent b'2' to Client at 127.0.0.1 : 49938

Disconnected from : 127.0.0.1 : 49938

Python 3.8.2 64-bit 0 0
```

Client 1:



```
File Edit Selection View Go Run Terminal Help server4.py - CN_webserver_assign - Visual Studio Code
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE 2: powershell
Windows PowerShell
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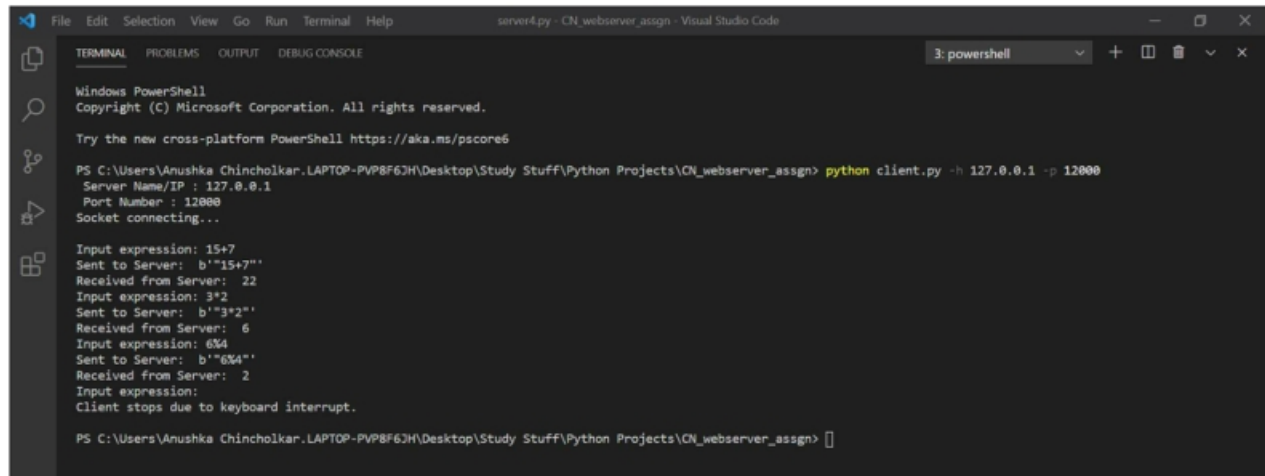
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 4+4
Sent to Server: b'"4+4"'
Received from Server: 8
Input expression: 4-8
Sent to Server: b'"4-8"'
Received from Server: -4
Input expression: 51*3
Sent to Server: b'"51*3"'
Received from Server: 0
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign>
```

Client 2:



```
File Edit Selection View Go Run Terminal Help server4.py - CN_webserver_assign - Visual Studio Code
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE 3: powershell
Windows PowerShell
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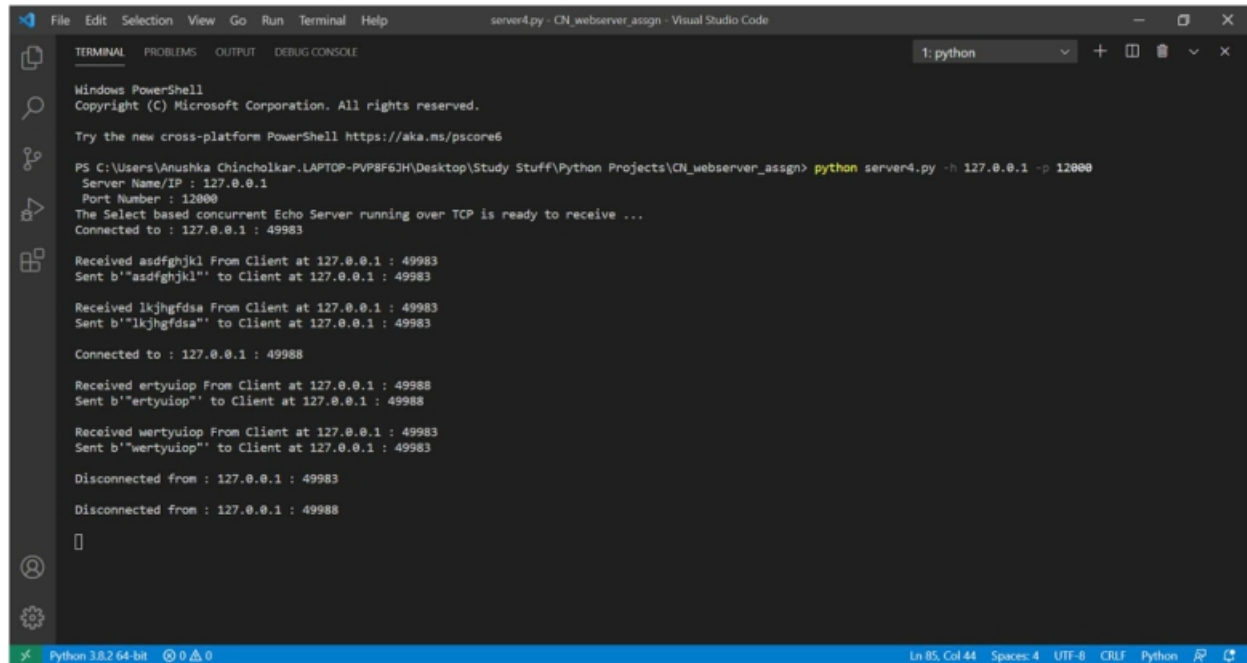
PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 15+7
Sent to Server: b'"15+7"'
Received from Server: 22
Input expression: 3*2
Sent to Server: b'"3*2"'
Received from Server: 6
Input expression: 6*4
Sent to Server: b'"6*4"'
Received from Server: 2
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka.Chincholkar.LAPTOP-PVP8F63H\Desktop\Study Stuff\Python Projects\CN_webserver_assign>
```

Server4:

Server Side:



```
server4.py - CN_webserver_assign - Visual Studio Code
1: python

Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python server4.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
The Select based concurrent Echo Server running over TCP is ready to receive ...
Connected to : 127.0.0.1 : 49983

Received asdfghjkl From Client at 127.0.0.1 : 49983
Sent b"asdfghjkl" to Client at 127.0.0.1 : 49983

Received lkjhgfdsa From Client at 127.0.0.1 : 49983
Sent b"lkjhgfdsa" to Client at 127.0.0.1 : 49983

Connected to : 127.0.0.1 : 49988

Received ertyuiop From Client at 127.0.0.1 : 49988
Sent b"ertyuiop" to Client at 127.0.0.1 : 49988

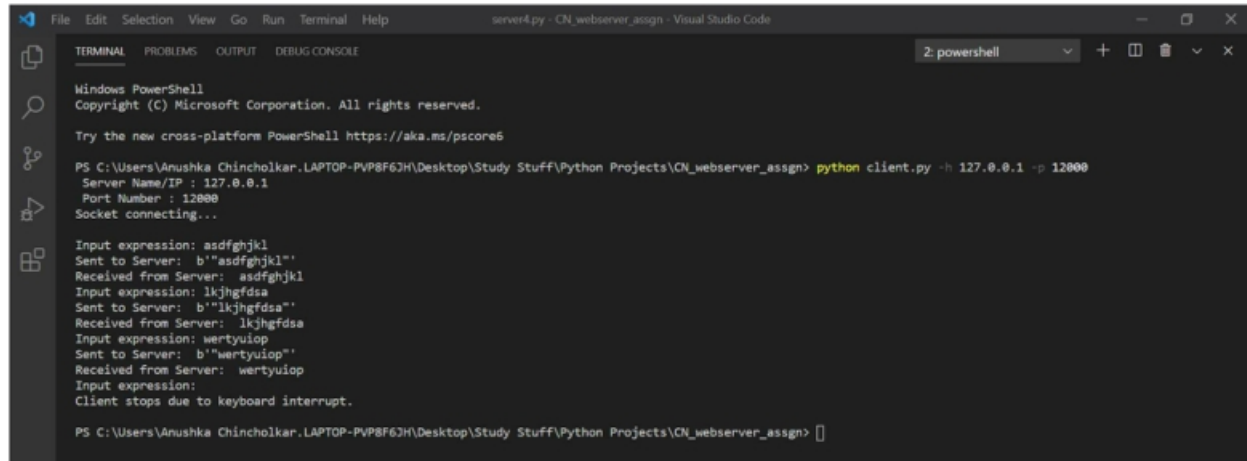
Received wertyuiop From Client at 127.0.0.1 : 49983
Sent b"wertyuiop" to Client at 127.0.0.1 : 49983

Disconnected from : 127.0.0.1 : 49983

Disconnected from : 127.0.0.1 : 49988

[]
```

Client 1:



```
server4.py - CN_webserver_assign - Visual Studio Code
2: powershell

Windows PowerShell
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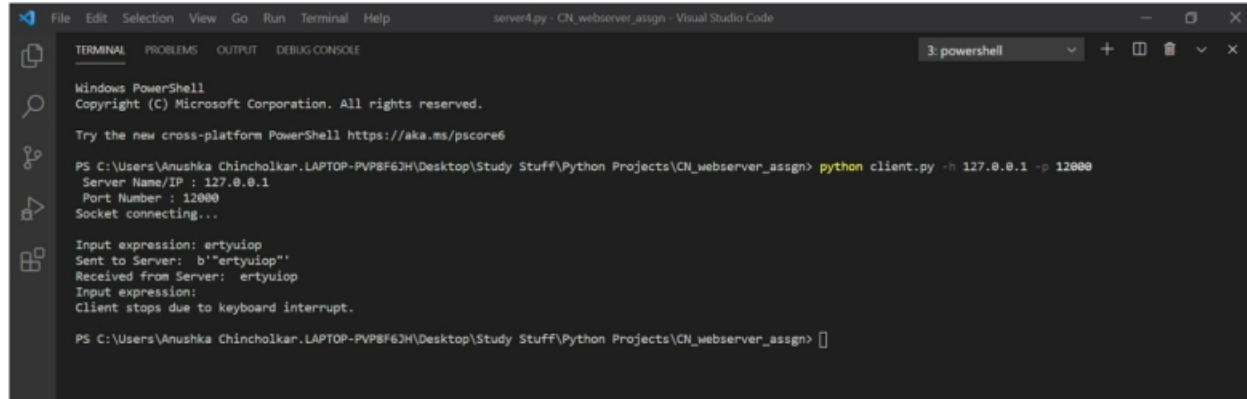
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: asdfghjkl
Sent to Server: b"asdfghjkl"
Received from Server: asdfghjkl
Input expression: lkjhgfdsa
Sent to Server: b"lkjhgfdsa"
Received from Server: lkjhgfdsa
Input expression: ertyuiop
Sent to Server: b"wertyuiop"
Received from Server: wertyuiop
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

Client 2:



```
server4.py - CN_webserver_assign - Visual Studio Code
3: powershell

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PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: ertyuiop
Sent to Server: b"ertyuiop"
Received from Server: ertyuiop
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

Additional features incorporated:

1. Extensive error checking and reporting, so that socket connections are closed properly on both client and server side.
2. Support for non-integer operands

```
PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 5.0 - 2.3
Sent to Server: b'"5.0 - 2.3"'
Received from Server: 2.7
Input expression: 22.345/5.5
Sent to Server: b'"22.345/5.5"'
Received from Server: 4.0627272727272725
Input expression: []
```

3. Support for more than two operands

```
PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 1 + 2 + 3
Sent to Server: b'"1 + 2 + 3"'
Received from Server: 6
Input expression: 15 - 5 - 3
Sent to Server: b'"15 - 5 - 3"'
Received from Server: 7
Input expression: 2*4*5
Sent to Server: b'"2*4*5"'
Received from Server: 40
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

4. Support for more than one operator

```
PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 1 + 2 * 3
Sent to Server: b'"1 + 2 * 3"'
Received from Server: 7
Input expression: 56/2 - 22/11
Sent to Server: b'"56/2 - 22/11"'
Received from Server: 26.0
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```

5. Support for other arithmetic operations like %

```
PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> python client.py -h 127.0.0.1 -p 12000
Server Name/IP : 127.0.0.1
Port Number : 12000
Socket connecting...

Input expression: 22%3
Sent to Server: b'"22%3"'
Received from Server: 1
Input expression: 48%2
Sent to Server: b'"48%2"'
Received from Server: 0
Input expression:
Client stops due to keyboard interrupt.

PS C:\Users\Anushka Chincholkar.LAPTOP-PVP8F6JH\Desktop\Study Stuff\Python Projects\CN_webserver_assign> []
```