

EE544 Fall 2014 Sections 1 and 2
Computer Networks and Internets
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Project 1 – Socket Network Programming in Python

Due: November 5th, 2014

Student Name: _____

CID: _____

Score:

Result	
Correctness	
Creativity	
Report	
Total Score	

Abstract

The first project is intended to implement a echo server and client software so as to:
Get acquainted with the socket-based networking programming model
Get acquainted with the Python programming and its associated libraries

Design Description

In this project we are required to implement two Python programs, one is server called echoServer.py and the other is called echoClient.py.

The program behaves as follows:

The client can send a message to the server, and the server will echo back any received message from to the client. In particular, once a return is pressed, the server will have to echo back the message the client sends to the server.

For example, if you run the Echo server on a machine, and run the client on another, the following are the messages you should receive at the client:

```
>Hello, Master! (from the client)
>Echo: Hello, Master! (from the server)
> My name is Android. (from the client)
>Echo: My name is Android. (from the server)Results
```

In addition to the high-level functions as described above, two programs also need to satisfy the following requirements:

1. Support command-line arguments:

Both echoServer.py and echoClient.py can be run with a command options in the format:

```
echoClient.py [options]
```

For example, % echoClient.py -t TCP/UDP -c -ip IPADD -h -v will be able to start the program with the desired features. The syntax and functions are defined in Table 1.

2. (2) Additional operation modes as specified in Table 1.

Options	Functions
-h	<p>Display supported options.</p> <p>For example, % echoServer.py -h will display the following: % Usage: echoServer.py [options] OPTIONS: -c Continuous echo mode. -h Display the available options --ip IPADD Specify the server IP address -t TCP/UDP Specify the transport layer protocol. -v Print the software version</p> <p>Default is to launch the program in default modes.</p>
-c	<p>Specify the operation mode.</p> <p>For example, % echoClient.py -c will start echoClient in the continuous mode. That is, what a user types on the client machine will be continuously sent to the server and echo back.</p> <p>Default is the non-continuous mode. That is, the client sends the message to be echoed by hit the Return key.</p>
-v	<p>Print the software version.</p> <p>For example, %echoClient.py -v will print out the following % echoClient.py version1.0</p> <p>Default is not to display the version.</p>
--ip IPADD	<p>Specify the server IP address. It is only available for the server.</p> <p>For example, %echoClient.py -ip 192.168.1.1 will connect the server on the machine with an IP address of 192.168.1.1.</p> <p>Default is the loop-back address: 127.0.0.1</p>
-t TCP/UDP	<p>Specify the transport layer protocol the server/client uses.</p> <p>Default is TCP. Note both the server and client need to use the same protocol.</p>

Results

<pre>[root@localhost echo]# python echoServer.py -h OPTIONS: -c Continuous echo mode. -h Display the available options -ip IPADD Specify the server IP Address -t TCP/UDP Specify the transport layer protocol. -v Print the software version [root@localhost echo]# python echoServer.py -v echoServer.py version1.0 [root@localhost echo]# python echoServer.py -t UDP protocolo UDP UDP Socket bind complete Socket bind complete . . . [root@localhost echo]# python echoServer.py -t TCP protocolo TCP TCP Socket bind complete Socket bind complete Socket now listening</pre>
<pre>[root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t TCP 127.0.0.1 version1.0 protocolo TCP >HELLO MASTER >ECHO:HELLO MASTER >WELCOME BACK >ECHO:WELCOME BACK</pre>

TCP SESSION
<pre>[root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t TCP 127.0.0.1 version1.0 protocolo TCP >HELLO MASTER >ECHO:HELLO MASTER >WELCOME BACK >ECHO:WELCOME BACK</pre>
<pre>[root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002 tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes 15:30:11.106833 IP (tos 0x0, ttl 64, id 46169, offset 0, flags [DF], proto TCP (6), length 60) 127.0.0.1.46096 > 127.0.0.1.4002: Flags [S], cksum 0x7e1e (correct), seq 2228874053, win 32792, options [mss 16396,sackOK,TS val 2122473244 ecr 0,nop,wscale 5], length 0 0x0000: 4500 003c b459 4000 4006 8860 7f00 0001 E..<.Y@.@..`.... 0x0010: 7f00 0001 b410 0fa2 84d9 eb45 0000 0000 E.... 0x0020: a002 8018 7e1e 0000 0204 400c 0402 080a ~.....@..... 0x0030: 7e82 5f1c 0000 0000 0103 0305 ~._..... 15:30:11.106885 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto TCP (6), length 60) 127.0.0.1.4002 > 127.0.0.1.46096: Flags [S.], cksum 0xc9c8 (correct), seq 1502706988, ack 2228874054, win 32768, options [mss 16396,sackOK,TS val 2122473244 ecr 2122473244,nop,wscale 5], length 0</pre>

```

0x0000: 4500 003c 0000 4000 4006 3cba 7f00 0001 E..<..@.@.<.....
0x0010: 7f00 0001 0fa2 b410 5991 7d2c 84d9 eb46 .....Y.)...F
0x0020: a012 8000 c9c8 0000 0204 400c 0402 080a .....@.....
0x0030: 7e82 5f1c 7e82 5f1c 0103 0305 ~._.~_.....
15:30:11.106904 IP (tos 0x0, ttl 64, id 46170, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46096 > 127.0.0.1.4002: Flags [.] , cksum 0xaea (correct), seq 2228874054,
ack 1502706989, win 1025, options [nop,nop,TS val 2122473244 ecr 2122473244], length 0
0x0000: 4500 0034 b45a 4000 4006 8867 7f00 0001 E..4.Z@.@..g....
0x0010: 7f00 0001 b410 0fa2 84d9 eb46 5991 7d2d .....FY.)-
0x0020: 8010 0401 aeaa 0000 0101 080a 7e82 5f1c .....~._.
0x0030: 7e82 5f1c ~._.
15:30:17.296666 IP (tos 0x0, ttl 64, id 46171, offset 0, flags [DF], proto TCP (6), length
65)
127.0.0.1.46096 > 127.0.0.1.4002: Flags [P.] , cksum 0xfe35 (incorrect -> 0xc30d), seq
2228874054:2228874067, ack 1502706989, win 1025, options [nop,nop,TS val 2122479434 ecr
2122473244], length 13
0x0000: 4500 0041 b45b 4000 4006 8859 7f00 0001 E..A.[@.@..Y....
0x0010: 7f00 0001 b410 0fa2 84d9 eb46 5991 7d2d .....FY.)-
0x0020: 8018 0401 fe35 0000 0101 080a 7e82 774a .....5.....~.wJ
0x0030: 7e82 5f1c 4845 4c4c 4f20 4d41 5354 4552 ~._.HELLO.MASTER
0x0040: 0a .
15:30:17.296757 IP (tos 0x0, ttl 64, id 8753, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.4002 > 127.0.0.1.46096: Flags [.] , cksum 0x7e82 (correct), seq 1502706989,
ack 2228874067, win 1024, options [nop,nop,TS val 2122479434 ecr 2122479434], length 0
0x0000: 4500 0034 2231 4000 4006 1a91 7f00 0001 E..4"1@.@.....
0x0010: 7f00 0001 0fa2 b410 5991 7d2d 84d9 eb53 .....Y.)-...S
0x0020: 8010 0400 7e82 0000 0101 080a 7e82 774a ....~.....~.wJ
0x0030: 7e82 774a ~.wJ
15:30:17.296805 IP (tos 0x0, ttl 64, id 8754, offset 0, flags [DF], proto TCP (6), length
65)
127.0.0.1.4002 > 127.0.0.1.46096: Flags [P.] , cksum 0xfe35 (incorrect -> 0xaad3), seq
1502706989:1502707002, ack 2228874067, win 1024, options [nop,nop,TS val 2122479434 ecr
2122479434], length 13
0x0000: 4500 0041 2232 4000 4006 1a83 7f00 0001 E..A"2@.@.....
0x0010: 7f00 0001 0fa2 b410 5991 7d2d 84d9 eb53 .....Y.)-...S
0x0020: 8018 0400 fe35 0000 0101 080a 7e82 774a .....5.....~.wJ
0x0030: 7e82 774a 4845 4c4c 4f20 4d41 5354 4552 ~.wJHELLO.MASTER
0x0040: 0a .
15:30:17.297036 IP (tos 0x0, ttl 64, id 46172, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46096 > 127.0.0.1.4002: Flags [.] , cksum 0x7e74 (correct), seq 2228874067,
ack 1502707002, win 1025, options [nop,nop,TS val 2122479434 ecr 2122479434], length 0
0x0000: 4500 0034 b45c 4000 4006 8865 7f00 0001 E..4.\@.@..e....
0x0010: 7f00 0001 b410 0fa2 84d9 eb53 5991 7d3a .....SY.}:
0x0020: 8010 0401 7e74 0000 0101 080a 7e82 774a ....~t.....~.wJ
0x0030: 7e82 774a ~.wJ
15:30:22.455629 IP (tos 0x0, ttl 64, id 46173, offset 0, flags [DF], proto TCP (6), length
65)
127.0.0.1.46096 > 127.0.0.1.4002: Flags [P.] , cksum 0xfe35 (incorrect -> 0xa2b5), seq
2228874067:2228874080, ack 1502707002, win 1025, options [nop,nop,TS val 2122484593 ecr
2122479434], length 13
0x0000: 4500 0041 b45d 4000 4006 8857 7f00 0001 E..A.]@.@..W....
0x0010: 7f00 0001 b410 0fa2 84d9 eb53 5991 7d3a .....SY.}:
0x0020: 8018 0401 fe35 0000 0101 080a 7e82 8b71 .....5.....~.q
0x0030: 7e82 774a 5745 4c43 4f4d 4520 4241 434b ~.wJWELCOME.BACK
0x0040: 0a .
15:30:22.455729 IP (tos 0x0, ttl 64, id 8755, offset 0, flags [DF], proto TCP (6), length
65)
127.0.0.1.4002 > 127.0.0.1.46096: Flags [P.] , cksum 0xfe35 (incorrect -> 0x8e82), seq
1502707002:1502707015, ack 2228874080, win 1024, options [nop,nop,TS val 2122484593 ecr
2122484593], length 13
0x0000: 4500 0041 2233 4000 4006 1a82 7f00 0001 E..A"3@.@.....
0x0010: 7f00 0001 0fa2 b410 5991 7d3a 84d9 eb60 .....Y.)}:...`
0x0020: 8018 0400 fe35 0000 0101 080a 7e82 8b71 .....5.....~.q
0x0030: 7e82 8b71 5745 4c43 4f4d 4520 4241 434b ~..qWELCOME.BACK
0x0040: 0a .

```

TCP SESSION CONTINUOUS

```
[root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t TCP -c
127.0.0.1 version1.0
protocolo TCP
continuos
LLIIFFE
```

```
[root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002
tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes
15:58:55.789168 IP (tos 0x0, ttl 64, id 57001, offset 0, flags [DF], proto TCP (6), length 60)
    127.0.0.1.46097 > 127.0.0.1.4002: Flags [S], cksum 0x7cb3 (correct), seq 2983554703,
    win 32792, options [mss 16396,sackOK,TS val 2124197926 ecr 0,nop,wscale 5], length 0
    0x0000:  4500 003c dea9 4000 4006 5e10 7f00 0001  E..<..@.@.^.....
    0x0010:  7f00 0001 b411 0fa2 b1d5 6e8f 0000 0000  .....n.....
    0x0020:  a002 8018 7cb3 0000 0204 400c 0402 080a  ....|....@.....
    0x0030:  7e9c b026 0000 0000 0103 0305          ~..&.....
15:58:55.790115 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto TCP (6), length 60)
    127.0.0.1.4002 > 127.0.0.1.46097: Flags [S.], cksum 0xb1d2 (correct), seq 1496204021,
    ack 2983554704, win 32768, options [mss 16396,sackOK,TS val 2124197927 ecr
    2124197926,nop,wscale 5], length 0
    0x0000:  4500 003c 0000 4000 4006 3c3a 7f00 0001  E..<..@.@.<.....
    0x0010:  7f00 0001 0fa2 b411 592e 42f5 b1d5 6e90  .....Y.B...n.
    0x0020:  a012 8000 b1d2 0000 0204 400c 0402 080a  .....@.....
    0x0030:  7e9c b027 7e9c b026 0103 0305          ~..'~..&....
15:58:55.790903 IP (tos 0x0, ttl 64, id 57002, offset 0, flags [DF], proto TCP (6), length 52)
    127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x96f2 (correct), seq 2983554704,
    ack 1496204022, win 1025, options [nop,nop,TS val 2124197928 ecr 2124197927], length 0
    0x0000:  4500 0034 deaa 4000 4006 5e17 7f00 0001  E..4..@.@.^.....
    0x0010:  7f00 0001 b411 0fa2 b1d5 6e90 592e 42f6  .....n.Y.B.
    0x0020:  8010 0401 96f2 0000 0101 080a 7e9c b028  .....~..(
    0x0030:  7e9c b027          ~..'
15:59:30.198712 IP (tos 0x0, ttl 64, id 57003, offset 0, flags [DF], proto TCP (6), length 53)
    127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0xc480), seq
    2983554704:2983554705, ack 1496204022, win 1025, options [nop,nop,TS val 2124232336 ecr
    2124197927], length 1
    0x0000:  4500 0035 deab 4000 4006 5e15 7f00 0001  E..5..@.@.^.....
    0x0010:  7f00 0001 b411 0fa2 b1d5 6e90 592e 42f6  .....n.Y.B.
    0x0020:  8018 0401 fe29 0000 0101 080a 7e9d 3690  .....~..6.
    0x0030:  7e9c b027 4c          ~..'L
15:59:30.199072 IP (tos 0x0, ttl 64, id 62174, offset 0, flags [DF], proto TCP (6), length 52)
    127.0.0.1.4002 > 127.0.0.1.46097: Flags [.], cksum 0x8a20 (correct), seq 1496204022,
    ack 2983554705, win 1024, options [nop,nop,TS val 2124232336 ecr 2124232336], length 0
    0x0000:  4500 0034 f2de 4000 4006 49e3 7f00 0001  E..4..@.@.I.....
    0x0010:  7f00 0001 0fa2 b411 592e 42f6 b1d5 6e91  .....Y.B...n.
    0x0020:  8010 0400 8a20 0000 0101 080a 7e9d 3690  .....~..6.
    0x0030:  7e9d 3690          ~.6.
15:59:30.199419 IP (tos 0x0, ttl 64, id 62175, offset 0, flags [DF], proto TCP (6), length 53)
    127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x3e17), seq
    1496204022:1496204023, ack 2983554705, win 1024, options [nop,nop,TS val 2124232336 ecr
    2124232336], length 1
    0x0000:  4500 0035 f2df 4000 4006 49e1 7f00 0001  E..5..@.@.I.....
    0x0010:  7f00 0001 0fa2 b411 592e 42f6 b1d5 6e91  .....Y.B...n.
    0x0020:  8018 0400 fe29 0000 0101 080a 7e9d 3690  .....~..6.
    0x0030:  7e9d 3690 4c          ~.6.L
15:59:30.199427 IP (tos 0x0, ttl 64, id 57004, offset 0, flags [DF], proto TCP (6), length 52)
    127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x8a1e (correct), seq 2983554705,
    ack 1496204023, win 1025, options [nop,nop,TS val 2124232336 ecr 2124232336], length 0
    0x0000:  4500 0034 deac 4000 4006 5e15 7f00 0001  E..4..@.@.^.....
    0x0010:  7f00 0001 b411 0fa2 b1d5 6e91 592e 42f7  .....n.Y.B.
    0x0020:  8010 0401 8a1e 0000 0101 080a 7e9d 3690  .....~..6.
    0x0030:  7e9d 3690          ~.6.
15:59:34.838104 IP (tos 0x0, ttl 64, id 57005, offset 0, flags [DF], proto TCP (6), length 53)
    127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x2ef6), seq
    2983554705:2983554706, ack 1496204023, win 1025, options [nop,nop,TS val 2124236975 ecr
```

```

2124232336], length 1
0x0000: 4500 0035 dead 4000 4006 5e13 7f00 0001 E..5..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e91 592e 42f7 .....n.Y.B.
0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 48af .....~.H.
0x0030: 7e9d 3690 49 ~.6.I
15:59:34.838277 IP (tos 0x0, ttl 64, id 62176, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x1cd7), seq
1496204023:1496204024, ack 2983554706, win 1024, options [nop,nop,TS val 2124236975 ecr
2124236975], length 1
0x0000: 4500 0035 f2e0 4000 4006 49e0 7f00 0001 E..5..@.@.I.....
0x0010: 7f00 0001 0fa2 b411 592e 42f7 b1d5 6e92 .....Y.B...n.
0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 48af .....~.H.
0x0030: 7e9d 48af 49 ~.H.I
15:59:34.838290 IP (tos 0x0, ttl 64, id 57006, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x65de (correct), seq 2983554706,
ack 1496204024, win 1025, options [nop,nop,TS val 2124236975 ecr 2124236975], length 0
0x0000: 4500 0034 deae 4000 4006 5e13 7f00 0001 E..4..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e92 592e 42f8 .....n.Y.B.
0x0020: 8010 0401 65de 0000 0101 080a 7e9d 48af ....e.....~.H.
0x0030: 7e9d 48af ~.H.
15:59:35.677658 IP (tos 0x0, ttl 64, id 57007, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x1c8d), seq
2983554706:2983554707, ack 1496204024, win 1025, options [nop,nop,TS val 2124237815 ecr
2124236975], length 1
0x0000: 4500 0035 deaf 4000 4006 5e11 7f00 0001 E..5..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e92 592e 42f8 .....n.Y.B.
0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 4bf7 .....~.K.
0x0030: 7e9d 48af 46 ~.H.F
15:59:35.677823 IP (tos 0x0, ttl 64, id 62177, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x1945), seq
1496204024:1496204025, ack 2983554707, win 1024, options [nop,nop,TS val 2124237815 ecr
2124237815], length 1
0x0000: 4500 0035 f2e1 4000 4006 49df 7f00 0001 E..5..@.@.I.....
0x0010: 7f00 0001 0fa2 b411 592e 42f8 b1d5 6e93 .....Y.B...n.
0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 4bf7 .....~.K.
0x0030: 7e9d 4bf7 46 ~.K.F
15:59:35.677835 IP (tos 0x0, ttl 64, id 57008, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x5f4c (correct), seq 2983554707,
ack 1496204025, win 1025, options [nop,nop,TS val 2124237815 ecr 2124237815], length 0
0x0000: 4500 0034 deb0 4000 4006 5e11 7f00 0001 E..4..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e93 592e 42f9 .....n.Y.B.
0x0020: 8010 0401 5f4c 0000 0101 080a 7e9d 4bf7 ...._L.....~.K.
0x0030: 7e9d 4bf7 ~.K.
15:59:37.390787 IP (tos 0x0, ttl 64, id 57009, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x1392), seq
2983554707:2983554708, ack 1496204025, win 1025, options [nop,nop,TS val 2124239528 ecr
2124237815], length 1
0x0000: 4500 0035 deb1 4000 4006 5e0f 7f00 0001 E..5..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e93 592e 42f9 .....n.Y.B.
0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 52a8 .....~.R.
0x0030: 7e9d 4bf7 45 ~.K.E
15:59:37.390959 IP (tos 0x0, ttl 64, id 62178, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x0ce1), seq
1496204025:1496204026, ack 2983554708, win 1024, options [nop,nop,TS val 2124239528 ecr
2124239528], length 1
0x0000: 4500 0035 f2e2 4000 4006 49de 7f00 0001 E..5..@.@.I.....
0x0010: 7f00 0001 0fa2 b411 592e 42f9 b1d5 6e94 .....Y.B...n.
0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 52a8 .....~.R.
0x0030: 7e9d 52a8 45 ~.R.E
15:59:37.390971 IP (tos 0x0, ttl 64, id 57010, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x51e8 (correct), seq 2983554708,
ack 1496204026, win 1025, options [nop,nop,TS val 2124239528 ecr 2124239528], length 0
0x0000: 4500 0034 deb2 4000 4006 5e0f 7f00 0001 E..4..@.@.^.....

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```

0x0010: 7f00 0001 b411 0fa2 b1d5 6e94 592e 42fa .....n.Y.B.
0x0020: 8010 0401 51e8 0000 0101 080a 7e9d 52a8 ....Q.....~.R.
0x0030: 7e9d 52a8 ~.R.
15:59:38.909859 IP (tos 0x0, ttl 64, id 57011, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [P.], cksum 0xfe29 (incorrect -> 0x41f0), seq
2983554708:2983554709, ack 1496204026, win 1025, options [nop,nop,TS val 2124241047 ecr
2124239528], length 1
0x0000: 4500 0035 deb3 4000 4006 5e0d 7f00 0001 E..5..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e94 592e 42fa .....n.Y.B.
0x0020: 8018 0401 fe29 0000 0101 080a 7e9d 5897 .....~.X.
0x0030: 7e9d 52a8 0a ~.R..
15:59:38.910013 IP (tos 0x0, ttl 64, id 62179, offset 0, flags [DF], proto TCP (6), length
53)
127.0.0.1.4002 > 127.0.0.1.46097: Flags [P.], cksum 0xfe29 (incorrect -> 0x3c01), seq
1496204026:1496204027, ack 2983554709, win 1024, options [nop,nop,TS val 2124241047 ecr
2124241047], length 1
0x0000: 4500 0035 f2e3 4000 4006 49dd 7f00 0001 E..5..@.@.I.....
0x0010: 7f00 0001 0fa2 b411 592e 42fa b1d5 6e95 .....Y.B...n.
0x0020: 8018 0400 fe29 0000 0101 080a 7e9d 5897 .....~.X.
0x0030: 7e9d 5897 0a ~.X..
15:59:38.910025 IP (tos 0x0, ttl 64, id 57012, offset 0, flags [DF], proto TCP (6), length
52)
127.0.0.1.46097 > 127.0.0.1.4002: Flags [.], cksum 0x4608 (correct), seq 2983554709,
ack 1496204027, win 1025, options [nop,nop,TS val 2124241047 ecr 2124241047], length 0
0x0000: 4500 0034 deb4 4000 4006 5e0d 7f00 0001 E..4..@.@.^.....
0x0010: 7f00 0001 b411 0fa2 b1d5 6e95 592e 42fb .....n.Y.B.
0x0020: 8010 0401 4608 0000 0101 080a 7e9d 5897 ....F.....~.X.
0x0030: 7e9d 5897 ~.X.

```


UDP SESSION

```
[root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t UDP
127.0.0.1 version1.0
protocolo UDP
>HELLO MASTER-UDP
>ECHO:HELLO MASTER-UDP
>WELCOME BACK MASTER-UDP
>ECHO:WELCOME BACK MASTER-UDP
```

```
[root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002
tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes
15:36:44.622770 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 45)
  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 10dc!] UDP, length 17
    0x0000:  4500 002d 0000 4000 4011 3cbe 7f00 0001  E...@.@.<.....
    0x0010:  7f00 0001 d29a 0fa2 0019 fe2c 4845 4c4c  .....HELL
    0x0020:  4f20 4d41 5354 4552 2d55 4450 0a          O.MASTER-UDP.
15:36:44.623666 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 45)
  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 10dc!] UDP, length 17
    0x0000:  4500 002d 0000 4000 4011 3cbe 7f00 0001  E...@.@.<.....
    0x0010:  7f00 0001 0fa2 d29a 0019 fe2c 4845 4c4c  .....HELL
    0x0020:  4f20 4d41 5354 4552 2d55 4450 0a          O.MASTER-UDP.
15:36:59.710676 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 52)
  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 56b6!] UDP, length 24
    0x0000:  4500 0034 0000 4000 4011 3cb7 7f00 0001  E..4..@.@.<.....
    0x0010:  7f00 0001 d29a 0fa2 0020 fe33 5745 4c43  .....3WELC
    0x0020:  4f4d 4520 4241 434b 204d 4153 5445 522d  OME.BACK.MASTER-
    0x0030:  5544 500a                                UDP.
15:36:59.710792 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 52)
  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 56b6!] UDP, length 24
    0x0000:  4500 0034 0000 4000 4011 3cb7 7f00 0001  E..4..@.@.<.....
    0x0010:  7f00 0001 0fa2 d29a 0020 fe33 5745 4c43  .....3WELC
    0x0020:  4f4d 4520 4241 434b 204d 4153 5445 522d  OME.BACK.MASTER-
    0x0030:  5544 500a                                UDP.
15:37:12.213805 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.53914 > 127.0.0.1.4002: [bad udp cksum 8017!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 d29a 0fa2 0009 felc 0a          .....
15:37:12.214002 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.4002 > 127.0.0.1.53914: [bad udp cksum 8017!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 0fa2 d29a 0009 felc 0a          .....
```

UDP SESSION CONTINUOUS

```
[root@localhost echo]# python echoClient.py --ip 127.0.0.1 -t UDP -c
127.0.0.1 version1.0
protocolo UDP
continuos
AABECC!!"
```

```
[root@localhost echo]# tcpdump -nnvvXSs 1514 -i lo port 4002
tcpdump: listening on lo, link-type EN10MB (Ethernet), capture size 1514 bytes
15:49:55.387772 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122c!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 8708 0fa2 0009 felc 41          .....A
15:49:55.388459 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122c!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 0fa2 8708 0009 felc 41          .....A
15:49:57.419949 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122b!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 8708 0fa2 0009 felc 42          .....B
15:49:57.420093 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
  127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122b!] UDP, length 1
    0x0000:  4500 001d 0000 4000 4011 3cce 7f00 0001  E.....@.@.<.....
    0x0010:  7f00 0001 0fa2 8708 0009 felc 42          .....B
```

```

15:49:58.859119 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 122a!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 8708 0fa2 0009 felc 43 .....C
15:49:58.859265 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 122a!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 0fa2 8708 0009 felc 43 .....C
15:50:02.579642 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 124c!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 8708 0fa2 0009 felc 21 .....!
15:50:02.579791 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 124c!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 0fa2 8708 0009 felc 21 .....!
15:50:04.259904 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.34568 > 127.0.0.1.4002: [bad udp cksum 124b!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 8708 0fa2 0009 felc 22 .....
15:50:04.260053 IP (tos 0x0, ttl 64, id 0, offset 0, flags [DF], proto UDP (17), length 29)
 127.0.0.1.4002 > 127.0.0.1.34568: [bad udp cksum 124b!] UDP, length 1
 0x0000: 4500 001d 0000 4000 4011 3cce 7f00 0001 E.....@.@.<.....
 0x0010: 7f00 0001 0fa2 8708 0009 felc 22 .....

```

Design Review

In this project we have tested different Python programming features and find some limitations.

- When passing options to python if we use a option with one character only, it should be used a “-” character. When doing a option with more than one character, we should use “—”. This was found on the “ip” address option.
- In the case of continuous mode, there was not a “Getch” function available. In order to overcome this limitation, we used a function “myGetch” that allowed to process one character at a time. This function worked on Linux.
- On the TCP server, we implemented threads in order to allow simultaneous connections from different clients. This wasn’t implemented on UDP server.
- On the non-continuous TCP and UDP client. We added a escape command “quit” so that we can close the socket on the client side.