



# Sockets Programming

REDES 2025-2026

# UDP socket programming

**UDP communication:** no "connection" between client and server

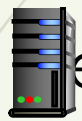
- No handshaking before starting data transmission
- The sender must explicitly place the destination IP address and port number in each datagram
- The receiver extracts the return address and port from the received datagram

**UDP communication:** data can be lost or received out of order

**From an application perspective:**

- UDP provides unreliable transfer of groups of bytes (datagrams or messages) between client and server

# UDP socket – client/server interaction



server (running serverIP)

Create socket associated to port X  
`serverSocket =  
socket(AF_INET, SOCK_DGRAM)`

Read datagram from  
`serverSocket`

Write answer in  
`serverSocket`  
Specifying clientIP address  
and port number

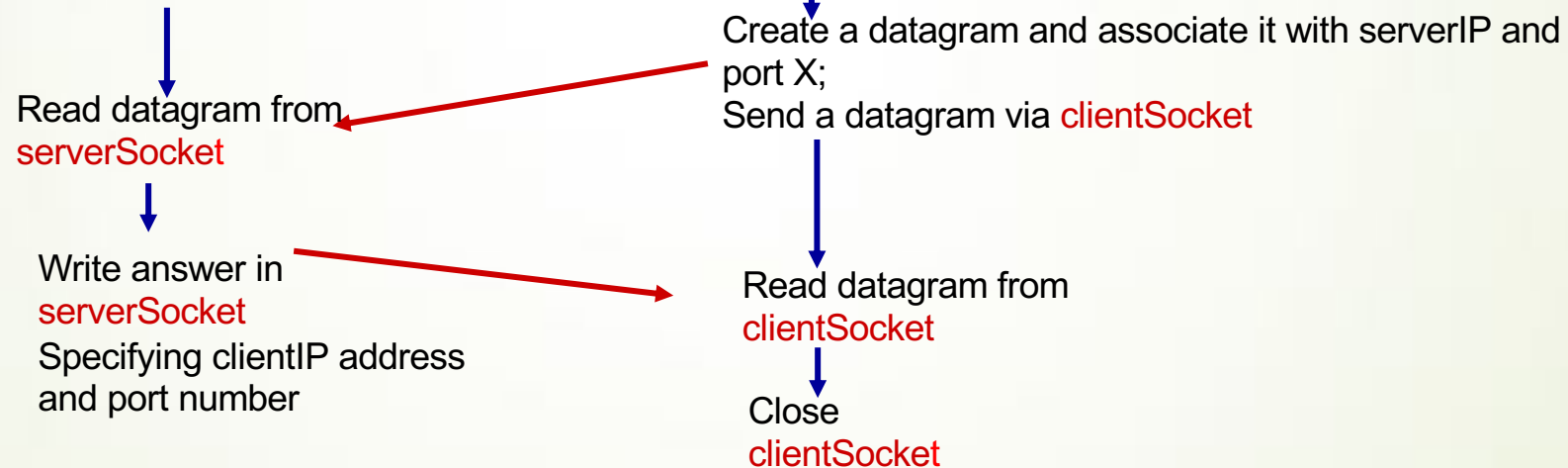
client 

Create socket  
`clientSocket =  
socket(AF_INET, SOCK_DGRAM)`

Create a datagram and associate it with serverIP and  
port X;  
Send a datagram via `clientSocket`

Read datagram from  
`clientSocket`

Close  
`clientSocket`



# UDP Client

## *Python client - UDPClient*

Include the Python sockets library



```
from socket import *
```

```
serverName = 'hostname'
```

```
serverPort = 12000
```

Create UDP socket



```
clientSocket = socket(AF_INET, SOCK_DGRAM)
```

Get input from keyboard



```
message = input('Input lowercase sentence:')
```

Define receiver IP address and port;  
Send through socket



```
clientSocket.sendto(message.encode(),  
                    (serverName, serverPort))
```

Get response to string



```
modifiedMessage, serverAddress =  
    clientSocket.recvfrom(2048)
```

Print the received message;  
Close port



```
print (modifiedMessage.decode())  
clientSocket.close()
```

**message.encode()** converts the Python string variable to an array of bytes to be placed in the datagram

**modifiedMessage.decode()** does the reverse

# UDP Server

## Python server - UDPServer

```
from socket import *
serverPort = 12000
```

Create UDP socket →

```
serverSocket = socket(AF_INET, SOCK_DGRAM)
```

Associate to local port 12000 →

```
serverSocket.bind("", serverPort))
```

```
print ("The server is ready to receive")
```

Server cycle 

```
while True:
```

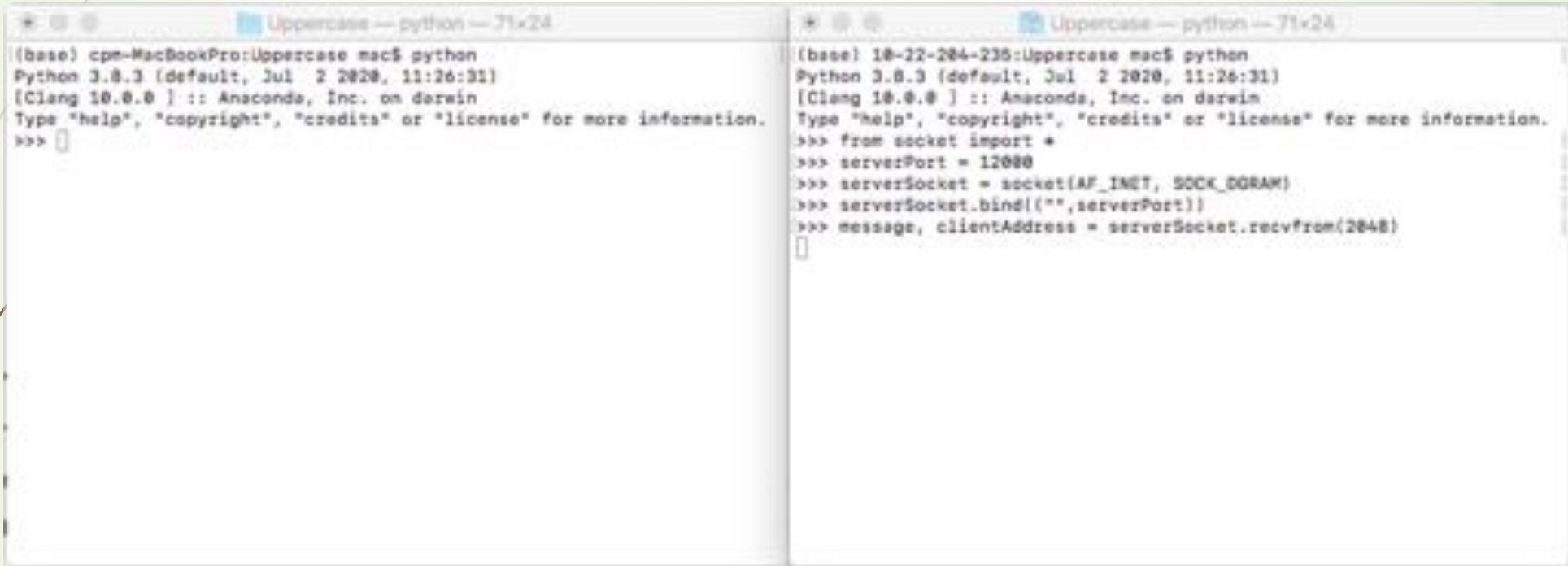
Read from UDP socket for message, get client address (client IP and port) →

```
message, clientAddress = serverSocket.recvfrom(2048)
modifiedMessage = message.decode().upper()
```

Send message to client →

```
serverSocket.sendto(modifiedMessage.encode(),
                    clientAddress)
```

Server starts → is available

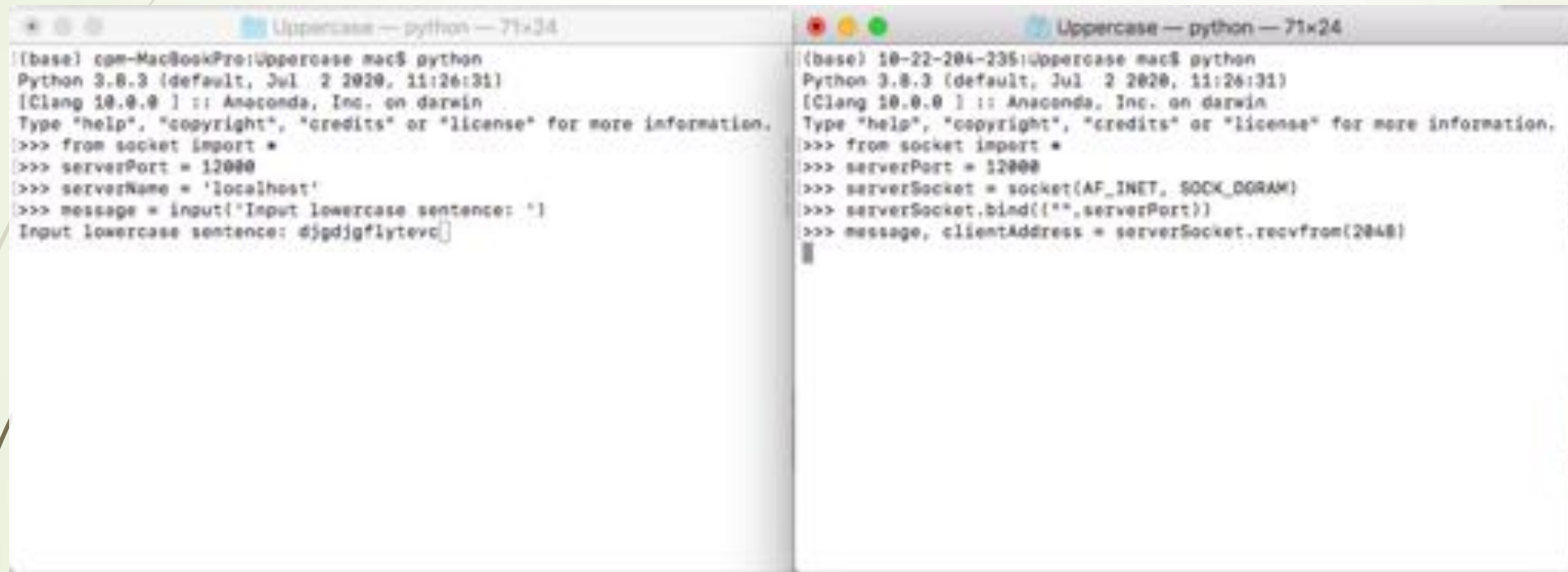


The image shows two side-by-side terminal windows. The left window is titled 'Uppercase -- python -- 71x24' and shows the prompt '(base) cpm-MacBookPro:Uppercase mac\$ python'. The right window is also titled 'Uppercase -- python -- 71x24' and shows the prompt '(base) 10-22-284-235:Uppercase mac\$ python'. Both windows show the same initial Python version and Clang information. The right window contains additional code for setting up a server socket.

```
(base) cpm-MacBookPro:Uppercase mac$ python
Python 3.8.3 (default, Jul 2 2020, 11:26:31)
[Clang 10.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> 
```

```
(base) 10-22-284-235:Uppercase mac$ python
Python 3.8.3 (default, Jul 2 2020, 11:26:31)
[Clang 10.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> from socket import *
>>> serverPort = 12080
>>> serverSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverSocket.bind(('', serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)
>>> 
```

# Client before sending datagram



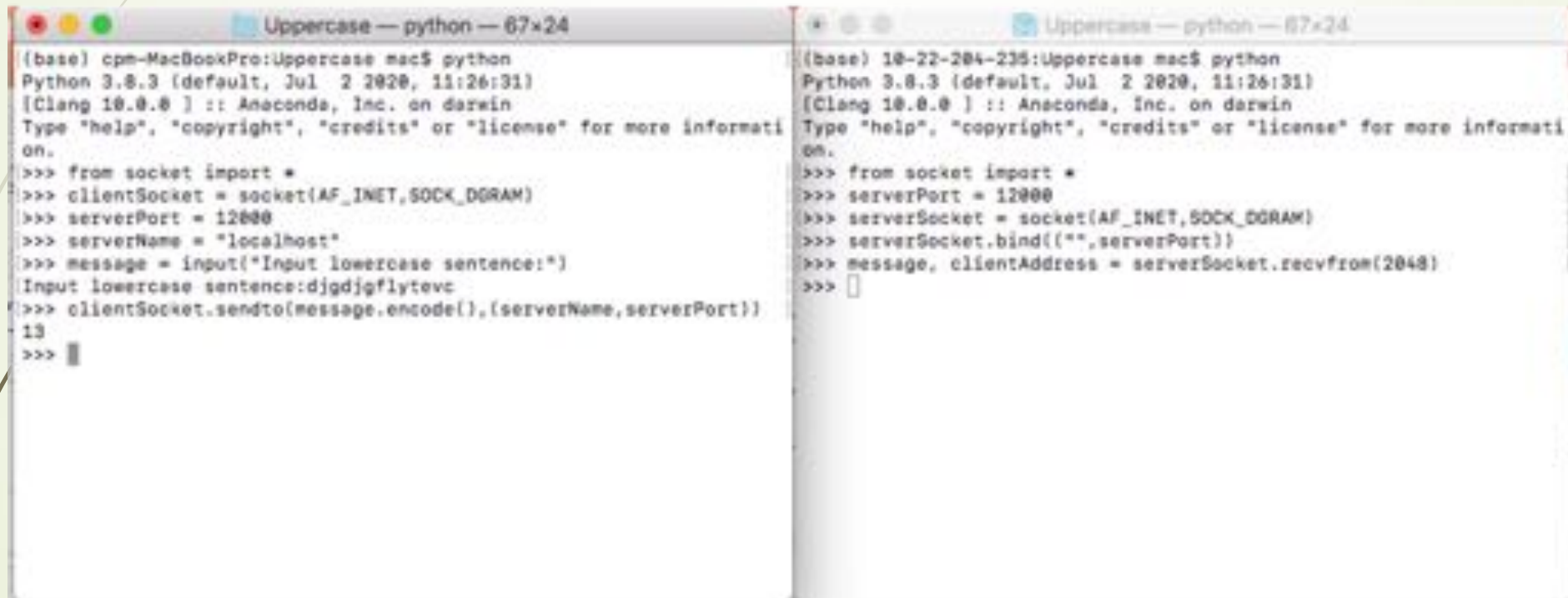
```

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Python 3.8.3 (default, Jul 2 2020, 11:26:31)
[Clang 10.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> from socket import *
>>> serverPort = 12000
>>> serverName = 'localhost'
>>> message = input('Input lowercase sentence: ')
Input lowercase sentence: djdjgflytevc

[base] 10-22-204-235:Uppercase mac$ python
Python 3.8.3 (default, Jul 2 2020, 11:26:31)
[Clang 10.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> from socket import *
>>> serverPort = 12000
>>> serverSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverSocket.bind(('',serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)

```

# After client sent and server received

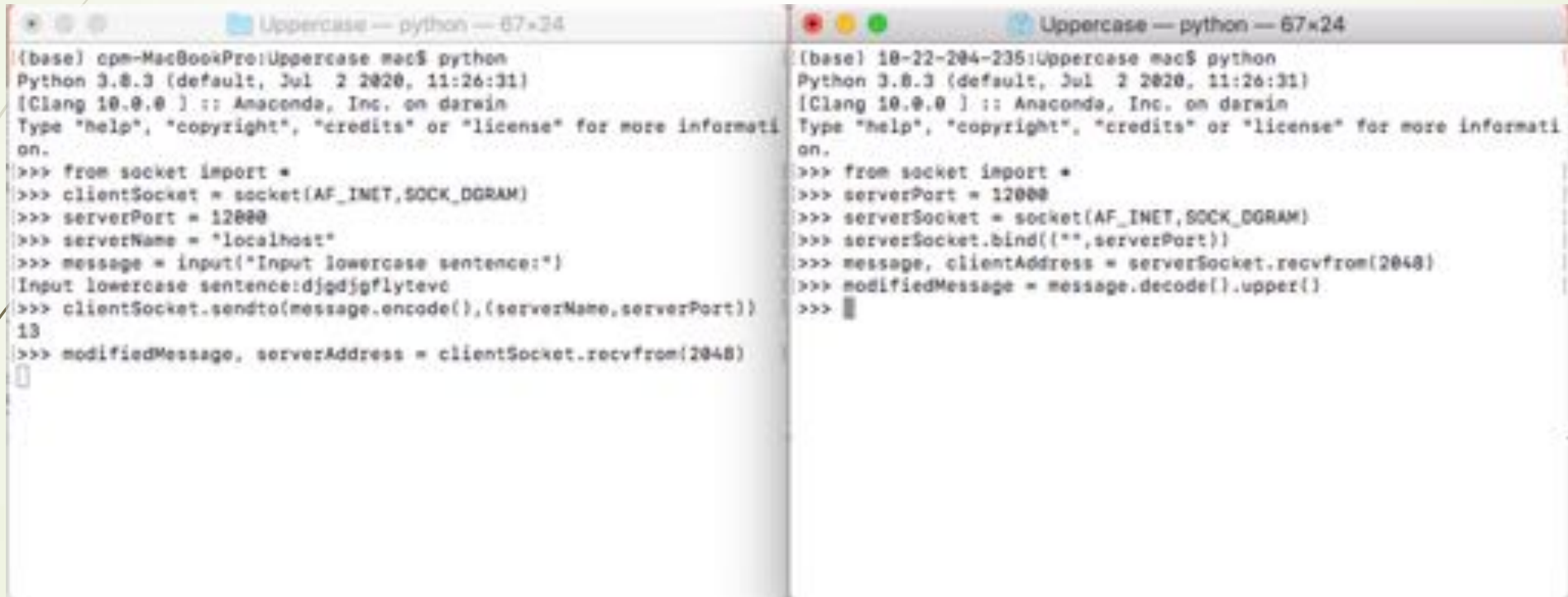


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>>> from socket import *
>>> clientSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverPort = 12000
>>> serverName = "localhost"
>>> message = input("Input lowercase sentence:")
Input lowercase sentence:djgdjgflytevc
>>> clientSocket.sendto(message.encode(), (serverName, serverPort))
13
>>>
```

```
(base) 10-22-204-235:Uppercase mac$ python
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>>> from socket import *
>>> serverPort = 12000
>>> serverSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverSocket.bind(("", serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)
>>>
```



# Client receives modified message

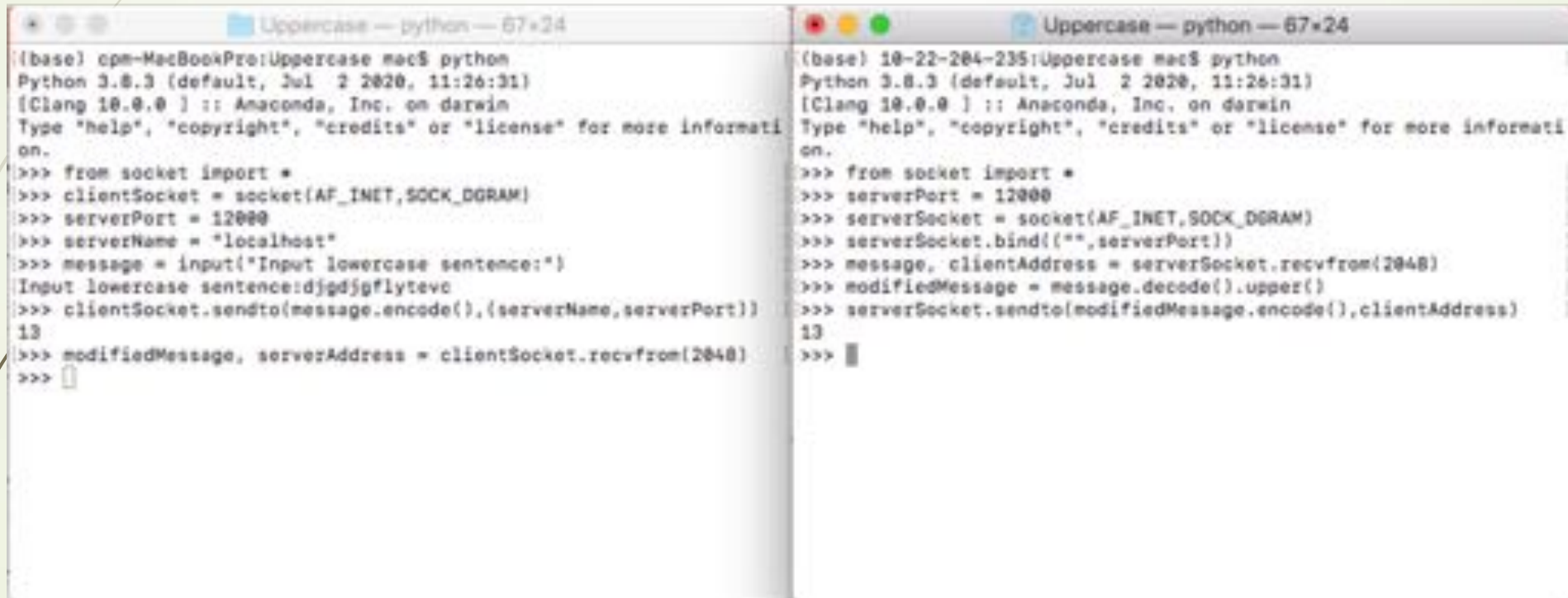


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>>> message = input("Input lowercase sentence:")
Input lowercase sentence:djgdjgflytevc
>>> clientSocket.sendto(message.encode(),(serverName,serverPort))
13
>>> modifiedMessage, serverAddress = clientSocket.recvfrom(2048)

```

```
{base} 18-22-204-235:Uppercase mac$ python
Python 3.8.3 (default, Jul 2 2020, 11:26:31)
[Clang 10.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> from socket import *
>>> serverPort = 12000
>>> serverSocket = socket(AF_INET,SOCK_DGRAM)
>>> serverSocket.bind(("",serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)
>>> modifiedMessage = message.decode().upper()
>>>
```

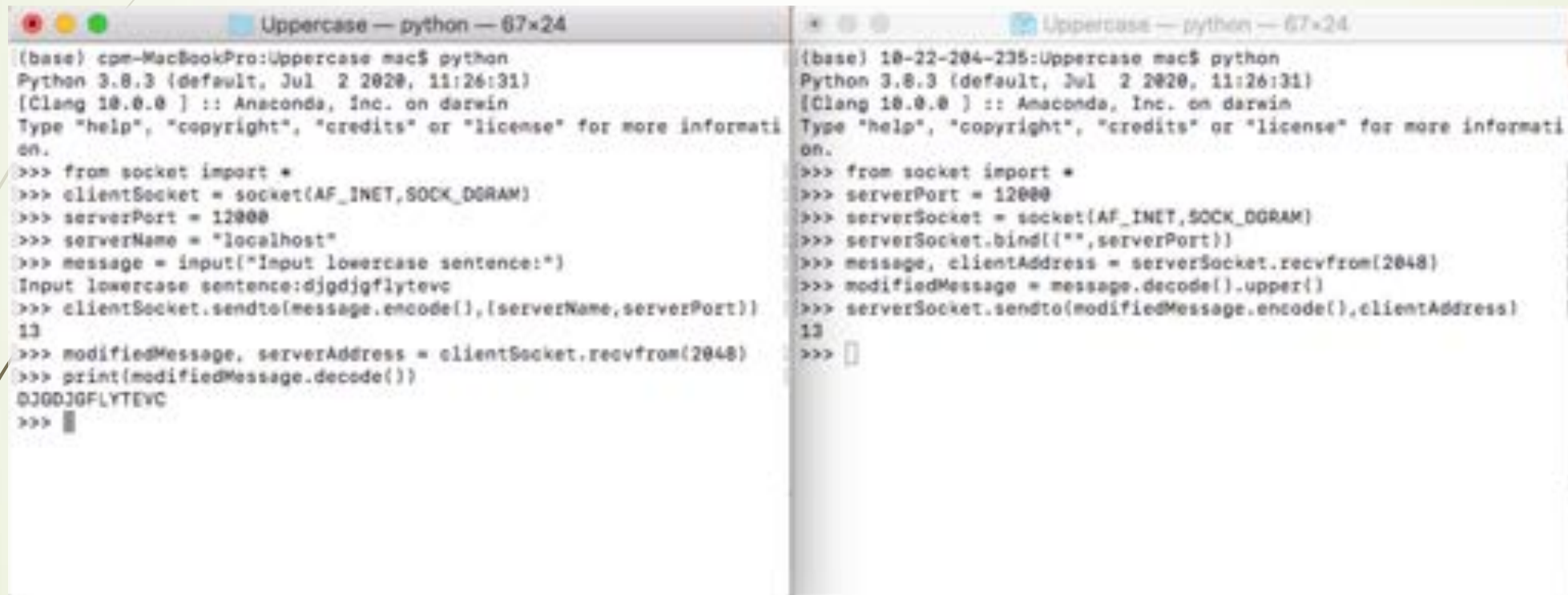
# Client receives modified message



```
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>>> clientSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverPort = 12000
>>> serverName = "localhost"
>>> message = input("Input lowercase sentence:")
Input lowercase sentence:djgdjgflytevc
>>> clientSocket.sendto(message.encode(), (serverName, serverPort))
13
>>> modifiedMessage, serverAddress = clientSocket.recvfrom(2048)
>>>
```

```
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>>> serverPort = 12000
>>> serverSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverSocket.bind(("", serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)
>>> modifiedMessage = message.decode().upper()
>>> serverSocket.sendto(modifiedMessage.encode(), clientAddress)
13
>>>
```

# Client receives modified message



```
Uppercase — python — 67x24
(base) cpm-MacBookPro:Uppercase mac$ python
Python 3.8.3 (default, Jul 2 2020, 11:26:31)
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>>> from socket import *
>>> clientSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverPort = 12000
>>> serverName = "localhost"
>>> message = input("Input lowercase sentence:")
Input lowercase sentence:djgdjgflytevc
>>> clientSocket.sendto(message.encode(), (serverName, serverPort))
13
>>> modifiedMessage, serverAddress = clientSocket.recvfrom(2048)
>>> print(modifiedMessage.decode())
DJGDJGFLYTEVC
>>>

Uppercase — python — 67x24
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Python 3.8.3 (default, Jul 2 2020, 11:26:31)
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>>> from socket import *
>>> serverPort = 12000
>>> serverSocket = socket(AF_INET, SOCK_DGRAM)
>>> serverSocket.bind(("", serverPort))
>>> message, clientAddress = serverSocket.recvfrom(2048)
>>> modifiedMessage = message.decode().upper()
>>> serverSocket.sendto(modifiedMessage.encode(), clientAddress)
13
>>>
```

# Client and server

```

1 from socket import *
2
3 clientSocket = socket(AF_INET, SOCK_DGRAM)
4
5 serverName="localhost"
6 serverPort= 12000
7
8 message=input("Input lowercase sequence: ")
9
10 clientSocket.sendto( message.encode(),(serverName, serverPort))
11
12 modifiedMessage, serverAddress = clientSocket.recvfrom(2048)
13
14 print(modifiedMessage.decode())
15
16 clientSocket.close()
17

```

```

from socket import *

serverSocket = socket(AF_INET, SOCK_DGRAM)

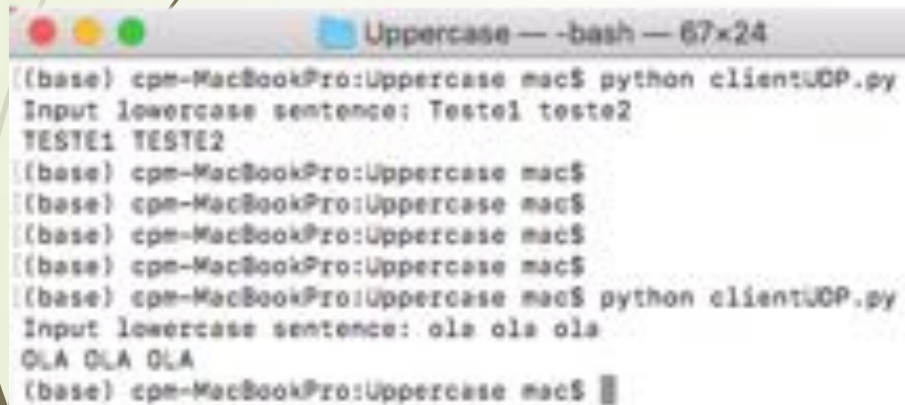
serverPort= 12000

serverSocket.bind(("", serverPort))

while True:
    message, clientAddress = serverSocket.recvfrom( 2048)
    modifiedMessage = message.decode().upper()
    serverSocket.sendto( modifiedMessage.encode(), clientAddress)

serverSocket.close()

```

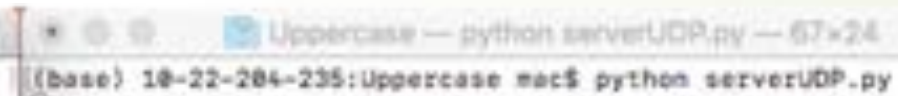


Uppercase — -bash — 67x24

```

(base) cpm-MacBookPro:Uppercase mac$ python clientUDP.py
Input lowercase sentence: Teste1 teste2
TESTE1 TESTE2
(base) cpm-MacBookPro:Uppercase mac$
(base) cpm-MacBookPro:Uppercase mac$
(base) cpm-MacBookPro:Uppercase mac$
(base) cpm-MacBookPro:Uppercase mac$
(base) cpm-MacBookPro:Uppercase mac$ python clientUDP.py
Input lowercase sentence: ola ola ola
OLA OLA OLA
(base) cpm-MacBookPro:Uppercase mac$

```



Uppercase — python serverUDP.py — 67x24

```

(base) 10-22-204-235:Uppercase mac$ python serverUDP.py

```