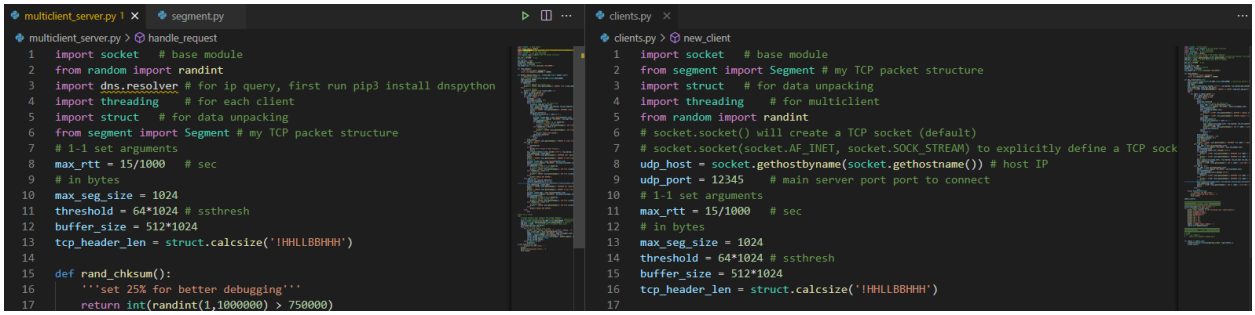
Computer Network Homework

Step 1:

- 1.

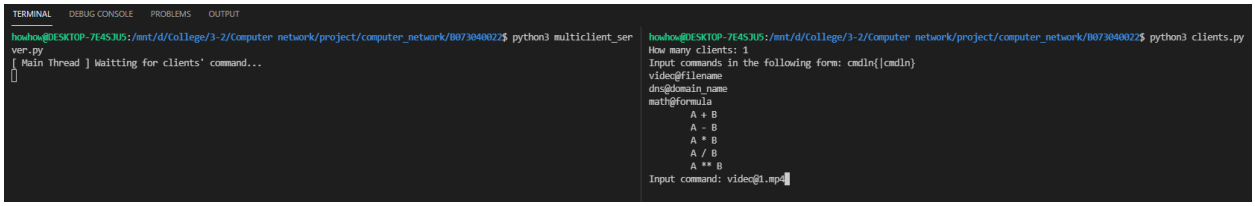


```python
import socket   # base module
from random import randint
import dns.resolver # for ip query, first run pip3 install dnspython
import threading    # for each client
import struct   # for data unpacking
from segment import Segment # my TCP packet structure
# 1-1 set arguments
max_rtt = 15/1000   # sec
# in bytes
max_seg_size = 1024
threshold = 64*1024 # ssthresh
buffer_size = 512*1024
tcp_header_len = struct.calcsize('!HHLLBBHHH')

def rand_chksum():
    '''set 25% for better debugging'''
    return int(randint(1,1000000) > 750000)
```

```python
import socket   # base module
from segment import Segment # my TCP packet structure
import struct   # for data unpacking
import threading    # for multiclient
from random import randint
# socket.socket() will create a TCP socket (default)
# socket.socket(socket.AF_INET, socket.SOCK_STREAM) to explicitly define a TCP sock
udp_host = socket.gethostbyname(socket.gethostname()) # host IP
udp_port = 12345    # main server port port to connect
# 1-1 set arguments
max_rtt = 15/1000   # sec
# in bytes
max_seg_size = 1024
threshold = 64*1024 # ssthresh
buffer_size = 512*1024
tcp_header_len = struct.calcsize('!HHLLBBHHH')
```

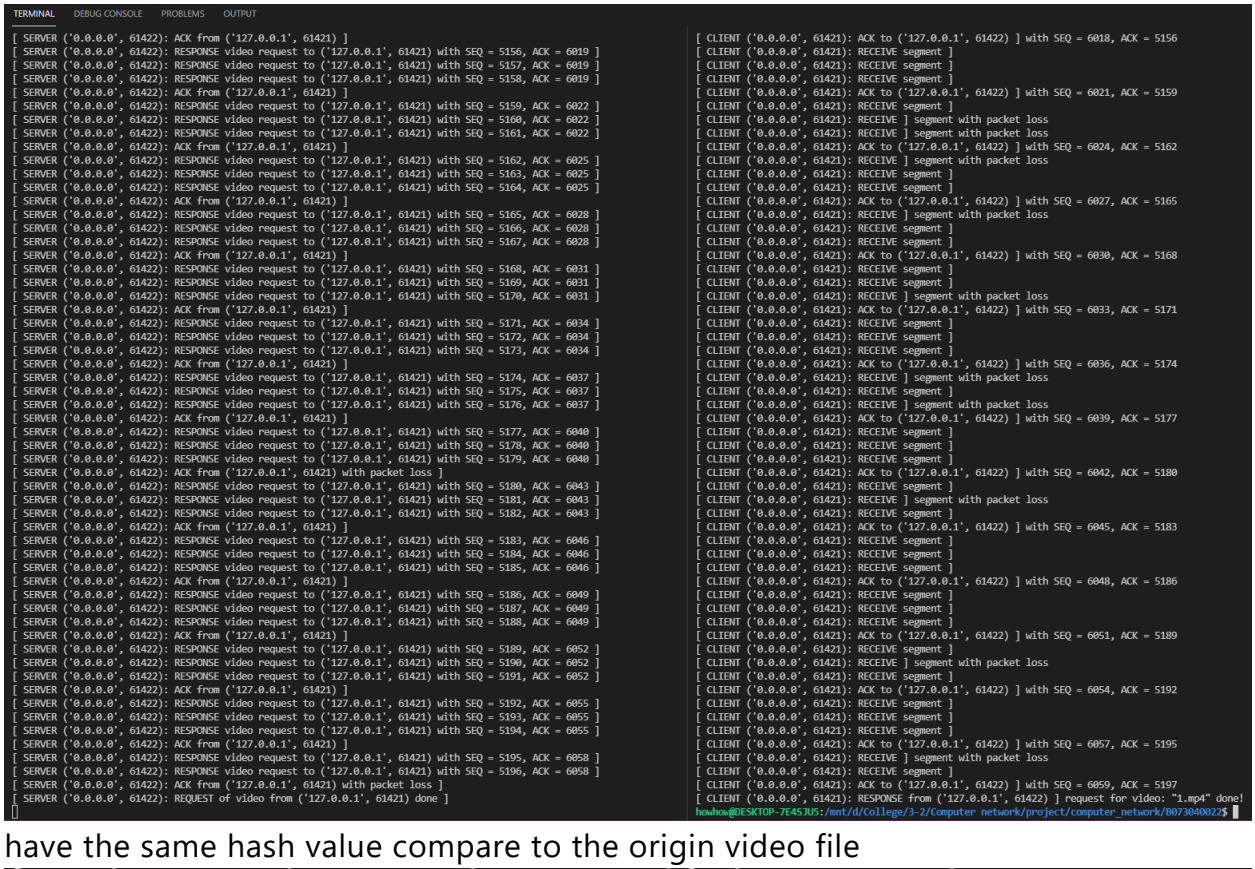
- 2.



```
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ python3 multiclient_server.py
[ Main Thread ] Waitting for clients' command...
```

```
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ python3 clients.py
How many clients: 1
Input commands in the following form: cmdln{|cmdln}
videc@filename
dns@domain_name
math@formula
        A + B
        A - B
        A * B
        A / B
        A ** B
Input command: videc@1.mp4
```

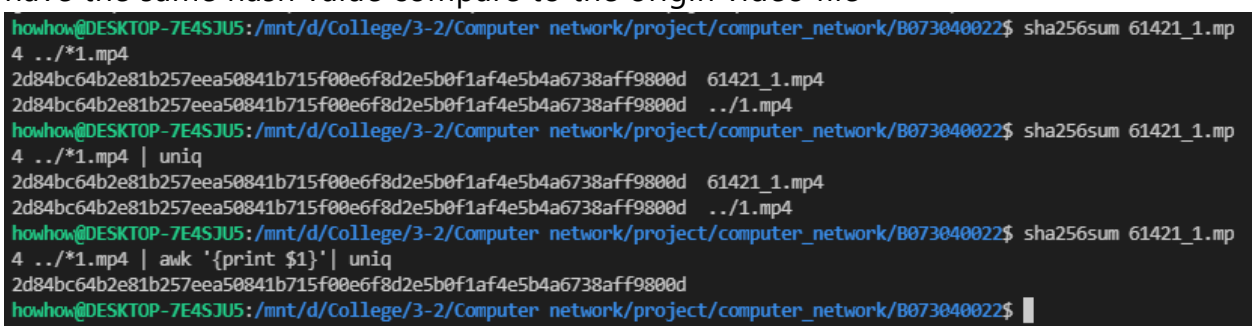
after a few output...



```
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5156, ACK = 6019 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5157, ACK = 6019 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5158, ACK = 6019 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5159, ACK = 6022 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5160, ACK = 6022 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5161, ACK = 6022 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5162, ACK = 6025 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5163, ACK = 6025 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5164, ACK = 6025 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5165, ACK = 6028 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5166, ACK = 6028 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5167, ACK = 6028 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5168, ACK = 6031 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5169, ACK = 6031 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5170, ACK = 6031 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5171, ACK = 6034 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5172, ACK = 6034 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5173, ACK = 6034 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5174, ACK = 6037 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5175, ACK = 6037 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5176, ACK = 6037 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5177, ACK = 6040 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5178, ACK = 6040 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5179, ACK = 6040 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) with packet loss ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5180, ACK = 6043 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5181, ACK = 6043 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5182, ACK = 6043 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5183, ACK = 6046 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5184, ACK = 6046 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5185, ACK = 6046 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5186, ACK = 6049 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5187, ACK = 6049 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5188, ACK = 6049 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5189, ACK = 6052 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5190, ACK = 6052 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5191, ACK = 6052 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5192, ACK = 6055 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5193, ACK = 6055 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5194, ACK = 6055 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5195, ACK = 6058 ]
[ SERVER ('0.0.0.0', 61422): RESPONSE video request to ('127.0.0.1', 61421) with SEQ = 5196, ACK = 6058 ]
[ SERVER ('0.0.0.0', 61422): ACK from ('127.0.0.1', 61421) with packet loss ]
[ SERVER ('0.0.0.0', 61422): REQUEST of video from ('127.0.0.1', 61421) done ]
```

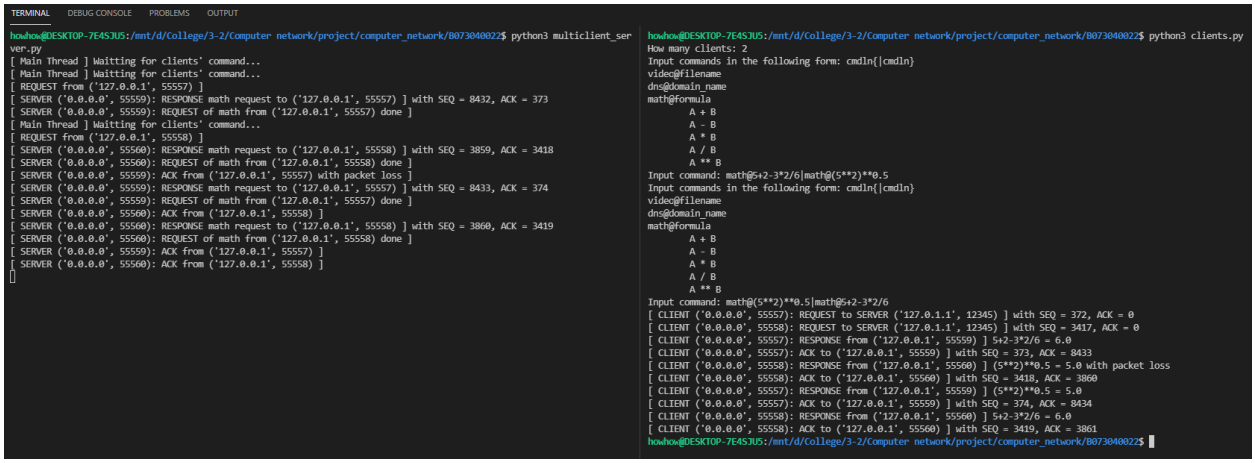
```
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6018, ACK = 5156
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6021, ACK = 5159
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6024, ACK = 5162
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6027, ACK = 5165
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6030, ACK = 5168
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6033, ACK = 5171
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6036, ACK = 5174
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6039, ACK = 5177
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6042, ACK = 5180
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6045, ACK = 5183
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6048, ACK = 5186
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6051, ACK = 5189
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6054, ACK = 5192
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6057, ACK = 5195
[ CLIENT ('0.0.0.0', 61421): RECEIVE ] segment with packet loss
[ CLIENT ('0.0.0.0', 61421): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 61421): ACK to ('127.0.0.1', 61422) ] with SEQ = 6059, ACK = 5197
[ CLIENT ('0.0.0.0', 61421): RESPONSE from ('127.0.0.1', 61422) ] request for video: "1.mp4" done!
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$
```

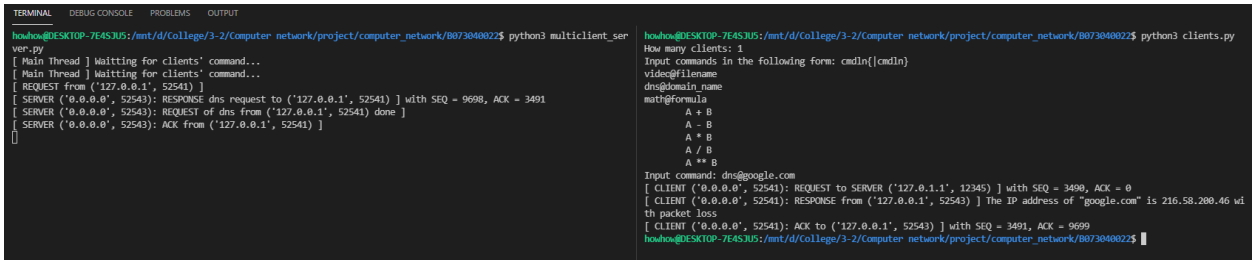
have the same hash value compare to the origin video file



```
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum 61421_1.mp4 ../*1.mp4
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d  61421_1.mp4
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d  ../1.mp4
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum 61421_1.mp4 ../*1.mp4 | uniq
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d  61421_1.mp4
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d  ../1.mp4
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum 61421_1.mp4 ../*1.mp4 | awk '{print $1}'| uniq
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$
```

clients each do multiple jobs



- 3. 

- 4. above covered (Step 1:3)
- 5. above covered
- 6. above covered

Step 2.

- above covered (Step 1:2-4)

Step 3.

- above covered (Step 1:2-4)

Step 4.

- above covered (modified the rate to 25% to better present)

Step 5.

- above covered(Step 1:2-2)

Step 9. (Partial)

- 2. code:

```
################################################
############### standard input ###############
################################################
# client_num=input('How many clients: ')
# for i in range(int(client_num)):
#     print('Input commands in the following form: cmdln{|cmdln}')
#     print('video@filename')
#     print('dns@domain_name')
#     print('math@formula')
#     print('\tA + B')
#     print('\tA - B')
#     print('\tA * B')
#     print('\tA / B')
#     print('\tA ** B')
#     cmdlns = input('Input command: ')
#     cmdlns_list.append(cmdlns)

################################################
################## n clients ##################
################################################
n=100
for i in range(n):
    cmdlns_list.append('video@1.mp4')
```

have the same hash value compare to the origin video file

```
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum *.mp4 ../*
1.mp4 | awk '{print $1}'| uniq
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$
```