Names: Kevin Diaz (1214583240),
Venkatesh Yaganti (1223441505)
Group: 29
Class: CSE434
Instructor: Syrotiuk

Lab 3

Exercise 1.1:

1. What is the output on PC A when the ping commands are issued?

```
[root@hostA ~]
$ ping -c 5 10.0.1.21
PING 10.0.1.21 (10.0.1.21) 56(84) bytes of data.
64 bytes from 10.0.1.21: icmp_seq=1 ttl=64 time=0.546 ms
64 bytes from 10.0.1.21: icmp_seq=2 ttl=64 time=0.175 ms
64 bytes from 10.0.1.21: icmp_seq=3 ttl=64 time=0.172 ms
64 bytes from 10.0.1.21: icmp_seq=4 ttl=64 time=0.158 ms
64 bytes from 10.0.1.21: icmp_seq=5 ttl=64 time=0.162 ms

--- 10.0.1.21 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4000ms
rtt min/avg/max/mdev = 0.158/0.242/0.546/0.152 ms

[root@hostA ~]
$ ping -c 5 10.0.2.1
connect: Network is unreachable

[root@hostA ~]
$ ping -c 5 10.0.3.41
connect: Network is unreachable

[root@hostA ~]
$
```

2. Which packets, if any, are captured by wireshark?

No.	Time	Source	Destination	Protocol	Length	Info
1 0.000000000		00:13:3b:21:78:4d	ff:ff:ff:ff:ff:ff	ARP	42	Who has 10.0.1.21? Tell 10.0.1.11
2 0.000146914		00:13:3b:21:78:01	00:13:3b:21:78:4d	ARP	60	10.0.1.21 is at 00:13:3b:21:78:01
3 0.000159912		10.0.1.11	10.0.1.21	ICMP	98	Echo (ping) request id=0x7d0d, seq=1/256, ttl=64
4 0.000361177		10.0.1.21	10.0.1.11	ICMP	98	Echo (ping) reply id=0x7d0d, seq=1/256, ttl=64
5 1.000023439		10.0.1.11	10.0.1.21	ICMP	98	Echo (ping) request id=0x7d0d, seq=2/512, ttl=64
6 1.000181018		10.0.1.21	10.0.1.11	ICMP	98	Echo (ping) reply id=0x7d0d, seq=2/512, ttl=64
7 2.000014099		10.0.1.11	10.0.1.21	ICMP	98	Echo (ping) request id=0x7d0d, seq=3/768, ttl=64
8 2.000168593		10.0.1.21	10.0.1.11	ICMP	98	Echo (ping) reply id=0x7d0d, seq=3/768, ttl=64
9 3.000022298		10.0.1.11	10.0.1.21	ICMP	98	Echo (ping) request id=0x7d0d, seq=4/1024, ttl=64
10 3.000163273		10.0.1.21	10.0.1.11	ICMP	98	Echo (ping) reply id=0x7d0d, seq=4/1024, ttl=64
11 4.000022829		10.0.1.11	10.0.1.21	ICMP	98	Echo (ping) request id=0x7d0d, seq=5/1280, ttl=64
12 4.000167913		10.0.1.21	10.0.1.11	ICMP	98	Echo (ping) reply id=0x7d0d, seq=5/1280, ttl=64
13 5.000241771		00:13:3b:21:78:01	00:13:3b:21:78:4d	ARP	60	Who has 10.0.1.11? Tell 10.0.1.21
14 5.000254326		00:13:3b:21:78:4d	00:13:3b:21:78:01	ARP	42	10.0.1.11 is at 00:13:3b:21:78:4d

A mix of ICMP and ARP packets are captured by wireshark.

3. Do you observe any ARP or ICMP packets? If so, what do they indicate?

Yes, they indicate that a ping is being sent out with the ICMP requests/replies. The ARP indicate that there is an unknown address that is being queried for in the network,

4. Which destinations are not reachable? Explain.

Destinations 10.0.2.1 and 10.0.3.41 are not reachable at this given time due to the fact that the router has not yet had its interfaces configured properly for that IP address of 10.0.2.1 and therefore it can even reach PC D at 10.0.3.41. This along with the fact that PC B has not yet been set to "1" in the IP forwarding setting.

Exercise 1.2:

1. Include the saved output of the routing tables in step 3 in §1.3.

PC A:

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
10.0.2.0        10.0.1.21       255.255.255.0   UG      0 0            0 p2p1
10.0.3.0        10.0.1.21       255.255.255.0   UG      0 0            0 p2p1
```

PC B:

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        10.0.2.1        255.255.255.0   UG      0 0            0 p2p2
10.0.1.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
10.0.2.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p2
10.0.3.0        10.0.2.1        255.255.255.0   UG      0 0            0 p2p2
```

PC D:

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        10.0.3.1        255.255.255.0   UG      0 0            0 p2p1
10.0.2.0        10.0.3.1        255.255.255.0   UG      0 0            0 p2p1
10.0.3.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
```

2. Explain the entries in the routing tables and discuss the values of the fields for each entry.

The destination is just where the net where the packet is meant to be sent, with the gateway being the interface to send the packet out of its local network. The genmask is simply the netmask. The flag U means the interface is to be used up and the flag G means the route uses a gateway as specified. MSS is maximum segment size, the window is the maximum amount of data the system will accept in a single burst, irtt stands for initial round trip time, and Iface is simply the interface name. The zero values in some of these fields are just the set defaults.

Exercise 1.3:

For the lab report, include the output from Step 3 of §1.4.3.

<u>Show Interfaces:</u>

```
Router#show interfaces
FastEthernet0/0 is up, line protocol is up
  Hardware is MV96340 Ethernet, address is 001b.2a49.2e08 (bia 001b.2a49.2e08)
  Internet address is 10.0.2.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:01:53, output 00:00:03, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     99 packets input, 9530 bytes
     Received 1 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     334 packets output, 33154 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
FastEthernet0/1 is up, line protocol is up
  Hardware is MV96340 Ethernet, address is 001b.2a49.2e09 (bia 001b.2a49.2e09)
  Internet address is 10.0.3.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:01:58, output 00:00:06, output hang never
```

```
  Last input 00:01:58, output 00:00:06, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     15 packets input, 1280 bytes
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     233 packets output, 20986 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
Serial0/0/0 is administratively down, line protocol is down
  Hardware is GT96K Serial
  MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  CRC checking enabled
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
```

```
 5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    0 unknown protocol drops
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
    DCD=down  DSR=down  DTR=down  RTS=down  CTS=down

Serial0/0/1 is administratively down, line protocol is down
  Hardware is GT96K Serial
  MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  CRC checking enabled
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    0 unknown protocol drops
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
    DCD=down  DSR=down  DTR=down  RTS=down  CTS=down
```

Show Running-Config:

```
Router# show running-config
Building configuration...

Current configuration : 801 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
!
ip cef
!
!
multilink bundle-name authenticated
!
!
!
archive
 log config
  hidekeys
!
!
!
!
!
interface FastEthernet0/0
 ip address 10.0.2.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 10.0.3.1 255.255.255.0
 duplex auto
 speed auto
!
interface Serial0/0/0
 no ip address
 shutdown
```

```
interface Serial0/0/0
 no ip address
 shutdown
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 shutdown
 clock rate 2000000
!
ip forward-protocol nd
ip route 10.0.1.0 255.255.255.0 10.0.2.22
!
!
no ip http server
!
!
!
control-plane
!
!
line con 0
line aux 0
line vty 0 4
 login
!
scheduler allocate 20000 1000
!
end

Router#
```

Exercise 1.4:
1. Include the saved output of the routing table from Steps 1 and 2 of §1.4.4.
Show IP Route:

```
Router#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
C       10.0.3.0 is directly connected, FastEthernet0/1
```

Adding Route Entry:

```
Router(config)#ip route 10.0.1.0 255.255.255.0 10.0.2.22
Router(config)#show ip route
                 ^
```

2. Explain the fields of the routing table entries of the Cisco router.

The output is essentially stating that the router is directly connected to the networks 10.0.2.0/24 and 10.0.3.0/24 directly via it's ethernet links as set up prior. Those two networks are the subnet for the 10.0.0.0/24 network.

3. Explain how the routing table has changed from Step 1 to Step 3

Show IP Route:

```
Router#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
C       10.0.3.0 is directly connected, FastEthernet0/1
S       10.0.1.0 [1/0] via 10.0.2.22
```

The IP Route rule was added for a static connection to reach the network 10.0.1.0/24 via the interface 10.0.2.22 which connects a switch to PC B, which in this case B will be able to forward packets in the 10.0.1.0/24 network.

Exercise 1.5:

For the lab report, use the wireshark output and the previously saved routing table (in Exercise 1.4) to explain the operation of traceroute.

Routing Table PC A:

```
[root@hostA ~]
$ netstat -rn
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
10.0.2.0        10.0.1.21       255.255.255.0   UG      0 0            0 p2p1
10.0.3.0        10.0.1.21       255.255.255.0   UG      0 0            0 p2p1
```

Routing Table PC B:

```
[root@hostB ~]
$ netstat -rn
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
10.0.2.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p2
10.0.3.0        10.0.2.1        255.255.255.0   UG      0 0            0 p2p2
```

Routing Table PC D:

```
[root@hostD ~]
$ netstat -rn
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt Iface
10.0.1.0        10.0.3.1        255.255.255.0   UG      0 0            0 p2p1
10.0.2.0        10.0.3.1        255.255.255.0   UG      0 0            0 p2p1
10.0.3.0        0.0.0.0         255.255.255.0   U       0 0            0 p2p1
```

Routing Table Router A:

```
Router#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
C       10.0.3.0 is directly connected, FastEthernet0/1
S       10.0.1.0 [1/0] via 10.0.2.22
Router#
```

Traceroute:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.0.1.11	10.0.3.41	UDP	74	Source port: 56391 Destination port: 33434
2	0.000027174	10.0.1.11	10.0.3.41	UDP	74	Source port: 46687 Destination port: 33435
3	0.000041314	10.0.1.11	10.0.3.41	UDP	74	Source port: 55328 Destination port: 33436
4	0.000054346	10.0.1.11	10.0.3.41	UDP	74	Source port: 57956 Destination port: 33437
5	0.000067197	10.0.1.11	10.0.3.41	UDP	74	Source port: 49629 Destination port: 33438
6	0.000079882	10.0.1.11	10.0.3.41	UDP	74	Source port: 36044 Destination port: 33439
7	0.000092505	10.0.1.11	10.0.3.41	UDP	74	Source port: 40329 Destination port: 33440
8	0.000125229	10.0.1.11	10.0.3.41	UDP	74	Source port: 48705 Destination port: 33441
9	0.000139727	10.0.1.11	10.0.3.41	UDP	74	Source port: 49288 Destination port: 33442
10	0.000154521	10.0.1.11	10.0.3.41	UDP	74	Source port: 55365 Destination port: 33443
11	0.000167324	10.0.1.11	10.0.3.41	UDP	74	Source port: 38379 Destination port: 33444
12	0.000181599	10.0.1.11	10.0.3.41	UDP	74	Source port: 44267 Destination port: 33445
13	0.000195784	10.0.1.11	10.0.3.41	UDP	74	Source port: 42897 Destination port: 33446
14	0.000210006	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
15	0.000220793	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
16	0.000225225	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
17	0.000250969	10.0.1.11	10.0.3.41	UDP	74	Source port: 60811 Destination port: 33447
18	0.000268080	10.0.1.11	10.0.3.41	UDP	74	Source port: 55684 Destination port: 33448
19	0.000281619	10.0.1.11	10.0.3.41	UDP	74	Source port: 59058 Destination port: 33449
20	0.000787207	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
21	0.000797789	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
22	0.000800392	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
23	0.000811490	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
24	0.000824286	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)

No.	Time	Source	Destination	Protocol	Length	Info
10	0.000154521	10.0.1.11	10.0.3.41	UDP	74	Source port: 55365 Destination port: 33443
11	0.000167324	10.0.1.11	10.0.3.41	UDP	74	Source port: 38379 Destination port: 33444
12	0.000181599	10.0.1.11	10.0.3.41	UDP	74	Source port: 44267 Destination port: 33445
13	0.000195784	10.0.1.11	10.0.3.41	UDP	74	Source port: 42897 Destination port: 33446
14	0.000210006	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
15	0.000220793	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
16	0.000225225	10.0.1.21	10.0.1.11	ICMP	102	Time-to-live exceeded (Time to live exceeded in transit)
17	0.000250969	10.0.1.11	10.0.3.41	UDP	74	Source port: 60811 Destination port: 33447
18	0.000268080	10.0.1.11	10.0.3.41	UDP	74	Source port: 55684 Destination port: 33448
19	0.000281619	10.0.1.11	10.0.3.41	UDP	74	Source port: 59058 Destination port: 33449
20	0.000787207	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
21	0.000797789	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
22	0.000800392	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
23	0.000811490	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
24	0.000824286	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
25	0.000835671	10.0.3.41	10.0.1.11	ICMP	102	Destination unreachable (Port unreachable)
26	0.001092349	10.0.1.11	10.0.3.41	UDP	74	Source port: 50751 Destination port: 33450
27	0.001108989	10.0.1.11	10.0.3.41	UDP	74	Source port: 60358 Destination port: 33451
28	0.001121214	10.0.1.11	10.0.3.41	UDP	74	Source port: 53862 Destination port: 33452
29	0.001203128	10.0.2.1	10.0.1.11	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
30	0.001576354	10.0.2.1	10.0.1.11	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
31	0.001768299	10.0.2.1	10.0.1.11	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
32	4.999331459	00:13:3b:21:78:4d	00:13:3b:21:78:01	ARP	42	Who has 10.0.1.21? Tell 10.0.1.11
33	4.999547423	00:13:3b:21:78:01	00:13:3b:21:78:4d	ARP	60	10.0.1.21 is at 00:13:3b:21:78:01

Exercise 1.6:

PC A Wireshark:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.21? Tell 10.0.1.11
2	0.000229788	SpeedDra_21:78:01	SpeedDra_21:78:4d	ARP	60	10.0.1.21 is at 00:13:3b:21:78:01
3	0.000240437	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=1/256, ttl=64 (reply in 4)
4	0.003584743	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=1/256, ttl=62 (request in 3)
5	1.000728022	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=2/512, ttl=64 (reply in 6)
6	1.001333022	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=2/512, ttl=62 (request in 5)
7	2.001035051	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=3/768, ttl=64 (reply in 8)
8	2.001652260	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=3/768, ttl=62 (request in 7)
9	3.001020577	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=4/1024, ttl=64 (reply in 10)
10	3.001606985	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=4/1024, ttl=62 (request in 9)
11	4.001018817	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=5/1280, ttl=64 (reply in 12)
12	4.001603168	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=5/1280, ttl=62 (request in 11)
13	5.003305661	SpeedDra_21:78:01	SpeedDra_21:78:4d	ARP	60	Who has 10.0.1.11? Tell 10.0.1.21
14	5.003318751	SpeedDra_21:78:4d	SpeedDra_21:78:01	ARP	42	10.0.1.11 is at 00:13:3b:21:78:4d

The ICMP Echo Request messages contained 10.0.1.11 as source and 10.0.3.41 as destination.

PC D Wireshark:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	Cisco_49:2e:09	CDP/VTP/DTP/PAgP/UD…	CDP	357	Device ID: Router Port ID: FastEthernet0/1
2	1.628929160	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=1/256, ttl=62 (reply in 5)
3	1.629641281	SpeedDra_11:3d:80	Broadcast	ARP	42	Who has 10.0.3.1? Tell 10.0.3.41
4	1.630186490	Cisco_49:2e:09	SpeedDra_11:3d:80	ARP	60	10.0.3.1 is at 00:1b:2a:49:2e:09
5	1.630196866	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=1/256, ttl=64 (request in 2)
6	2.627979941	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=2/512, ttl=62 (reply in 7)
7	2.627998828	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=2/512, ttl=64 (request in 6)
8	3.628292260	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=3/768, ttl=62 (reply in 9)
9	3.628312015	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=3/768, ttl=64 (request in 8)
10	4.628265728	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=4/1024, ttl=62 (reply in 11)
11	4.628285187	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=4/1024, ttl=64 (request in 10)
12	5.628262784	10.0.1.11	10.0.3.41	ICMP	98	Echo (ping) request id=0x4b1d, seq=5/1280, ttl=62 (reply in 13)
13	5.628281766	10.0.3.41	10.0.1.11	ICMP	98	Echo (ping) reply id=0x4b1d, seq=5/1280, ttl=64 (request in 12)
14	10.620109795	Cisco_49:2e:09	DEC-MOP-Remote-Cons…	0x6002	77	DEC DNA Remote Console

The ICMP Echo Request messages contained 10.0.3.41 as source and 10.0.1.11 as destination.

As the datagram is transferred from source to destination, the source and destination header are unchanged when going through switches. When it reaches the router, the source MAC address is changed from hop to hop.

Exercise 1.7:

1. Use the saved output to indicate the number of matches for each of the preceding IP addresses.

There are no matches for each of the IP addresses because none of the gateways with IP addresses 10.0.1.61, 10.0.1.71, or 10.0.1.81 exist.

2. Explain how PC A resolves multiple matches in the routing table.

PC A will attempt to resolve multiple matches by going with the most exact fitting destination as stated in the routing table. For example, it will attempt to use the gateway 10.0.1.81 when pinging 10.0.3.9 because the netmask is 255.255.255.255. Then for 10.0.3.14 the next closest exact match would be with 10.0.3.0 with gateway 10.0.1.61. Lastly, the pinged IP address of 10.0.4.1 does not match any so it will abide by the destination rule from 10.0.0.0 and gateway 10.0.1.71.

When it comes down to it, the best route is the one with the greatest number of matching bits to the IP address.

3. Include only relevant output data in your report to support your analysis of the data.

```
[root@hostA ~]
$ route add -net 10.0.0.0 netmask 255.255.0.0 gw 10.0.1.71

[root@hostA ~]
$ route add -host 10.0.3.9 gw 10.0.1.81

[root@hostA ~]
$ route add -net 10.0.3.0 netmask 255.255.255.0 gw 10.0.1.61

[root@hostA ~]
$ netstat -rn
Kernel IP routing table
Destination     Gateway          Genmask          Flags   MSS Window   irtt Iface
10.0.3.9        10.0.1.81        255.255.255.255 UGH        0 0            0 p2p1
10.0.1.0        0.0.0.0          255.255.255.0   U          0 0            0 p2p1
10.0.2.0        10.0.1.21        255.255.255.0   UG         0 0            0 p2p1
10.0.3.0        10.0.1.61        255.255.255.0   UG         0 0            0 p2p1
10.0.3.0        10.0.1.21        255.255.255.0   UG         0 0            0 p2p1
10.0.0.0        10.0.1.71        255.255.0.0     UG         0 0            0 p2p1
```

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.81? Tell 10.0.1.11
2	0.998990559	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.81? Tell 10.0.1.11
3	1.998991185	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.81? Tell 10.0.1.11
4	19.087049662	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.61? Tell 10.0.1.11
5	20.087063272	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.61? Tell 10.0.1.11
6	21.087054399	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.61? Tell 10.0.1.11
7	32.207048915	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.71? Tell 10.0.1.11
8	33.207055279	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.71? Tell 10.0.1.11
9	34.207050996	SpeedDra_21:78:4d	Broadcast	ARP	42	Who has 10.0.1.71? Tell 10.0.1.11

Exercise 1.8:

Wireshark PC A:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=1/256, ttl=64 (no response found!)
2	0.001026515	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
3	1.001149786	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=2/512, ttl=64 (no response found!)
4	1.002196840	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
5	2.002342784	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=3/768, ttl=64 (no response found!)
6	2.003404445	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
7	3.002632113	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=4/1024, ttl=64 (no response found!)
8	3.003686918	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
9	4.003792051	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=5/1280, ttl=64 (no response found!)
10	4.004842710	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
11	4.999579444	SpeedDra_21:78:4d	SpeedDra_21:78:01	ARP	42	Who has 10.0.1.21? Tell 10.0.1.11
12	4.999807138	SpeedDra_21:78:01	SpeedDra_21:78:4d	ARP	60	10.0.1.21 is at 00:13:3b:21:78:01

Wireshark PC B:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=1/256, ttl=64 (no response found!)
2	0.000811680	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
3	1.001143775	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=2/512, ttl=64 (no response found!)
4	1.001954160	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
5	2.002336390	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=3/768, ttl=64 (no response found!)
6	2.003142567	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
7	3.002620620	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=4/1024, ttl=64 (no response found!)
8	3.003438489	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
9	4.003777240	10.0.1.11	10.0.10.110	ICMP	98	Echo (ping) request id=0x2821, seq=5/1280, ttl=64 (no response found!)
10	4.004587169	10.0.2.1	10.0.1.11	ICMP	70	Destination unreachable (Host unreachable)
11	4.999574423	SpeedDra_21:78:4d	SpeedDra_21:78:01	ARP	60	Who has 10.0.1.21? Tell 10.0.1.11
12	4.999588047	SpeedDra_21:78:01	SpeedDra_21:78:4d	ARP	42	10.0.1.21 is at 00:13:3b:21:78:01

1. What is the output on PC A when the ping command is issued?

It states the destination is unreachable.

2. Determine how far the ICMP Echo Request message travels?

The ICMP Echo Request, as shown above, only manages to reach PC B especially given that it is the last host on the network 10.0.1.0/24 that could contain knowledge of where 10.0.10.110 is located.

3. Which, if any, ICMP Echo Reply message returns to PC A?

The ICMP Echo Reply message is not sent, the only output is that the destination/host is unreachable. There is an ARP reply, but that is just the response with where PC B is located.