

Introduction: Operating Environment

Programming Language: Python

Operating system: Windows or Mac

SSH client for Windows: <https://www.bitvise.com/ssh-client-download>

Github Repository Link: <https://github.com/mjensro/Online-Stock-Trading>

Youtube Link:

Running Instructions: How to Compile

- Download a secure shell application that will give you access to create a network communication protocol, such as the bitvise client. On Mac, you may use the default terminal.
- Sign into the following
 - Server Host: login.umd.umich.edu
 - Port: 22
- Authenticate with personal username and password
- Upload server and client files via SFTP window
- Open 2 new terminal windows and run the files by using the following commands:
 - For server: python Server.py (run first)
 - For client: python Client.py 127.0.0.1 (IP address)
- Wait for the client to connect to server
- Login using 'LOGIN "username" "password"

- **Default user accounts**

Username	Password
root	root01
mary	mary01
john	john01
moe	moe01

- **Default Stock Records**

- Stocks(ID, stock_symbol, stock_name, stock_balance, user_id)
 - VALUES(1, 'TSLA', 'Tesla', '50.00', 'root')
 - VALUES(2, 'AMZN', 'Amazon', '100.00', 'root')
 - VALUES(3, 'AMZN', 'Amazon', '100.00', 'mary')
 - VALUES(4, 'MSFT', 'Microsoft', '250.00', 'mary')
 - VALUES(5, 'MSFT', 'Microsoft', '250.00', 'john')
 - VALUES(6, 'MSFT', 'Microsoft', '250.00', 'moe')

- Try using the following:
WHO/LOOKUP/DEPOSIT/BUY/SELL/LIST/BALANCE/QUIT/SHUTDOWN/LOGOUT
commands

Student Roles: Commands Implemented

LOGIN - by Taylor Williams - Login the user to the remote server. A client that wants to login should begin by sending the ASCII string "LOGIN" followed by a space, followed by a UserID, followed by a space, followed by a Password, and followed by the newline character (i.e., '\n').

WHO- by Taylor Williams - List all active users, including the UserID and the user's IP addresses. A client sends the ASCII string "WHO" followed by the newline character (i.e., '\n'). This command is only allowed for the root user.

LOOKUP- by Taylor Williams - Look up a stock name in the list. Display the complete stock record for the logged in user. A client sends the ASCII string "LOOKUP" followed by a space, followed by a name followed by the newline character (i.e., '\n').

DEPOSIT- by Michelle Sroka - Deposit USD to the users account and update their total balance by just entering 'DEPOSIT' and then following it with the amount to update by

BUY- by Michelle Sroka - Buy a number of stocks after logging in. Enter the "BUY" command and let the prompts guide you through entering all other needed information (purchase price, amount, userID)

SELL- by Michelle Sroka - SELL an amount of stock after logging in. Enter "SELL" and let the prompts guide you through entering all other needed information (purchase price, amount, userID)

LIST- by Michelle Sroka - Displays all stock records within the Stocks table for the user currently logged in

BALANCE- by Michelle Sroka - Updated to shows balance for the user that is logged in

QUIT- by Taylor Williams - Upon the user entering 'QUIT' the client is terminated

SHUTDOWN - by Taylor Williams - closes down all sockets and connections, then terminates

LOGOUT- by Taylor Williams - Logout from the server. A client sends the ASCII string "LOGOUT" followed by a name followed by the newline character (i.e., '\n'). A user is not allowed to send BUY, SELL, LIST, BALANCE, and SHUTDOWN commands after logout, but it can still send the QUIT commands. This command should result in the server terminating the allocated socket and thread for this client.

Known Bugs

- When the authorized user runs the SHUTDOWN command, the client side of the program exits with no issues but the server and other clients do not, even though its coded to do so. The function's functionality was not changed from program 1 to program 2 so it could be a personal system error.

Test Case Table

Test #	Description of test	Input Value	Expected Output	Actual Output	Test Pass / Fail
1	LOGIN: test correct user/password	LOGIN john john1	200 OK	200 OK	pass
2	LOGIN: test invalid input	LOGIN root password	403 Wrong UserID or Password	403 Wrong UserID or Password	pass
2.5	LOGIN: with multiple users active	Client1: LOGIN root root01 Client2: LOGIN mary mary01	200 OK 200 OK	200 OK 200 OK	pass
3	LOGOUT: there are multiple clients active, one logs out successfully	Client1: LOGIN root root01 LOGOUT Client2: LOGIN mary mary01	200 OK 200 OK 200 OK	200 OK 200 OK 200 OK	pass

				
4	WHO: by client that is not the root user	LOGIN mary mary01 WHO	200 OK "Error! Only Root User is authorized to use command : 'WHO', try another command."	200 OK "Error! Only Root User is authorized to use command : 'WHO', try another command."	pass
5	WHO	LOGIN root root01 WHO	200 OK List of active users	200 OK List of active users	pass
6	LOOKUP: valid with multiple users running	LOGIN root root01 LOOKUP TSLA	200 OK FOUND MATCH Displays stock records for client matching the stock symbol entered	200 OK FOUND MATCH Displays stock records for client matching the stock symbol entered	pass
6.5	LOOKUP: invalid stock symbol with multiple users running	LOGIN root root01 LOOKUP NOSTOCK	200 OK 404 Your search did not match any records	200 OK 404 Your search did not match any records	pass
7	DEPOSIT	DEPOSIT 200 (logged in as mary)	Deposit successfully. New balance \$200	Deposit successfully. New balance \$200	pass
8	BUY 2 APPL stock	LOGIN root	Output: 200	Output: 200 OK	pass

	priced at \$2 logged into root user	root01 BUY APPL 2 2 1	OK BOUGHT:APPL PL New balance: 96.0	BOUGHT:APPL New balance: 96.0	
9	SELL previous 2 APPL stock priced at \$2 logged into root user	SELL APPL 2 2 1	Output: 200 OK SOLD: New balance:APP L USD Balance: \$0.0	Output: 200 OK SOLD: New balance:APPL USD Balance: \$0.0	pass
10	LIST: user logs in then runs list function	LOGIN mary mary01 LIST	200 OK 200 OK List of records in the stocks table for mary01	200 OK 200 OK List of records in the stocks table for mary01	pass
10.1	LIST: root user logs in and it displays all existing records regardless of username	LOGIN root root01 LIST	Output: 200 OK The list of records in the Stocks database for root: 1 TSLA Tesla 50.0 root 2 AMZN Amazon 100.0 root 3 MSFT Microsoft 250.0 mary	Output: 200 OK The list of records in the Stocks database for root: 1 TSLA Tesla 50.0 root 2 AMZN Amazon 100.0 root 3 MSFT Microsoft 250.0 mary	pass
11	Test functions of the program with more than one client active	Client1: LOGIN root root01 WHO Client2: LOGIN mary mary01	Program should be able to complete tasks successfully	Program completed tasks successfully	pass

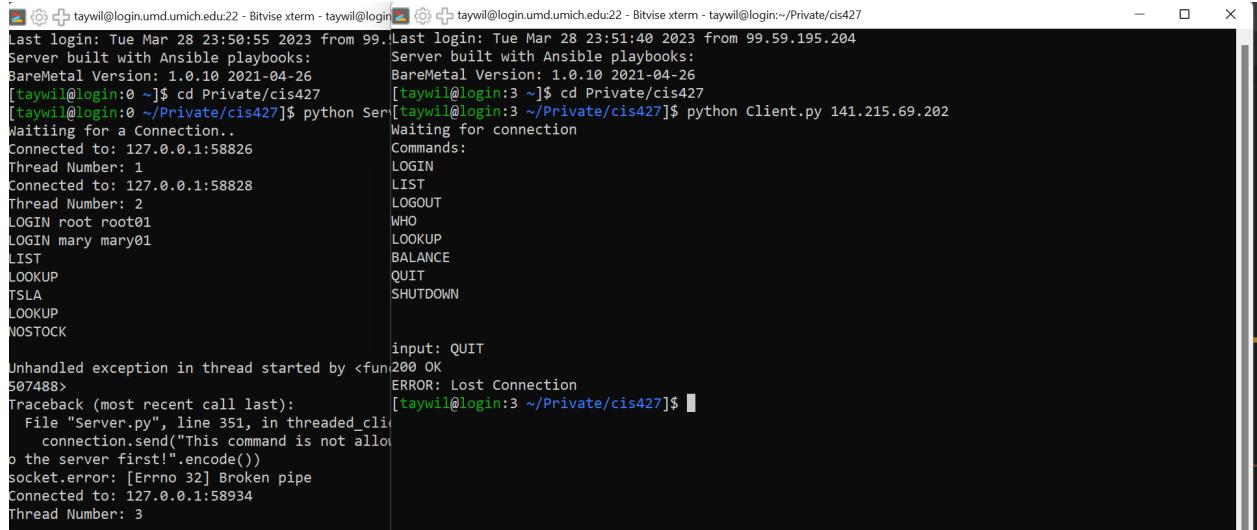
		LIST			
12	SHUTDOWN: shutdown is activated by root user	LOGIN root root01 SHUTDOWN	200 OK Then all clients and system exit	200 OK Then all clients and system exit	
13	SHUTDOWN: shutdown is attempted by non-root user, which is unallowed	LOGIN mary mary01 SHUTDOWN	200 OK Only root user is authorized to SHUTDOWN! Denied!	200 OK Only root user is authorized to SHUTDOWN! Denied!	
14	QUIT: user quits as soon as they open the program, no login	QUIT	200 OK ERROR: Lost Connection	200 OK ERROR: Lost Connection	pass
15	QUIT: user logs in then quits	LOGIN mary mary01 QUIT	200 OK ERROR: Lost Connection	200 OK ERROR: Lost Connection	pass
16	BALANCE: user logs then uses balance function with multiple clients running	LOGIN root root01 BALANCE	200 OK 200 OK Displays the client's current balance	200 OK 200 OK Displays the client's current balance	pass

Screenshots

Quit

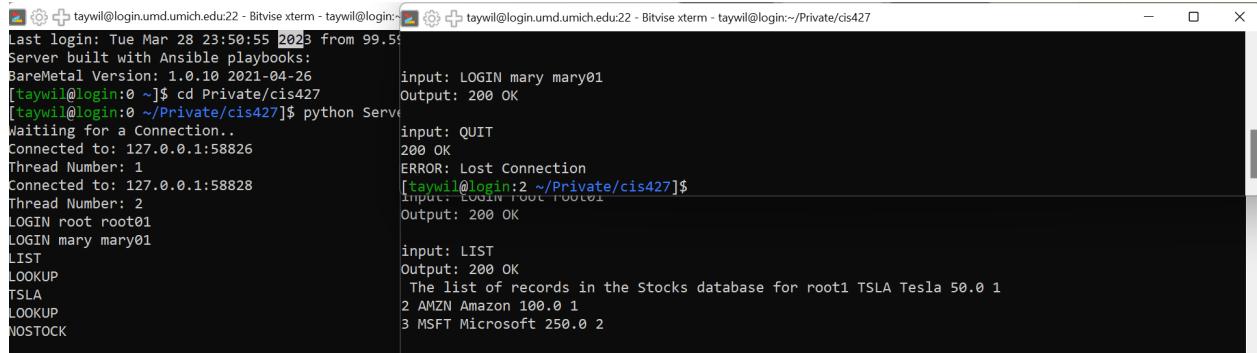
```
[taywil@login:7 ~/Private/cis427]$ python Client.py 127.0.0.1
127.0.0.1
input: QUIT
200 OK
lost connection to server
```

Test #14



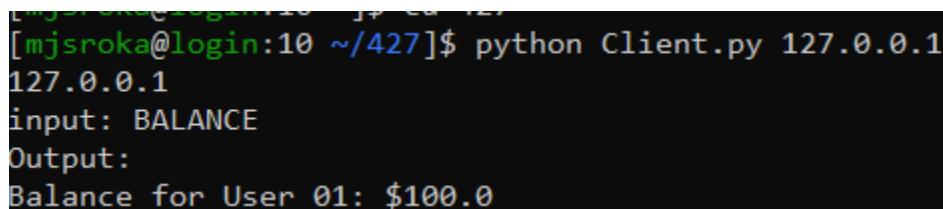
```
taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Last login: Tue Mar 28 23:50:55 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Client.py 141.215.69.202
Waiting for a Connection..
Connected to: 127.0.0.1:58826
Thread Number: 1
Connected to: 127.0.0.1:58828
Thread Number: 2
LOGIN root root01
LOGIN mary mary01
LIST
LOOKUP
TSLA
LOOKUP
NOSTOCK
input: QUIT
Unhandled exception in thread started by <fun>
507488: ERROR: Lost Connection
Traceback (most recent call last):
  File "Server.py", line 351, in threaded_client
    connection.send("This command is not allowed to the server first!".encode())
socket.error: [Errno 32] Broken pipe
Connected to: 127.0.0.1:58934
Thread Number: 3
```

Test #15



```
taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Last login: Tue Mar 28 23:50:55 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Client.py 141.215.69.202
Waiting for a Connection..
Connected to: 127.0.0.1:58826
Thread Number: 1
Connected to: 127.0.0.1:58828
Thread Number: 2
LOGIN root root01
LOGIN mary mary01
LIST
LOOKUP
TSLA
LOOKUP
NOSTOCK
input: BALANCE
Output: 200 OK
The list of records in the Stocks database for root1 TSLA Tesla 50.0 1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
```

BALANCE



```
[mjsroka@login:10 ~/427]$ python Client.py 127.0.0.1
127.0.0.1
input: BALANCE
Output:
Balance for User 01: $100.0
```

Test #16 (user logs in then uses balance function with multiple clients running)

```
[taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427] taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Last login: Sun Mar 26 23:22:19 [taywil@login:1 ~]$ cd Private/cis427
Server built with Ansible playb[...]
[taywil@login:1 ~/Private/cis427]$ python Client.py 1
BareMetal Version: 1.0.10 2021-04-26
Waiting for connection
[taywil@login:0 ~]$ cd Private/Commands:
[taywil@login:0 ~]$ LOGIN
[...]
Waiting for a Connection..
Connected to: 127.0.0.1:49012
Thread Number: 1
Connected to: 127.0.0.1:49014
Thread Number: 2
LOGIN root root01
LIST
LOGIN mary mary01
BALANCE
WHO
[...]
input: LOGIN root root01
Output: 200 OK

input: LIST
Output: 200 OK
The list of records in the Stocks database for root1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2

input: BALANCE
Output: 200 OK
Balance for User Root: $100.0

input: WHO
Output: 200 OK
The list of the active users:
root 127.0.0.1:49014root 127.0.0.1:49014mary 127.0
[...]
input: [taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427] taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Last login: Sun Mar 26 23:27:04 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:2 ~]$ cd Private/cis427
[taywil@login:2 ~/Private/cis427]$ python Client.py 141.215.69.2
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN
[...]
input: LOGIN mary mary01
Output: 200 OK

input: LIST
Output: 200 OK
The list of records in the Stocks database for mary1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2

input: [
```

LIST

Test #10

```
[taywil@login:2 ~/Private/cis427]$ python Client.py 141.215.69.202
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN mary mary01
Output: 200 OK

input: LIST
Output: 200 OK
The list of records in the Stocks database for mary1 TSLA Tesla 50.0 1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
```

LIST test with multiple users (root sees all records, mary only sees her own)

```
mjsroka@login:5 ~]$ python Client.py
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BUY
SELL
DEPOSIT
BALANCE
QUIT
SHUTDOWN

input: LOGIN root root01
Output: 200 OK

input: LIST
Output: 200 OK
The list of records in the Stocks database for root:
1 TSLA Tesla 50.0 root
2 AMZN Amazon 100.0 root
3 MSFT Microsoft 250.0 mary

input:

input: LOGIN mary mary01
Output: 200 OK

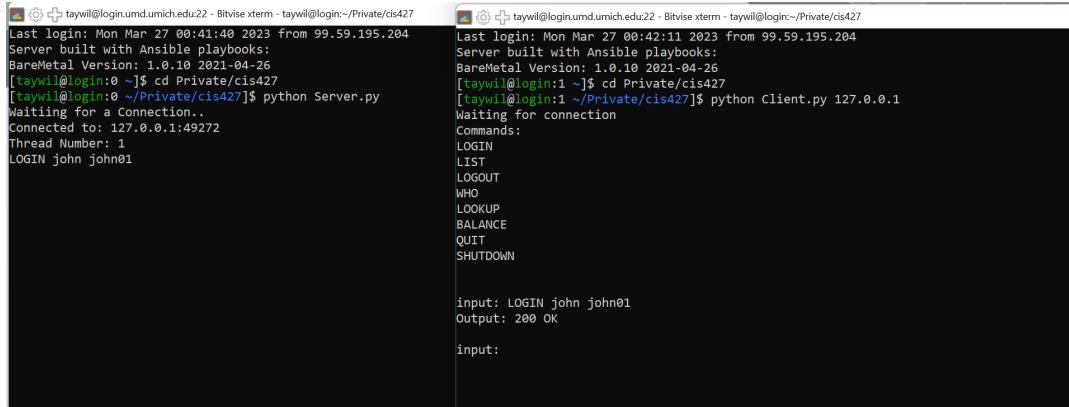
input: LIST
Output: 200 OK
The list of records in the Stocks database for mary:
1 TSLA Tesla 50.0 mary
```

```
[mjsroka@login:0 ~/427]$ python Client.py
input: LIST
Output: All records in the Stocks table:
1 TSLA Tesla 50.0 user1
2 AMZN Amazon 100.0 user1
3 MSFT Microsoft 250.0 user1

input: 
```

LOGIN

Test #1 (Server and client 1):



```

taywil@login:0 ~$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Waiting for a Connection..
Connected to: 127.0.0.1:49272
Thread Number: 1
LOGIN john john01

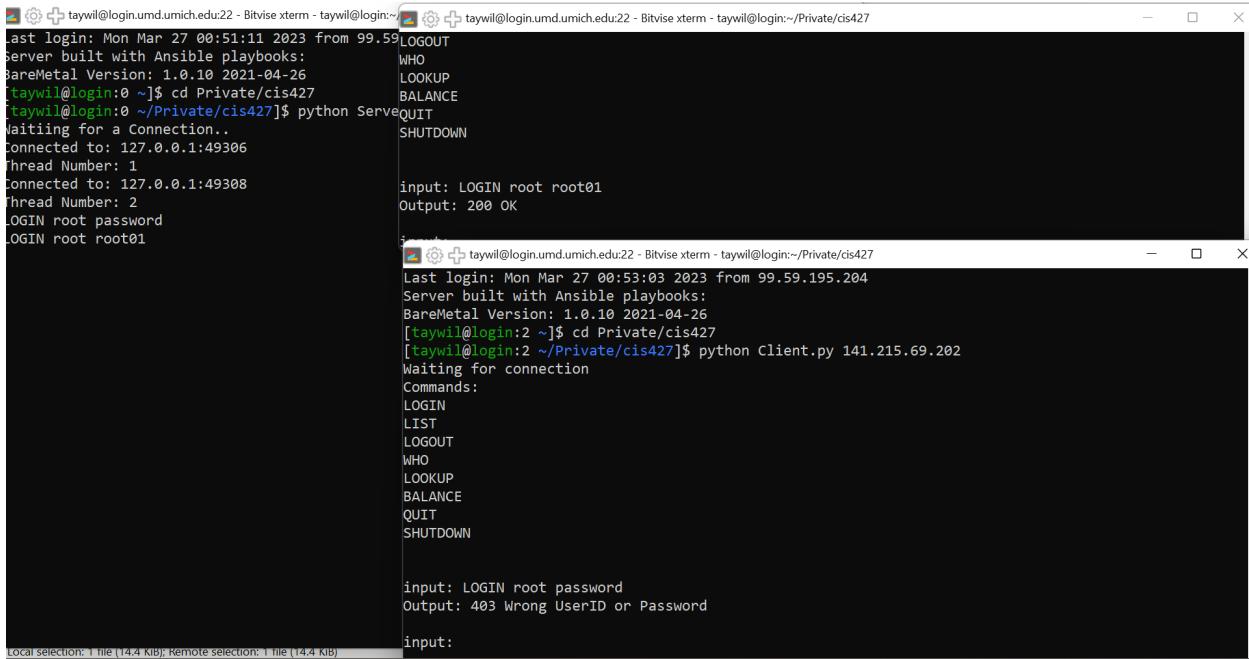
taywil@login:1 ~/Private/cis427$ python Client.py 127.0.0.1
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN john john01
Output: 200 OK

input:

```

Test #2 (Server and client 1):



```

taywil@login:0 ~$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Waiting for a Connection..
Connected to: 127.0.0.1:49306
Connected to: 127.0.0.1:49308
Thread Number: 1
Thread Number: 2
LOGIN root password
LOGIN root root01

taywil@login:1 ~/Private/cis427$ python Client.py 127.0.0.1
Waiting for connection
Commands:
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN root root01
Output: 200 OK

taywil@login:2 ~/Private/cis427$ python Client.py 127.0.0.1
Waiting for connection
Commands:
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN root password
Output: 403 Wrong UserID or Password

input:

```

Test #2.5 (multiple clients active in server):

```
taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Last login: Sun Mar 26 23:22:15 [taywil@login:1 ~]$ cd Private/cis427
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
Waiting for connection
[taywil@login:0 ~]$ cd Private/Commands:
[taywil@login:0 ~/Private/Commands]$ LOGIN
Waiting for a Connection...
Connected to: 127.0.0.1:49012
Thread Number: 1
Connected to: 127.0.0.1:49014
Thread Number: 2
LOGIN root root01
LIST
LOGIN mary mary01
LIST
BALANCE
WHO
input: LOGIN root root01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for root1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
input: BALANCE
Output: 200 OK
Balance for User Root: $100.0
input: WHO
Output: 200 OK
The list of the active users:
root 127.0.0.1:49014root 127.0.0.1:49014mary 127.0
input:
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:2 ~/Private/cis427]$ python Client.py 141.215.69.2
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN
input: LOGIN mary mary01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for mary1 TSLA Tesla
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
input: ■
```

WHO

Test #4 (unauthorized WHO)

```
[taywil@login:2 ~/Private/cis427]$ python Client.py 141.215.69.202
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

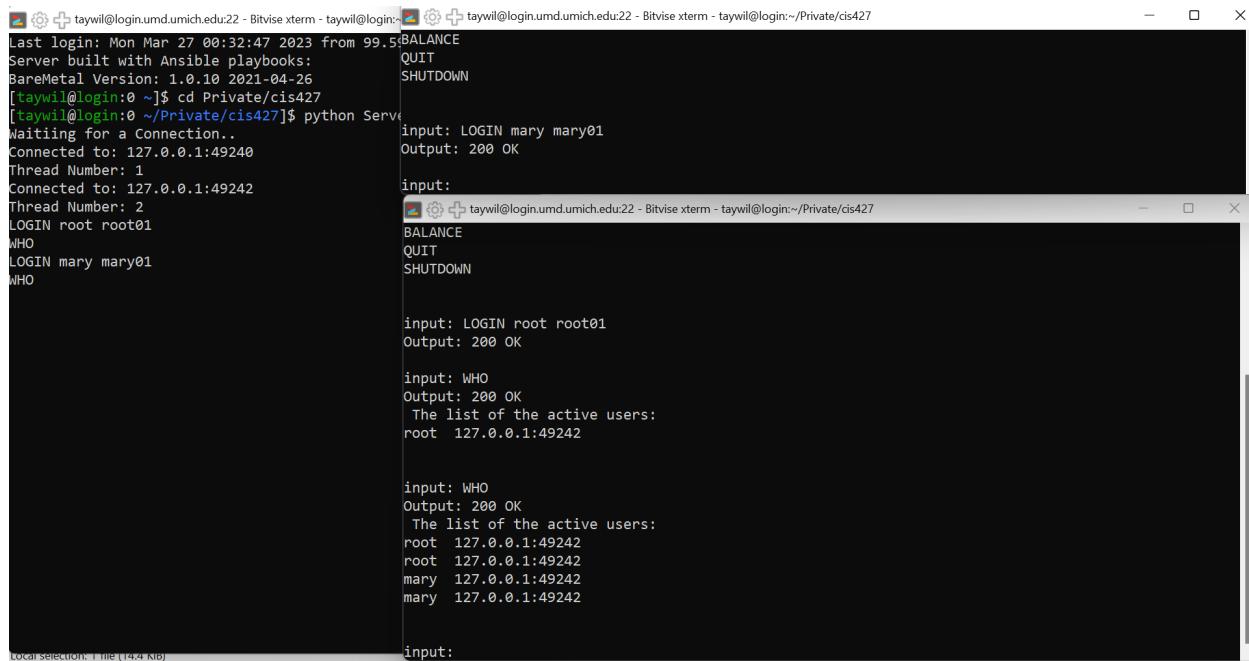
input: LOGIN mary mary01
Output: 200 OK

input: LIST
Output: 200 OK
The list of records in the Stocks database for mary1
1 TSLA Tesla 50.0 1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2

input: WHO
Output: Error! Only Root User is authorized to use command : 'WHO', try another command.

input: 
```

Test #5 (authorized WHO)



```
LAST login: Mon Mar 27 00:32:47 2023 from 99.58.128.1
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server
Waiting for a Connection...
Connected to: 127.0.0.1:49240
Thread Number: 1
Connected to: 127.0.0.1:49240
Thread Number: 2
LOGIN root root01
WHO
LOGIN mary mary01
WHO

input: LOGIN mary mary01
Output: 200 OK

input:
BALANCE
QUIT
SHUTDOWN

input: LOGIN root root01
Output: 200 OK

input: WHO
Output: 200 OK
The list of the active users:
root 127.0.0.1:49240
root 127.0.0.1:49240
mary 127.0.0.1:49240
mary 127.0.0.1:49240

input: WHO
Output: 200 OK
The list of the active users:
root 127.0.0.1:49240
root 127.0.0.1:49240
mary 127.0.0.1:49240
mary 127.0.0.1:49240

input:
```

BUY

```
input: LOGIN root root01
Output: 200 OK

input: BUY
Output:
Enter Stock Name

input: APPL
Output:
Enter Purchase Amount

input: 2
Output:
Enter Price

input: 2
Output:
Enter UserID

input: 1
Output: 200 OK
BOUGHT:APPL New balance: 96.0
```

SELL

```
input: SELL
Output: Enter Stock Name:

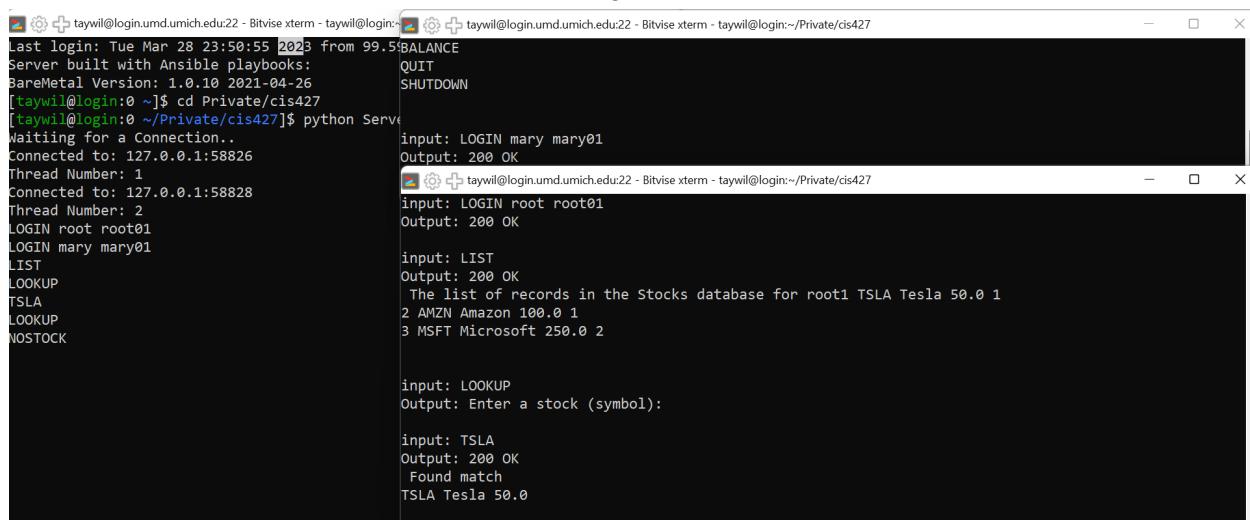
input: APPL
Output: Enter Sell Amount:

input: 2
Output: Enter Price:

input: 2
Output: 200 OK
SOLD: New balance:APPL USD Balance: $0.0
```

LOOKUP

test#6 (valid lookup with multiple clients running)



The screenshot shows two terminal windows. The left window is a server process (BareMetal Version 1.0.10) that handles multiple client connections. It shows a client named 'mary' logging in, listing stocks, and then performing a 'LOOKUP' on 'TSLA'. The right window is a client terminal where a user named 'root' is connected to the server. The user enters 'LOOKUP' and 'TSLA', and the server returns the correct stock record.

```
Last login: Tue Mar 28 23:50:55 2023 from 99.55.14.1
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[mary@root:0 ~]$ cd Private/cis427
[mary@root:0 ~/Private/cis427]$ python Server.py
Waiting for a Connection..
Connected to: 127.0.0.1:58826
Thread Number: 1
Connected to: 127.0.0.1:58828
Thread Number: 2
LOGIN root root01
LOGIN mary mary01
LIST
LOOKUP
TSLA
LOOKUP
NOSTOCK

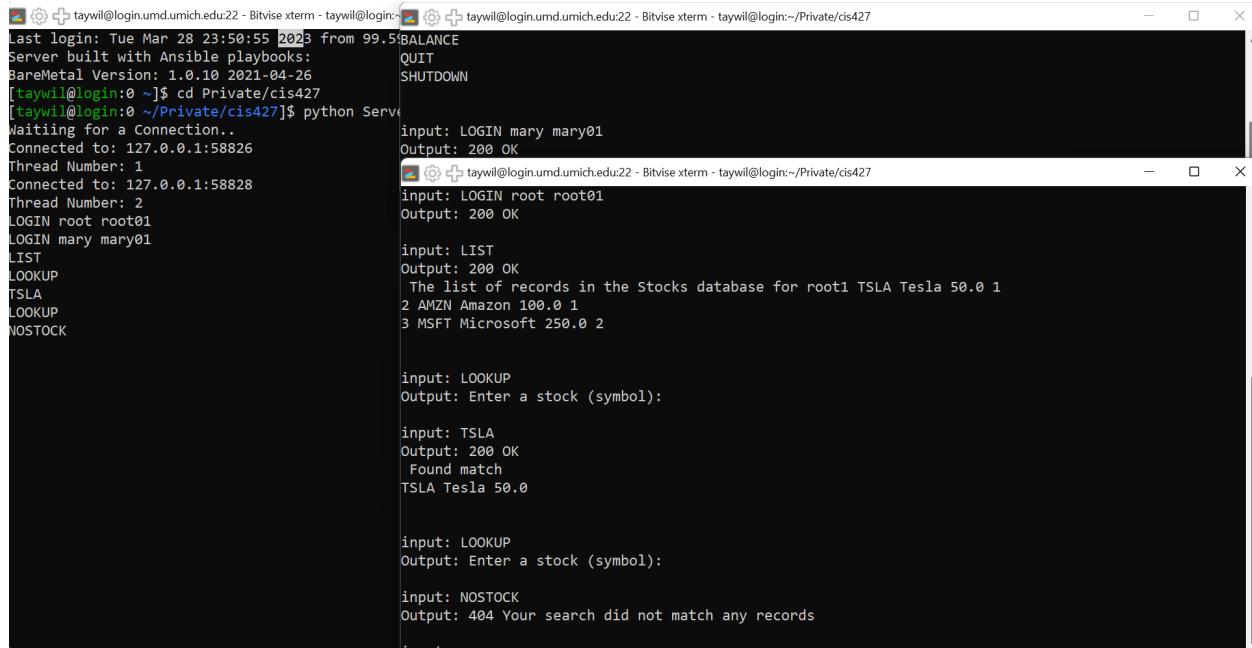
[mary@root:0 ~/Private/cis427]$ python Client.py
[mary@root:0 ~/Private/cis427]$
```

```
taywil@login:0 ~]$ cd Private/cis427
taywil@login:0 ~/Private/cis427]$ python Client.py
[mary@root:0 ~/Private/cis427]$
```

```
input: LOGIN mary mary01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for root1
1 TSLA Tesla 50.0
2 AMZN Amazon 100.0
3 MSFT Microsoft 250.0

input: LOOKUP
Output: Enter a stock (symbol):
input: TSLA
Output: 200 OK
Found match
TSLA Tesla 50.0
```

Test #6.5 (invalid stock symbol entered by client)



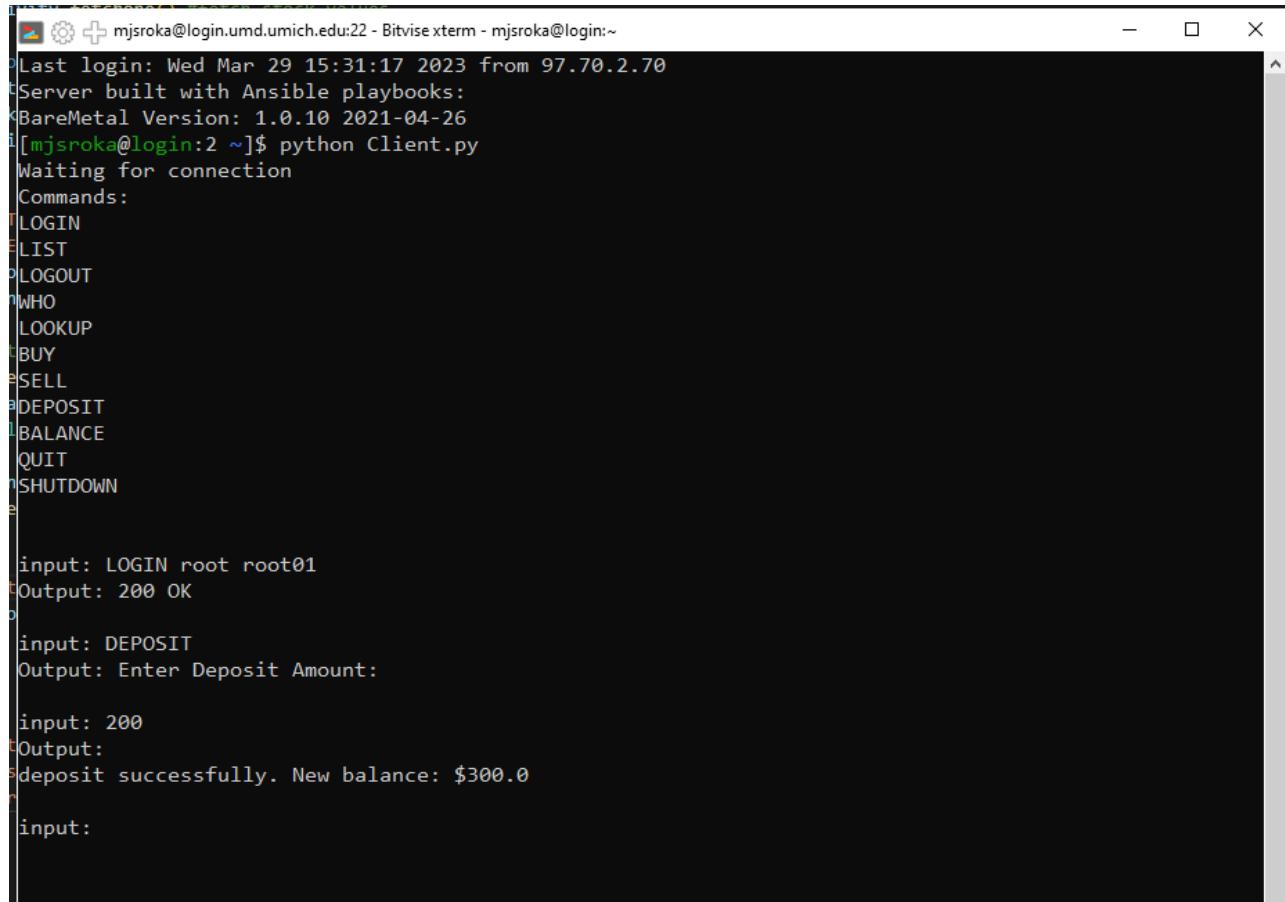
```
Last login: Tue Mar 28 23:50:55 2023 from 99.58.128.1
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server
Waiting for a Connection..
Connected to: 127.0.0.1:58826
Thread Number: 1
Connected to: 127.0.0.1:58828
Thread Number: 2
LOGIN root root01
LOGIN mary mary01
LIST
LOOKUP
TSLA
LOOKUP
NOSTOCK
[ taywil@login:0 ~/Private/cis427]$ python Client.py
[ taywil@login:0 ~/Private/cis427]$ QUIT
[ taywil@login:0 ~/Private/cis427]$ SHUTDOWN
[ taywil@login:0 ~/Private/cis427]$
```

```
taywil@login:0 ~]$ cd Private/cis427
taywil@login:0 ~/Private/cis427]$ python Server
input: LOGIN mary mary01
Output: 200 OK
input: LOGIN root root01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for root1
1 TSLA Tesla 50.0 1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2

input: LOOKUP
Output: Enter a stock (symbol):
input: TSLA
Output: 200 OK
Found match
TSLA Tesla 50.0

input: LOOKUP
Output: Enter a stock (symbol):
input: NOSTOCK
Output: 404 Your search did not match any records
```

DEPOSIT

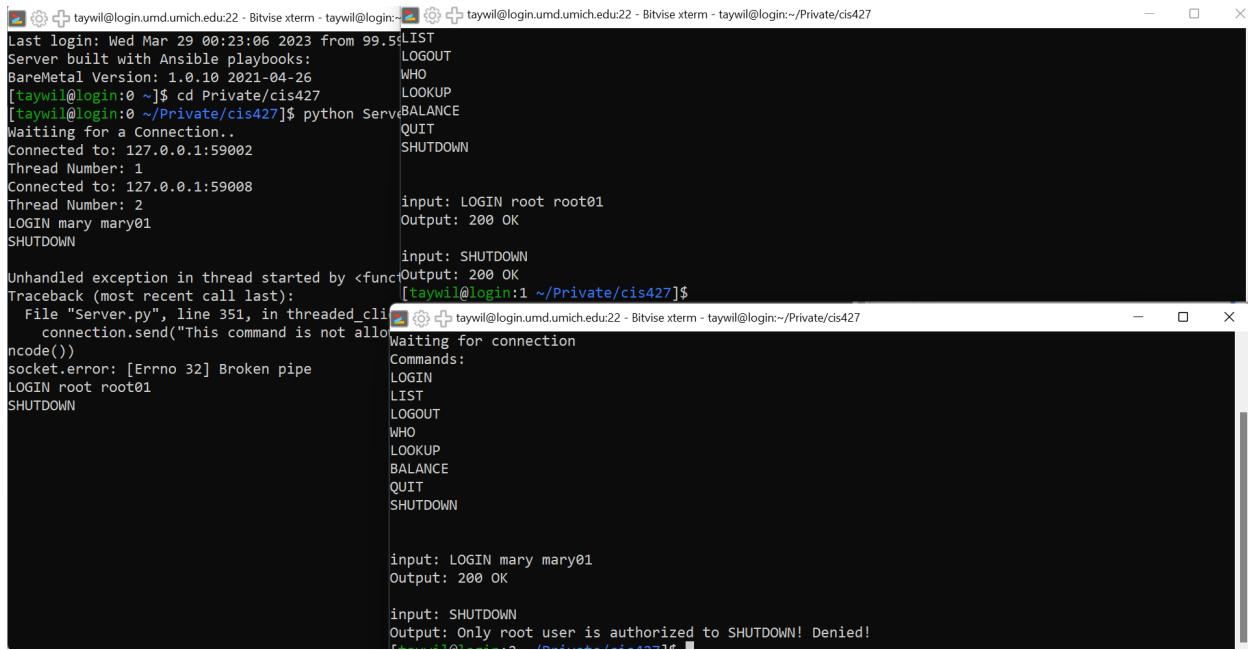


```
Last login: Wed Mar 29 15:31:17 2023 from 97.70.2.70
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[mjsroka@login:2 ~]$ python Client.py
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BUY
SELL
DEPOSIT
BALANCE
QUIT
SHUTDOWN
a

input: LOGIN root root01
Output: 200 OK
b
input: DEPOSIT
Output: Enter Deposit Amount:
input: 200
Output:
deposit successfully. New balance: $300.0
c
input:
```

SHUTDOWN

Test #13



```
taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Last login: Wed Mar 29 00:23:06 2023 from 99.51.12.1
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Waiting for a Connection..
Connected to: 127.0.0.1:59002
Thread Number: 1
Connected to: 127.0.0.1:59008
Thread Number: 2
LOGIN mary mary01
SHUTDOWN

Unhandled exception in thread started by <function _bootstrap_inner at 0x7f3a1a1a1a1a>:
Traceback (most recent call last):
  File "Server.py", line 351, in _bootstrap_inner
    connection.send("This command is not allowed for non-root user")
socket.error: [Errno 32] Broken pipe
LOGIN root root01
SHUTDOWN

input: LOGIN root root01
Output: 200 OK

input: SHUTDOWN
Output: 200 OK
[taywil@login:1 ~/Private/cis427]$
```

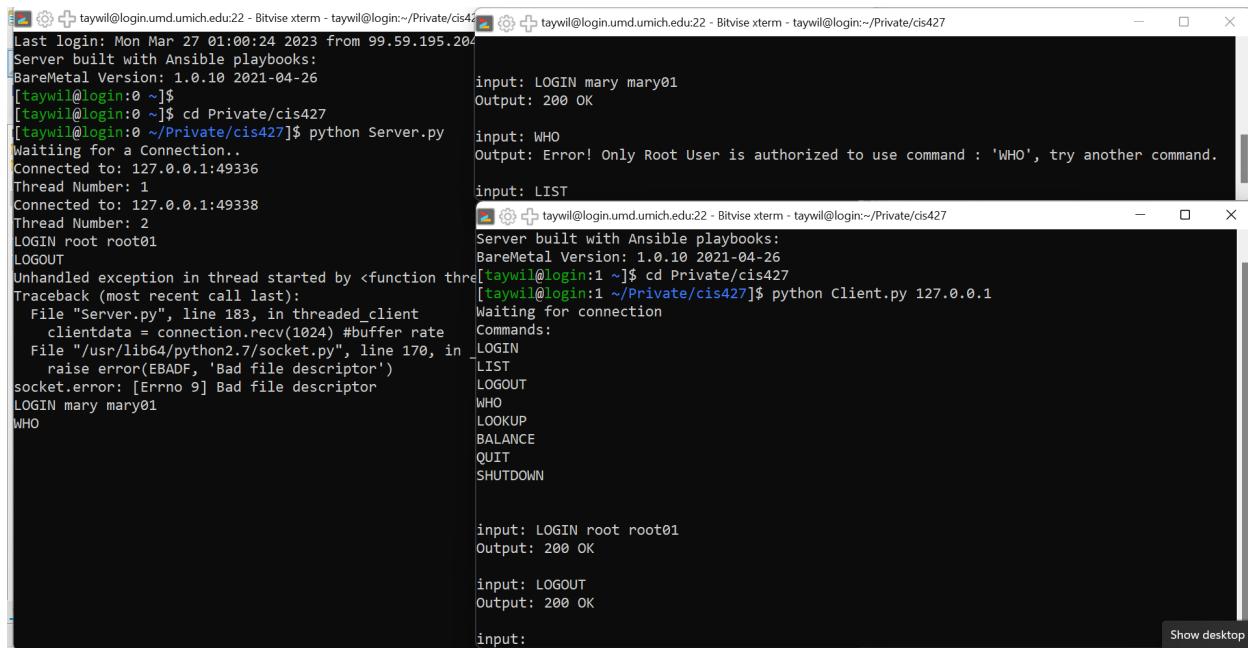
```
taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN mary mary01
Output: 200 OK

input: SHUTDOWN
Output: Only root user is authorized to SHUTDOWN! Denied!
[taywil@login:1 ~/Private/cis427]$
```

LOGOUT

Test # 3 (valid logout with multiple clients active)



```
taywil@login.umd.umich.edu:22 - Bitvise xterm - taywil@login:~/Private/cis427
Last login: Mon Mar 27 01:00:24 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ 
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:0 ~/Private/cis427]$ python Server.py
Waiting for a Connection..
Connected to: 127.0.0.1:49336
Thread Number: 1
Connected to: 127.0.0.1:49338
Thread Number: 2
LOGIN root root01
LOGOUT

Unhandled exception in thread started by <function _bootstrap_inner at 0x7f3a1a1a1a1a>:
Traceback (most recent call last):
  File "Server.py", line 183, in _bootstrap_inner
    clientdata = connection.recv(1024) #buffer rate
  File "/usr/lib64/python2.7/socket.py", line 170, in recv
    raise error(EBADF, 'Bad file descriptor')
socket.error: [Errno 9] Bad file descriptor
LOGIN mary mary01
WHO

input: LOGIN mary mary01
Output: 200 OK

input: WHO
Output: Error! Only Root User is authorized to use command : 'WHO', try another command.

input: LIST
[taywil@login:1 ~/Private/cis427]$ python Client.py 127.0.0.1
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:1 ~/Private/cis427]$ python Client.py 127.0.0.1
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN

input: LOGIN root root01
Output: 200 OK

input: LOGOUT
Output: 200 OK
input:
```

Multiple clients at once

Test #11

```
taywil@login:0 ~]$ cd Private/cis427
Last login: Sun Mar 26 23:22:16 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:0 ~]$ cd Private/cis427
[taywil@login:1 ~]$ python Client.py 141.215.69.2
Waiting for connection
Connected to: 127.0.0.1:49012
Thread Number: 1
Connected to: 127.0.0.1:49014
Thread Number: 2
LOGIN root root01
LIST
BALANCE
WHO
LOGIN mary mary01
LIST
BALANCE
WHO
input: LOGIN root root01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for root1
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
input: BALANCE
Output: 200 OK
Balance for User Root: $100.0
input: WHO
Output: 200 OK
The list of the active users:
root 127.0.0.1:49014root 127.0.0.1:49014mary 127.0
input:
[taywil@login:1 ~]$ cd Private/cis427
Last login: Sun Mar 26 23:27:04 2023 from 99.59.195.204
Server built with Ansible playbooks:
BareMetal Version: 1.0.10 2021-04-26
[taywil@login:2 ~]$ cd Private/cis427
[taywil@login:2 ~]$ python Client.py 141.215.69.2
Waiting for connection
Commands:
LOGIN
LIST
LOGOUT
WHO
LOOKUP
BALANCE
QUIT
SHUTDOWN
input: LOGIN mary mary01
Output: 200 OK
input: LIST
Output: 200 OK
The list of records in the Stocks database for mary1 TSLA Tesla
2 AMZN Amazon 100.0 1
3 MSFT Microsoft 250.0 2
input: ■
```