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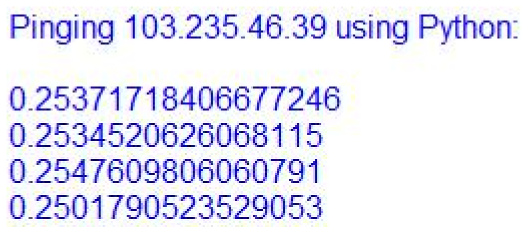
CS4793
Homework - Program 03

Python Code for Pinger:

```
import socket
import os
import sys
import struct
import time
import select
import binascii

ICMP_ECHO_REQUEST = 8
timeRTT = []
packageSent =0;
packageRev = 0;

def checksum(str):
        csum = 0
        countTo = (len(str) / 2) * 2
        count = 0
        while count < countTo:
                thisVal = str[count+1] * 256 + str[count]
                csum = csum + thisVal
                csum = csum & 0xffffffff
                count = count + 2

        if countTo < len(str):
                csum = csum + ord(str[len(str) - 1])
                csum = csum & 0xffffffff
                csum = (csum >> 16) + (csum & 0xffff)
        csum = csum + (csum >> 16)
        answer = ~csum
        answer = answer & 0xffff
        answer = answer >> 8 | (answer << 8 & 0xff00)
        return answer

def receiveOnePing(mySocket, ID, timeout, destAddr):
        global packageRev, timeRTT
        timeLeft = timeout
        while 1:
                startedSelect = time.time()
                whatReady = select.select([mySocket], [], [], timeLeft)
                howLongInSelect = (time.time() - startedSelect)
                if whatReady[0] == []: # Timeout
                        return ("Request timed out. Not Ready")
                timeReceived = time.time()
                recPacket, addr = mySocket.recvfrom(1024)
#Fill in start
#Fetch the ICMP header from the IP packet
                icmpHeader = recPacket[20:28]
                requestType, code, revChecksum, revId, revSequence = struct.unpack('bbHHh',icmpHeader)
                if ID == revId:
```

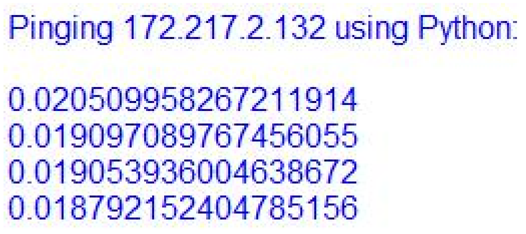
```
                bytesInDouble = struct.calcsize('d')
                timeData = struct.unpack('d',recPacket[28:28 + bytesInDouble])[0]
                timeRTT.append(timeReceived - timeData)
                packageRev += 1
                return timeReceived - timeData
            else:
                return ("Mismatched!")
  #Fill in end
            timeLeft = timeLeft - howLongInSelect
            if timeLeft <= 0:
                return ("Request timed out. Waited")

def sendOnePing(mySocket, destAddr, ID):
# Header is type (8), code (8), checksum (16), id (16), sequence (16)
        myChecksum = 0
# Make a dummy header with a 0 checksum.
# struct -- Interpret strings as packed binary data
        header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, myChecksum, ID, 1)
        data = struct.pack("d", time.time())
# Calculate the checksum on the data and the dummy header.
        myChecksum = checksum(header + data)

# Get the right checksum, and put in the header
        if sys.platform == 'darwin':
            myChecksum = socket.htons(myChecksum) & 0xffff
#Convert 16-bit integers from host to network byte order.
        else:
            myChecksum = socket.htons(myChecksum)

        header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, myChecksum, ID, 1)
        packet = header + data

        mySocket.sendto(packet, (destAddr, 1)) # AF_INET address must be tuple, not str
#Both LISTS and TUPLES consist of a number of objects
#which can be referenced by their position number within the object

def doOnePing(destAddr, timeout):
        icmp = socket.getprotobyname("icmp")
#SOCK_RAW is a powerful socket type. For more details see: http://sock-raw.org/papers/sock_raw
#Fill in start
#Create Socket here
#        try:
        mySocket = socket.socket(socket.AF_INET, socket.SOCK_RAW, icmp)
#        except socket.error as errno:
#            if errno == 1:
#                raise socket.error(msg)
#Fill in end
        myID = os.getpid() & 0xFFFF #Return the current process i
        sendOnePing(mySocket, destAddr, myID)
        delay = receiveOnePing(mySocket, myID, timeout, destAddr)

        mySocket.close()
        return delay

def ping(host, timeout=1):
#timeout=1 means: If one second goes by without a reply from the server,
#the client assumes that either the client’s ping or the server’s pong is lost
```

```
        dest = socket.gethostbyname(host)
        print ("Pinging " + dest + " using Python:")
        print ("")
#Send ping requests to a server separated by approximately one second
        while 1 :
                delay = doOnePing(dest, timeout)
                print (delay)
                time.sleep(1)# one second
        return delay

ping("127.0.0.1")
#ping("www.baidu.com")
#China
#ping("www.google.com")
#U.S.
#ping ("Thelocal.de")
#Europe
#ping("www.pichunter.com")
#Africa
```



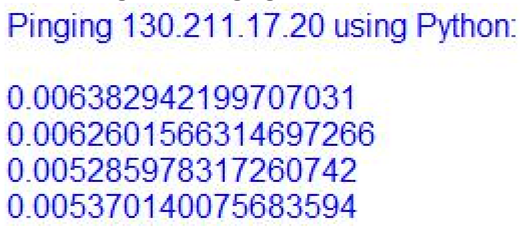
```
Pinging 103.235.46.39 using Python:

0.25371718406677246
0.2534520626068115
0.2547609806060791
0.2501790523529053
```

Figure 1. Pinging Asia



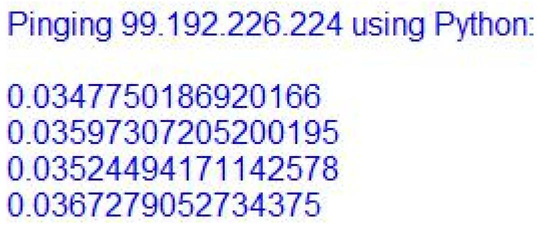
```
Pinging 172.217.2.132 using Python:

0.020509958267211914
0.019097089767456055
0.019053936004638672
0.018792152404785156
```

Figure 2. Pinging North America



```
Pinging 130.211.17.20 using Python:

0.006382942199707031
0.0062601566314697266
0.005285978317260742
0.005370140075683594
```

Figure 3. Pinging Europe



```
Pinging 99.192.226.224 using Python:

0.0347750186920166
0.03597307205200195
0.03524494171142578
0.0367279052734375
```

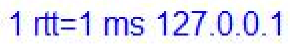
Figure 4. Pinging Africa

Python Code for Trace- Route:

```
import socket
import os
import sys
import struct
import time
import select
import binascii

label = '*************{0}*************'
ICMP_ECHO_REQUEST = 8
MAX_HOPS = 30
TIMEOUT = 2.0
TRIES = 2
# The packet that we shall send to each router along the path is the ICMP echo
# request packet, which is exactly what we had used in the ICMP ping exercise.
# We shall use the same packet that we built in the Ping exercise
def checksum(str):
# In this function we make the checksum of our packet
    csum = 0
    countTo = (len(str) / 2) * 2
    count = 0
    while count < countTo:

        thisVal = str[count+1] * 256 + str[count]
        csum = csum + thisVal
        csum = csum & 0xffffffff
        count = count + 2
    if countTo < len(str):
        csum = csum + ord(str[len(str) - 1])
        csum = csum & 0xffffffff
    csum = (csum >> 16) + (csum & 0xffff)
    csum = csum + (csum >> 16)
    answer = ~csum
    answer = answer & 0xffff
    answer = answer >> 8 | (answer << 8 & 0xff00)
    return answer

def build_packet():
    #create header and append check sum, Header is type (8), code (8), checksum (16), id (16), seq
(16)
    myChecksum = 0
    myID = os.getpid() & 0xFFFF #Return the current process i
    # Make a dummy header with a 0 checksum.
    # struct -- Interpret strings as packed binary data
    header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, myChecksum, myID, 1)
    data = struct.pack("d", time.time())
    # Calculate the checksum on the data and the dummy header.
    myChecksum = checksum(header + data)
    # Get the right checksum, and put in the header
    if sys.platform == 'darwin':
        myChecksum = socket.htons(myChecksum) & 0xffff
        #Convert 16-bit integers from host to network byte order.
    else:
        myChecksum = socket.htons(myChecksum)
    header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, myChecksum, myID, 1)
```

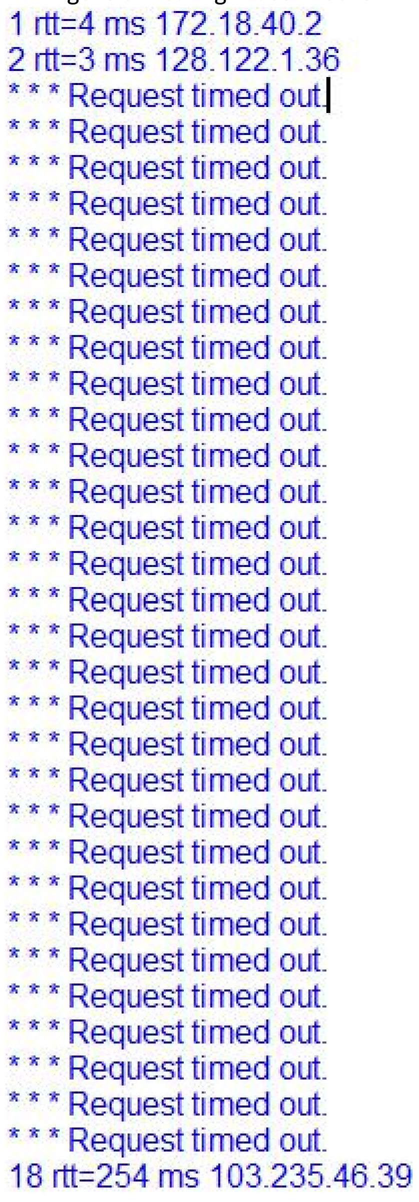
```
        packet = header + data
        return packet

def get_route(hostname):
        timeLeft = TIMEOUT
        for ttl in range(1,MAX_HOPS):
                for tries in range(TRIES):
                        destAddr = socket.gethostbyname(hostname)

                        #Fill in start
                        # Make a raw socket named mySocket
                        icmp = socket.getprotobyname("icmp")
                        mySocket = socket.socket(socket.AF_INET, socket.SOCK_RAW, icmp)
                        #Fill in end

                        mySocket.setsockopt(socket.IPPROTO_IP, socket.IP_TTL, struct.pack('I', ttl))
                        mySocket.settimeout(TIMEOUT)
                        try:
                                d = build_packet()
                                mySocket.sendto(d, (hostname, 0))
                                t= time.time()
                                startedSelect = time.time()
                                whatReady = select.select([mySocket], [], [], timeLeft)
                                howLongInSelect = (time.time() - startedSelect)
                                if whatReady[0] == []: # Timeout
                                        print( " * * * Request timed out.")
                                recvPacket, addr = mySocket.recvfrom(1024)
                                timeReceived = time.time()
                                timeLeft = timeLeft - howLongInSelect
                                if timeLeft <= 0:
                                        print (" * * * Request timed out.")
                        except socket.timeout:
                                continue
                        else:
                                #Fill in start
                                #Fetch the icmp type from the IP packet
                                icmpHeaderContent = recvPacket[20:28]
                                type, code, checksum, packetID, sequence = struct.unpack("bbHHh",
icmpHeaderContent)
                                #Fill in end
                                if type == 11:
                                        bytes = struct.calcsize("d")
                                        timeSent = struct.unpack("d", recvPacket[28:28 + bytes])[0]
                                        print (" %d rtt=%.0f ms %s" %(ttl, (timeReceived -t)*1000, addr[0]))
                                elif type == 3:
                                        bytes = struct.calcsize("d")
                                        timeSent = struct.unpack("d", recvPacket[28:28 + bytes])[0]
                                        print (" %d rtt=%.0f ms %s" %(ttl, (timeReceived-t)*1000, addr[0]))
                                elif type == 0:
                                        bytes = struct.calcsize("d")
                                        timeSent = struct.unpack("d", recvPacket[28:28 + bytes])[0]
                                        print (" %d rtt=%.0f ms %s" %(ttl, (timeReceived - timeSent)*1000, addr[0]))
                                        return
                                else:
                                        print ("error")
                                break
                        finally:
```

```
                    mySocket.close()
get_route("127.0.0.1")
get_route("www.baidu.com")
#China
get_route("www.google.com")
#U.S.
get_route ("Thelocal.de")
#Europe
get_route("www.pichunter.com")
#Africa
```



```
1 rtt=1 ms 127.0.0.1
```

Figure 5. Testing Tracer Route



```
1 rtt=4 ms 172.18.40.2
2 rtt=3 ms 128.122.1.36
* * * Request timed out.
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* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
18 rtt=254 ms 103.235.46.39
```
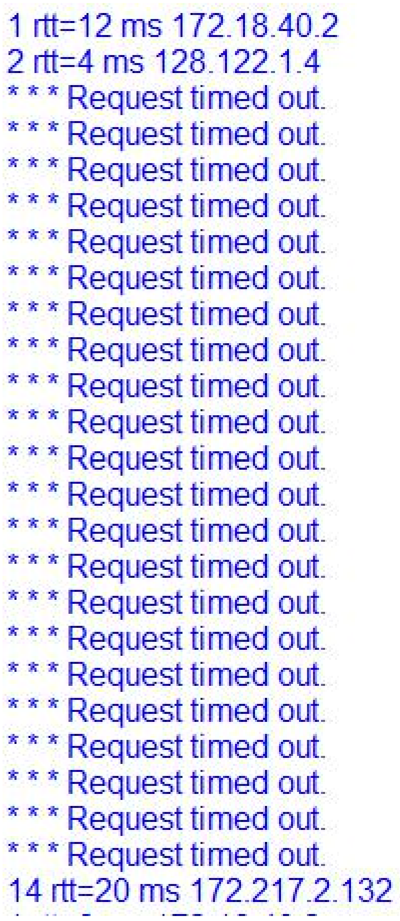

Figure 6. Tracing Asia



```
1 rtt=12 ms 172.18.40.2
2 rtt=4 ms 128.122.1.4
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
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* * * Request timed out.
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* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
14 rtt=20 ms 172.217.2.132
```
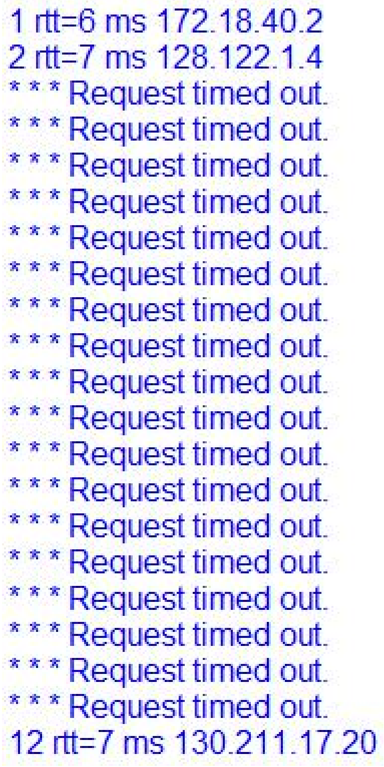

Figure 7. Tracing North America



```
1 rtt=6 ms 172.18.40.2
2 rtt=7 ms 128.122.1.4
* * * Request timed out.
* * * Request timed out.
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* * * Request timed out.
* * * Request timed out.
12 rtt=7 ms 130.211.17.20
```
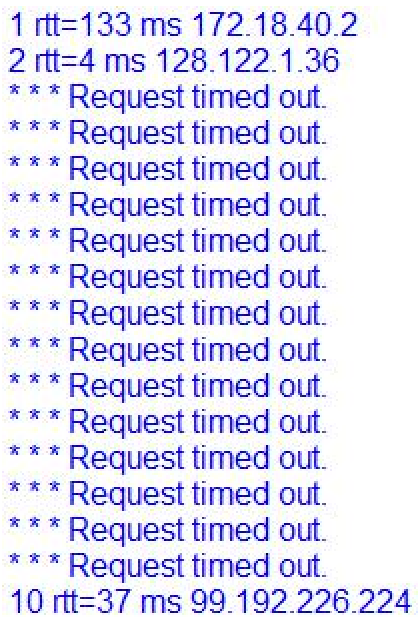

Figure 8. Tracing Europe



```
1 rtt=133 ms 172.18.40.2
2 rtt=4 ms 128.122.1.36
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
* * * Request timed out.
10 rtt=37 ms 99.192.226.224
```

Figure 9. Tracing Africa