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Week 2

Exercise 2

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C
tfolio-networks-module/week-2/exercise 2.py"
Python is an easy-to-learn programming language
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 3

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData
tfolio-networks-module/week-2/exercise 3.py"
enter a number to be checked 5
your number is positive
Enter a word: hello
Your word starts with a consonant!
Enter the first number: 12
Enter the second number: 24
The numbers are not equal.
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 4

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/Microsoft/WindowsApps/python3.13.exe "c:/Use
tfolio-networks-module/week-2/exercise 4.py"
1
2
3
4
5
6
7
8
9
10
2
4
6
8
10
0
1
1
2
3
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 5

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/Microsoft/WindowsAp
tfolio-networks-module/week-2/exercise 5.py"
Sum: 12
Largest number: 15
Number of vowels: 3
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 6

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-2/exercise 6.py"
Enter password: cherry44_
Password must contain at least one uppercase letter.
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-2/exercise 6.py"
Enter password: Cherry44_
Password is strong
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 7

Encrypt

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moh
tfolio-networks-module/week-2/exercise 7.py"
Enter message: hello there
Enter key (number of positions): 4
Enter mode (encrypt/decrypt): encrypt
Output: lipps xlivi
```

Decrypt

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Lo
tfolio-networks-module/week-2/exercise 7.py"
Enter message: lipps xlivi
Enter key (number of positions): 4
Enter mode (encrypt/decrypt): decrypt
Output: hello there
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 8

```
j _ _ _ _ _ _ _ _ _

Guess a letter: avascript
Please enter a single alphabet letter.

Guess a letter: a
Correct!

j a _ a _ _ _ _ _ _

Guess a letter: v
Correct!

j a v a _ _ _ _ _ _

Guess a letter: s
Correct!

j a v a s _ _ _ _ _

Guess a letter: c
Correct!

j a v a s c _ _ _ _

Guess a letter: r
Correct!

j a v a s c r _ _ _

Guess a letter: p
Correct!

j a v a s c r _ p _

Guess a letter: t
Correct!

j a v a s c r _ p t

Guess a letter: i
Correct!

j a v a s c r i p t

Congratulations, you guessed the word "javascript"!
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Week 3

Exercise 1

```
google.com: 142.250.200.14
facebook.com: 157.240.214.35
twitter.com: 162.159.140.229
```

Exercise 2/3

Trace route for facebook

```
Tracing route to facebook.com [157.240.214.35]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dsldevice.lan [192.168.1.1]
  2     5 ms     4 ms     5 ms  81.1.113.33
  3     5 ms     5 ms     5 ms  ae50-ner002.thw.as13285.net [78.144.1.3]
  4     5 ms     6 ms     5 ms  ae50-scr102.thw.as13285.net [78.144.1.2]
  5     5 ms     8 ms     6 ms  ae6.pr04.lhr3.tfbnw.net [157.240.68.54]
  6     5 ms     5 ms     5 ms  po141.asw02.lhr3.tfbnw.net [129.134.45.58]
  7     5 ms     5 ms     5 ms  psw02.lhr8.tfbnw.net [129.134.57.128]
  8     8 ms     8 ms     7 ms  msw1ah.02.lhr8.tfbnw.net [129.134.94.36]
  9     6 ms     6 ms     6 ms  edge-star-mini-shv-02-lhr8.facebook.com [157.240.214.35]

Trace complete.
```

Trace route for youtube.com

```
Enter the website or IP address: youtube.com

Tracing route to youtube.com [216.58.212.206]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dsldevice.lan [192.168.1.1]
  2     7 ms     5 ms     8 ms  81.1.113.33
  3    16 ms     9 ms    11 ms  ae50-ner002.thw.as13285.net [78.144.1.3]
  4     6 ms     5 ms     5 ms  ae50-scr102.thw.as13285.net [78.144.1.2]
  5     7 ms     8 ms     7 ms  74.125.51.108
  6     5 ms     5 ms     5 ms  209.85.253.95
  7     6 ms     6 ms     6 ms  209.85.248.241
  8     6 ms     6 ms     6 ms  ams16s21-in-f14.1e100.net [216.58.212.206]

Trace complete.
```

,

Trace route for discord.com

```
Tracing route to discord.com [162.159.137.232]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dsldevice.lan [192.168.1.1]
  2     6 ms     5 ms     5 ms  81.1.113.33
  3     6 ms     6 ms     5 ms  ae50-ner002.thw.as13285.net [78.144.1.3]
  4     6 ms     6 ms     5 ms  ae50-scr102.thw.as13285.net [78.144.1.2]
  5    20 ms    21 ms    11 ms  ae60-scr101.thw.as13285.net [78.144.1.110]
  6     7 ms     8 ms     7 ms  host-78-144-3-181.as13285.net [78.144.3.181]
  7     7 ms     7 ms     7 ms  141.101.71.139
  8     7 ms     7 ms     7 ms  162.159.137.232

Trace complete.
```

Exercise 4:

Facebook's traceroute showed a total of 9 hops compared to the other routes that took 8, this could be due to the location of Facebook server which could be further away or may require a different path. However, we see no anomalies in terms of hop times as they all stay within a respectable region

On the 3rd hop for YouTube traceroute we see an extensively long hop indicating a bottleneck or some other type of inefficiency

On the 5th hop to discord.com, the hop took 20ms which is comparatively higher than the other hops indicating there may be a bottleneck or congestion hindering the speed of the hop

Exercise 5:

Below I have run traceroutes at home connected to my standard home wifi, the second screenshot shows me running a traceroute through my university wifi, when running the traceroute through the university wifi, we receive timeouts for every hop but the last one, this could be due to the security measures emplaced by the university to prevent malicious activities such as DNS attacks.

```
Tracing route to facebook.com [157.240.214.35]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  dsldevice.lan [192.168.1.1]
  2     6 ms     9 ms    10 ms  81.1.113.33
  3    33 ms    29 ms    35 ms  ae50-ner002.thw.as13285.net [78.144.1.3]
  4     5 ms     5 ms     5 ms  ae50-scr102.thw.as13285.net [78.144.1.2]
  5     6 ms     6 ms     6 ms  ae6.pr04.lhr3.tfbnw.net [157.240.68.54]
  6     6 ms     5 ms     6 ms  po141.asw02.lhr3.tfbnw.net [129.134.45.58]
  7     5 ms     5 ms     5 ms  psw02.lhr8.tfbnw.net [129.134.57.128]
  8     9 ms     9 ms     7 ms  msw1ah.02.lhr8.tfbnw.net [129.134.94.36]
  9     6 ms     6 ms     6 ms  edge-star-mini-shv-02-lhr8.facebook.com [157.240.214.35]

Trace complete.
```

```
Tracing route to facebook.com [157.240.221.35]
over a maximum of 30 hops:


  1     *        *        *     Request timed out.
  2     *        *        *     Request timed out.
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9     *        *        *     Request timed out.
 10     *        *        *     Request timed out.
 11    18 ms    58 ms    99 ms  edge-star-mini-shv-01-lhr8.facebook.com [157.240.221.35]

Trace complete.
```

WEEK 4

Exercise 1:

Server

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/User
tfolio-networks-module/week-4/exercise 1 server.py"
UDP Server is ready to receive messages...
Received message from ('127.0.0.1', 54852): hello
Reply: hi there
```

Client

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-netv
tfolio-networks-module/week-4/exercise 1 client.py"
You: hello
Server: hi there
You:
```

Exercise 2:

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-mod
tfolio-networks-module/week-4/exercise 2 server.py"
UDP Server is ready to receive messages...
New user connected from 127.0.0.1. Please enter a username: yameen0001
User yameen0001 (IP: 127.0.0.1) sent: hello
Reply: how you doing
User yameen0001 (IP: 127.0.0.1) sent: i am doing swell
Reply:
```

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfol
tfolio-networks-module/week-4/exercise 2 client.py"
You: hello
Server: how you doing
You: i am doing swell
```

Exercise 3

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/
tfolio-networks-module/week-4/exercise 3 client.py"
Enter username: user1
Enter password: password123
Authentication successful! You can now start chatting.
You: hello
You:
```

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Use
tfolio-networks-module/week-4/exercise 3 server.py"
UDP Server waiting for authentication...
Authentication successful for user1 from ('127.0.0.1', 57135)
Now entering chat mode...
Received from ('127.0.0.1', 57135): hello
```

Exercise 4

In this exercise 2 clients messaged the server and their messages were encrypted and decrypted in the server

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/A
tfolio-networks-module/week-4/exercise 4 server.py"
UDP Server is ready to receive encrypted messages...
Decrypted message from ('127.0.0.1', 64602): hello
Decrypted message from ('127.0.0.1', 64602): this message is encrypted
Decrypted message from ('127.0.0.1', 50061): hellooo
```

Exercise 5/6:

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/Microsoft/WindowsApps/
tfolio-networks-module/week-4/exercise 5 server.py"
UDP Server listening on port 65433...
Received from ('127.0.0.1', 61863) : University Temp: 12.6°C, British Library Temp: 12.6°C. Both locations have the same temperature.
```

Week 5

Exercise 1

Server Listening

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
2/Networks and OS/E-portfolio-networks-module/week-5/exercise 1 server.py"
TCP Server is listening...
Connected to ('127.0.0.1', 52982)
Received: hello
```

Client sends message and also calculating the time taken taking 0.001664 seconds

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module\week-5> & C:/Users/moham/App
al/Microsoft/WindowsApps/python3.13.exe "c:/Users/moham/University/Year 2/Networks and OS/E-portfolio-networ
e/week-5/exercise 1 client.py"
Enter message: hello
Server response: ACK: hello
Time taken to send data: 0.001664 seconds
```

Exercise 2

UDP Server

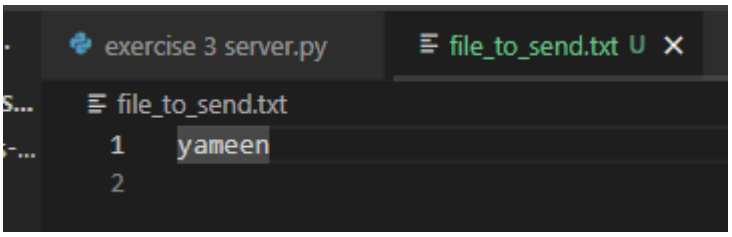
```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-n
m/University/Year 2/Networks and OS/E-portfolio-networks-module/w
UDP Server is listening on port 65433...
Received from ('127.0.0.1', 60770): hello test
```

Client sends message and also calculating the time taken taking 0.008017 seconds

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module\week-5> & C:/Users/moham/A
al/Microsoft/WindowsApps/python3.13.exe "c:/Users/moham/University/Year 2/Networks and OS/E-portfolio-netw
e/week-5/exercise 2 client.py"
Enter message: hello test
Server response: ACK: hello test
Time taken to send data using UDP: 0.008017 seconds
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module\week-5>
```

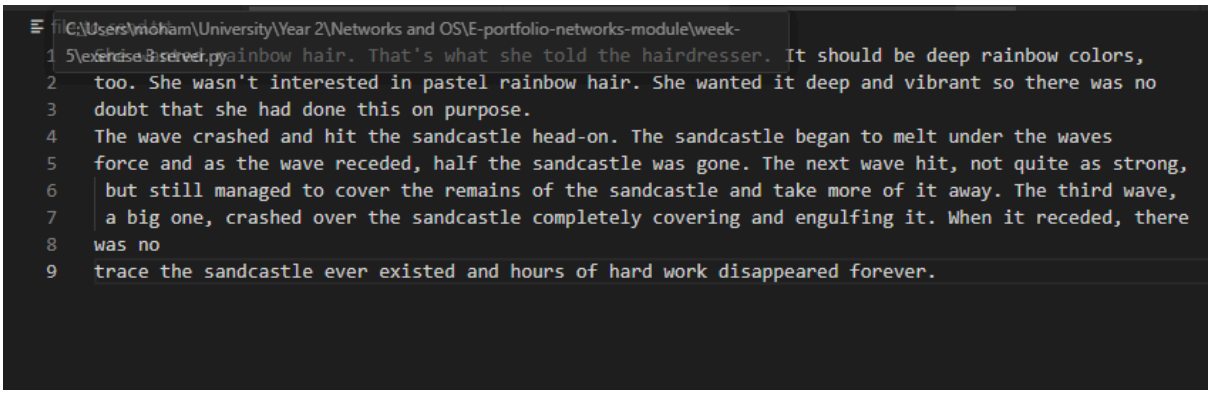
Exercise 3

The word yameen was sent and took 0.000793 seconds




```
File data sent to the server taking 0.000793 seconds
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

The paragraph below was sent and took 0.025408 seconds which makes sense as the content is more compared to a single word therefore requiring less time to be sent

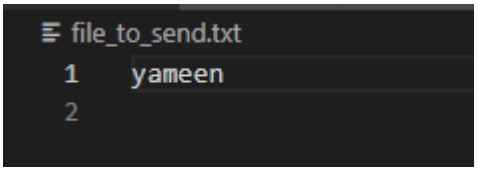


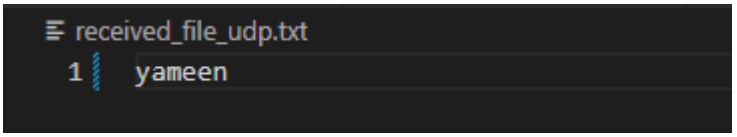

```
ercise 3 client.py"
File data sent to the server taking 0.025408 seconds
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 4

The word yameen was sent and took 0.001031 seconds

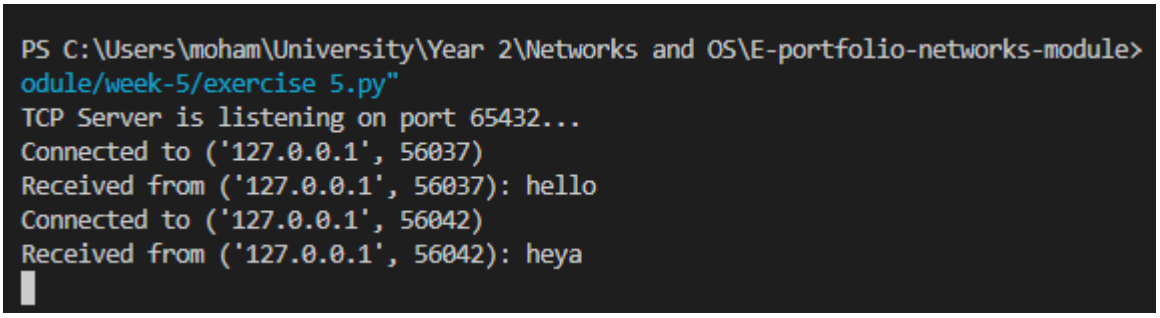
```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users
odule/week-5/exercise 4 client.py"
File 'file_to_send_udp.txt' sent in 0.001031 seconds.
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```





Exercise 5

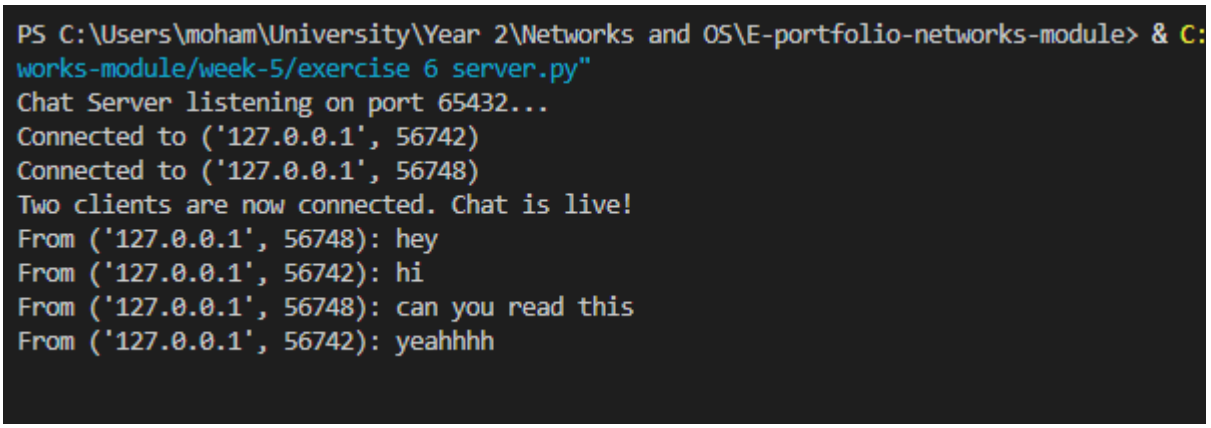
The screenshot below shows a TCP server receiving messages from 2 client, each using a unique port (56037 and 56042). Upon accepting each connection, the server prints “Connected to …” and then waits for data. When the clients send “hello” and “heya,” the server receives these messages and displays them, evidentthat it can handle multiple concurrent connections.



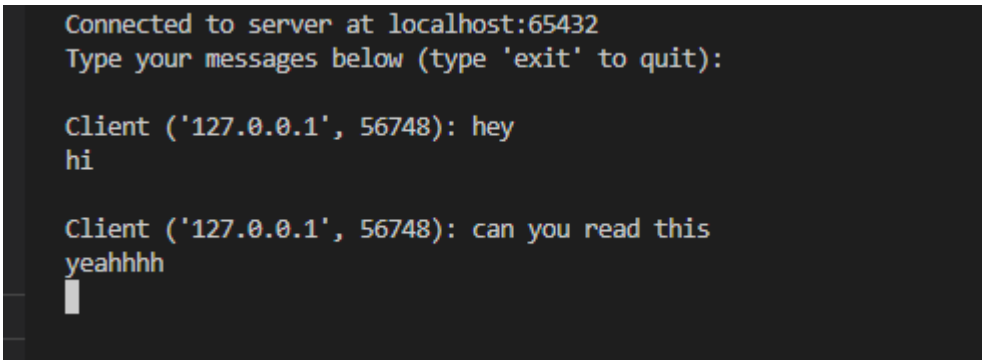
Exercise 6

The first screenshot shows two clients successfully connected to the server on port 65432. Each client's terminal displays the messages sent by the other, along with the sender's address. Meanwhile, the server terminal confirms that two clients have joined and prints the messages it relays, labeled by the respective client addresses. This output confirms that the chat application is functioning correctly, allowing both clients to exchange messages in real-time.

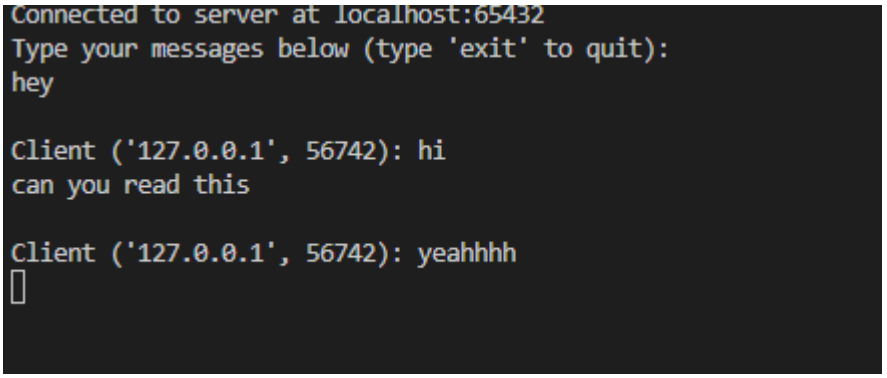
Server



Client 1



Client 2



Exercise 7
Server

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-m
o-networks-module/week-5/exercise 7 server.py"
Chat Server listening on port 65432...
Connected to ('127.0.0.1', 64495)
Connected to ('127.0.0.1', 64501)
Two clients are now connected. Chat is live!
From ('127.0.0.1', 64501): hello
From ('127.0.0.1', 64495): hello
From ('127.0.0.1', 64495): how you doing
From ('127.0.0.1', 64501): im good, this an ecrypyed message lets gooo
```

Client 1

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> &
o-networks-module/week-5/exercise 7 client 1.py"
Connected to server at localhost:65432
Type your messages below (type 'exit' to quit):

Client ('127.0.0.1', 64501): hello
hello
how you doing

Client ('127.0.0.1', 64501): im good, this an ecrypyed message lets gooo
```

Client 2

```
ta/Local/Microsoft/WindowsApps/python3.13.exe "c:/U
tworks-module/week-5/exercise 7 client 2.py"
Connected to server at localhost:65432
Type your messages below (type 'exit' to quit):
hello

Client ('127.0.0.1', 64495): hello

Client ('127.0.0.1', 64495): how you doing
im good, this an ecrypyed message lets gooo
```

Week 6

Exercise 1

the IP 192.168.1.1/32, shows that the network, broadcast address, and usable IP are all the same (192.168.1.1). This is because a /32 subnet is just for one IP address, usually to refer to a single device.Therefore, there are no other usable addresses, which is why it shows -1 for usable hosts.

But when the IP is 192.168.1.1/24, the output gives a network range, with usable addresses from 192.168.1.1 to 192.168.1.254. This is because a /24 subnet includes 254 possible addresses for devices in the network.
So the main difference is that /32 only allows one IP address, while /24 allows many more addresses for devices.

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/U
o-networks-module/week-6/exercise 1.py"
Address: 192.168.1.1
Network: 192.168.1.0/24
Netmask: 255.255.255.0
Is private: True
Is global: False
Broadcast Address: 192.168.1.255
First Usable IP: 192.168.1.1
Last Usable IP: 192.168.1.254
Number of usable hosts: 254
```

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/
o-networks-module/week-6/exercise 1.py"
Address: 192.168.1.1
Network: 192.168.1.1/32
Netmask: 255.255.255.255
Is private: True
Is global: False
Broadcast Address: 192.168.1.1
First Usable IP: 192.168.1.1
Last Usable IP: 192.168.1.1
Number of usable hosts: -1

Hosts in network:
192.168.1.1
```

Exercise 2

Below you can see my laptop name IP and also my network information.

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:
o-networks-module/week-6/exercise 2.py"
Your Computer Name is: Yoga_Pro_7
Your Computer IP Address is: 192.168.1.104
Address: 192.168.1.104
Network: 192.168.1.104/32
Netmask: 255.255.255.255
Is private: True
Is global: False
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 3

Below is the network information of gold.ac.uk, the most notable difference is that my ip was private whereas goldsmiths network is public. This is also signified in the ip due it starting with a 159

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:
o-networks-module/week-6/exercise 3.py"
Address: 159.100.136.66
Network: 159.100.136.66/32
Netmask: 255.255.255.255
Is private: False
Is global: True
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Exercise 4

1. Engineering Department (30 Hosts)

- Subnet: 172.16.0.0/27
    - Subnet Mask: 255.255.255.224
    - Total IPs: 32 (30 usable, 2 reserved for network and broadcast)
    - Usable Hosts: 30 hosts
    - Network Range: 172.16.0.0 - 172.16.0.31
    - Usable IPs: 172.16.0.1 - 172.16.0.30

2. Marketing Department (15 Hosts)

Since Marketing needs 15 hosts, we need to adjust the subnet mask to a /27 (which gives 30 usable addresses). Or else we would have 14 hosts if we downgrade

- Subnet: 172.16.0.32/27
    - Subnet Mask: 255.255.255.224
    - Usable Hosts: 30 hosts
    - Network Range: 172.16.0.32 - 172.16.0.63
    - Usable IPs: 172.16.0.33 - 172.16.0.62

3. Finance Department (10 Hosts)

- Subnet: 172.16.0.64/28
    - Subnet Mask: 255.255.255.240
    - Total IPs: 16 (14 usable, 2 reserved for network and broadcast)
    - Usable Hosts: 14 hosts
    - Network Range: 172.16.0.64 - 172.16.0.79
    - Usable IPs: 172.16.0.65 - 172.16.0.78

4. HR Department (5 Hosts)

- Subnet: 172.16.0.80/29
    - Subnet Mask: 255.255.255.248
    - Total IPs: 8 (6 usable, 2 reserved for network and broadcast)
    - Usable Hosts: 6 hosts
    - Network Range: 172.16.0.80 - 172.16.0.87
    - Usable IPs: 172.16.0.81 - 172.16.0.86

Exercise 5:

1. Client Sent: DHCP Discover: The client sends a DHCP Discover message to the DHCP server to request an IP address.
2. Server Responds: DHCP Offer: The server responds with a DHCP Offer message containing an available IP address (192.168.1.100, 192.168.1.101, or 192.168.1.102).
3. Client Sent: DHCP Request: The client then sends a DHCP Request message to the server, indicating the IP address it wants to use.
4. Server Acknowledges: DHCP Ack: The server acknowledges the request by sending a DHCP Ack message with the assigned IP address.
5. Client Receives "No IPs Available": After several requests, the client receives a message stating that no IPs are available from the server, indicating that the IP pool is exhausted.

Client

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-6/exercise 5 client.py"
client: Sent: DHCP Discover
client: Received: DHCPOffer 192.168.1.100
client: Sent: DHCP Request 192.168.1.100
client: Received: DHCPAck 192.168.1.100
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-6/exercise 5 client.py"
client: Sent: DHCP Discover
client: Received: DHCPOffer 192.168.1.101
client: Sent: DHCP Request 192.168.1.101
client: Received: DHCPAck 192.168.1.101
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-6/exercise 5 client.py"
client: Sent: DHCP Discover
client: Received: DHCPOffer 192.168.1.102
client: Sent: DHCP Request 192.168.1.102
client: Received: DHCPAck 192.168.1.102
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/
tfolio-networks-module/week-6/exercise 5 client.py"
client: Sent: DHCP Discover
client: Received: No IPs available
client: No offer received.
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

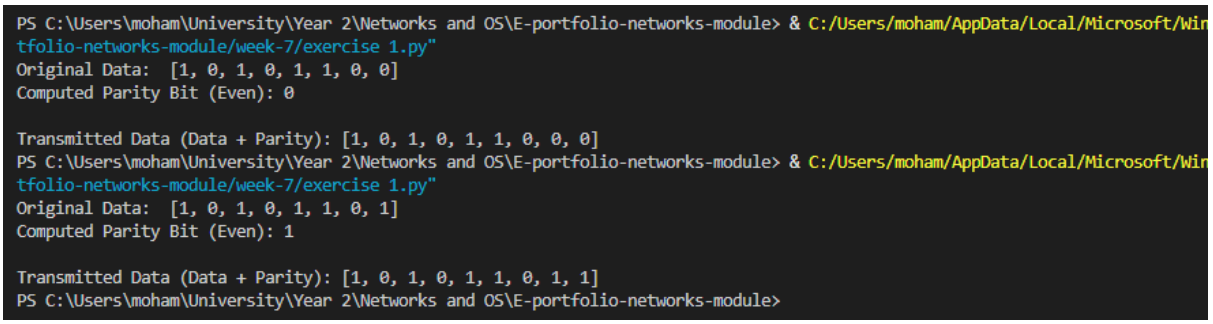
server

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/Users/moham/AppData/Local/M
rks-module/week-6/exercise 5 server.py"
server: Waiting for client connection...
server: Client connected from ('127.0.0.1', 56825)
server: Received: DHCP Discover
server: Offered IP: 192.168.1.100
server: Received: DHCP Request 192.168.1.100
server: IP 192.168.1.100 acknowledged and leased.
server: Client connected from ('127.0.0.1', 56827)
server: Received: DHCP Discover
server: Offered IP: 192.168.1.101
server: Received: DHCP Request 192.168.1.101
server: IP 192.168.1.101 acknowledged and leased.
server: Client connected from ('127.0.0.1', 56828)
server: Received: DHCP Discover
server: Offered IP: 192.168.1.102
server: Received: DHCP Request 192.168.1.102
server: IP 192.168.1.102 acknowledged and leased.
server: Client connected from ('127.0.0.1', 56833)
server: Received: DHCP Discover
server: No IPs available!
```

Week 7

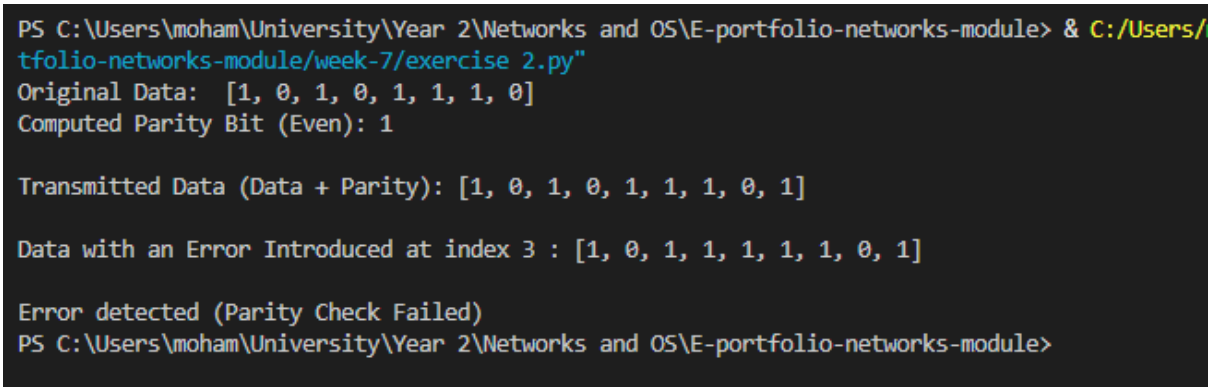
Exercise 1

As you can see I have 2 outputs, one with the given data and the second one where i changed the last digit to a 1, this change is shown in the terminal where the parity bit even is showing “1” meaning there is an odd number of 1s



Exercise 2:

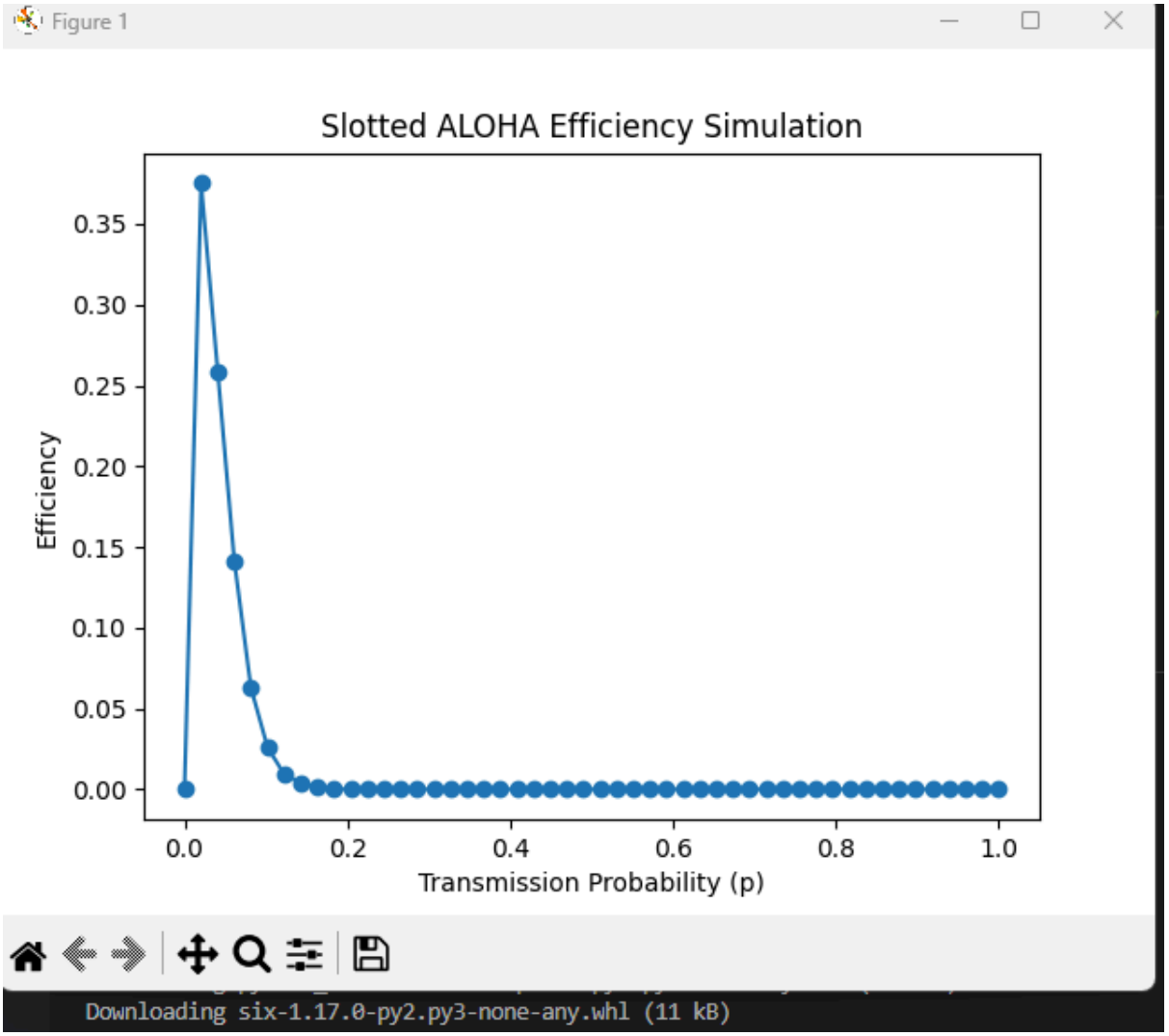
As you can see we introduced an error by flipping a bit in the transmitted data specifically index 3 causing an error to flag up due to the parity check failing



2D pasty check

```
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module> & C:/User
tfolio-networks-module/week-7/2D pasty check.py"
Original Data:
 [[1 0 1 1]
 [0 1 0 0]
 [1 1 1 0]
 [0 0 1 1]]
Row Parity: [1 1 1 0]
Column Parity: [0 0 1 0]
PS C:\Users\moham\University\Year 2\Networks and OS\E-portfolio-networks-module>
```

Multiple Access Protocols (MAP)



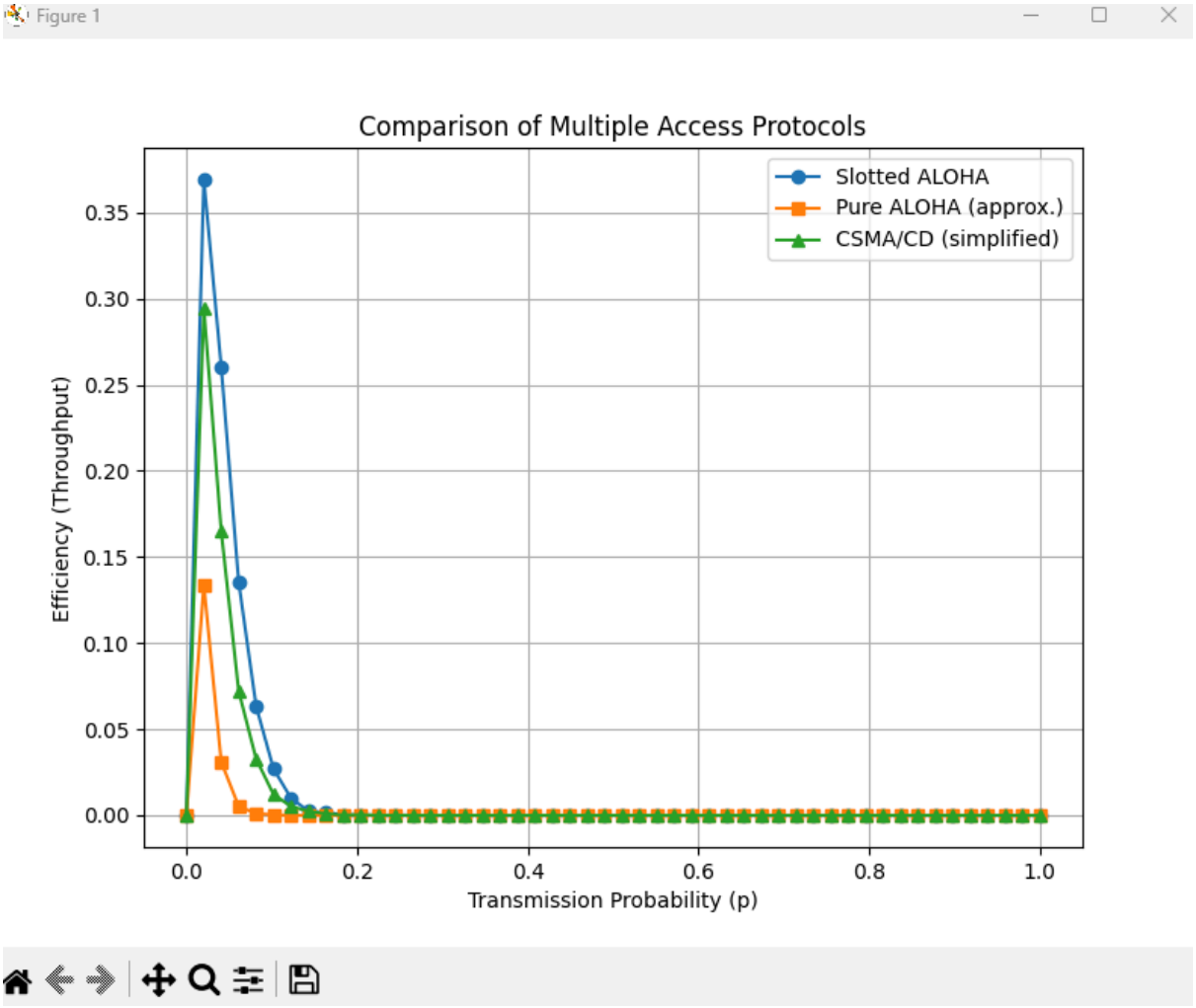


Figure 1
Comparison of Multiple Access Protocols
Slotted ALOHA
Pure ALOHA (approx.)
CSMA/CD (simplified)
Efficiency (Throughput)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.2
0.4
0.6
0.8
1.0
Transmission Probability (p)