

1.

a.

203.68.175.162

b.

01100100 01110010 00010100 01101011

c.

$2^{14} - 2$

d.

129.17.129.96/30
129.17.129.100/30
129.17.129.104/30
129.17.129.108/30

2.

Prefix	Interface	Number of host addresses
1	0	$128 - 4 - 28 - 2 = 94$
101	1	$28 - 2 = 26$
101110	2	$4 - 2 = 2$
Otherwise	3	$128 - 2 = 126$

The -2 for each interface is for the special addresses of all 0's and all 1's, which are not host addresses.

3.

Step	N	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)
0	A	2,A	2,A	4,A	Infinity	Infinity
1	A,B		2,A	4,A	12,B	6,B
2	A,B,C			3,C	12,B	6,B
3	A,B,C,D				7,D	6,B
4	A,B,C,D,E					6,B
5	A,B,C,D,E,F					

The shortest path from A to F is A->B->F.

The cost of that path is 6.

4.

```
C:\Windows\system32\cmd.exe
C:\Users\David Schoder>ipconfig /release

Windows IP Configuration

No operation can be performed on Local Area Connection 2 while it has its media disconnected.
No operation can be performed on Wireless Network Connection 3 while it has its media disconnected.
No operation can be performed on Wireless Network Connection 2 while it has its media disconnected.
No operation can be performed on Wireless Network Connection while it has its media disconnected.
No operation can be performed on Bluetooth Network Connection while it has its media disconnected.
An error occurred while releasing interface Local Area Connection : An address has not yet been associated with the network endpoint.

C:\Users\David Schoder>ipconfig /renew

Windows IP Configuration

No operation can be performed on Local Area Connection 2 while it has its media disconnected.
No operation can be performed on Wireless Network Connection 3 while it has its media disconnected.
No operation can be performed on Wireless Network Connection 2 while it has its media disconnected.
No operation can be performed on Wireless Network Connection while it has its media disconnected.
No operation can be performed on Bluetooth Network Connection while it has its media disconnected.

Ethernet adapter Local Area Connection 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Wireless LAN adapter Wireless Network Connection 3:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Wireless LAN adapter Wireless Network Connection 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Wireless LAN adapter Wireless Network Connection:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Ethernet adapter Bluetooth Network Connection:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : resnet.umn.edu
    IPv6 Address. . . . . : 2607:ea00:105:c03:647a:b219:8b73:de3f
    Temporary IPv6 Address. . . . . : 2607:ea00:105:c03:87e:cf87:aa66:ff61
    Link-local IPv6 Address . . . . . : fe80::647a:b219:8b73:de3f%11
    IPv4 Address. . . . . : 128.101.182.115
    Subnet Mask . . . . . : 255.255.255.128
    Default Gateway . . . . . : fe80::7ead:74ff:fe92:58c0%11
                                128.101.182.126
```

Wireshark 1.12.8 (v1.12.8-0-g5b6e543 from master-1.12)

Filter: bootp

No.	Time	Source	Destination	Protocol	Length	Info
159	15.6103380	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction
163	16.6152610	128.101.182.126	255.255.255.255	DHCP	342	DHCP Offer - Transaction
170	18.6154030	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction
172	18.6351470	128.101.182.126	255.255.255.255	DHCP	342	DHCP Offer - Transaction
228	26.2447130	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction
230	26.2490360	128.101.182.126	255.255.255.255	DHCP	342	DHCP Offer - Transaction
231	26.2492760	0.0.0.0	255.255.255.255	DHCP	362	DHCP Request - Transaction
232	26.2527020	128.101.182.126	255.255.255.255	DHCP	342	DHCP ACK - Transaction
376	27.2525050	128.101.182.126	255.255.255.255	DHCP	342	DHCP Offer - Transaction
745	29.3880210	128.101.182.115	255.255.255.255	DHCP	342	DHCP Inform - Transaction
746	29.3900500	128.101.101.209	128.101.182.115	DHCP	342	DHCP ACK - Transaction
749	29.3933140	128.101.101.210	128.101.182.115	DHCP	342	DHCP ACK - Transaction

Frame 745: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0

Ethernet II, Src: DellInc_35:ed:7b (d4:be:d9:35:ed:7b), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

Internet Protocol Version 4, Src: 128.101.182.115 (128.101.182.115), Dst: 255.255.255.255 (255.255.255.255)

User Datagram Protocol, Src Port: 68 (68), Dst Port: 67 (67)

Bootstrap Protocol (Inform)

File: "C:\Users\DAVIDS~1\AppData\Local\Te..." Packets: 935 · Displayed: 12 (1.3%) · Dropped: 0 (0.0%) · Profile: Default

a.

UDP

b.

The router is the router my computer is connected to.

The subnet mask is a bit mask to divide the network/host addresses.

In my case, the subnet mask is 255.255.255.128, meaning the first 25 bits are for the network and the last 7 bits are for the hosts.

c.

Lease time is how long the ip address can be used before it must be renewed.
My lease time is 1830 (30 minutes and 30 seconds).

d.

A dhcp release message cancels the lease on an IP. If the release message is lost, then the IP will be unused until the lease runs out.

e.

Since the IP address of the relay agent is not 0.0.0.0, there is a relay agent in this experiment. Its IP is 128.101.182.126.

5.

```
C:\Users\David Schoder>tracert www.inria.fr

Tracing route to ezp3.inria.fr [128.93.162.84]
over a maximum of 30 hops:

  1    5 ms    2 ms    <1 ms   cenh-cn-01-v753.ggnet.umn.edu [128.101.182.126]
  2   <1 ms   <1 ms   <1 ms   telecomb-bn-01-v3730.ggnet.umn.edu [128.101.58.177]
  3   <1 ms   <1 ms   <1 ms   telecomb-br-01-v3739.ggnet.umn.edu [128.101.58.178]
  4    1 ms    <1 ms   <1 ms   telecomb-gr-01-lo0-be5-2002.northernlights.gigapop.net [146.57.255.61]
  5    1 ms    <1 ms   <1 ms   mtc-gr-01-hu-0-7-0-0.1.northernlights.gigapop.net [146.57.252.193]
  6   45 ms   45 ms   44 ms   rtr-clev-v1260.northernlights.gigapop.net [146.57.255.251]
  7   53 ms   53 ms   54 ms   et-3-0-0.103.rtr.wash.net.internet2.edu [198.71.45.51]
  8  128 ms  128 ms  128 ms  internet2.mx1.lon.uk.geant.net [62.40.124.44]
  9  134 ms  134 ms  134 ms  ae0.mx1.par.fr.geant.net [62.40.98.77]
 10  138 ms  135 ms  143 ms  renater-lb1-gw.mx1.par.fr.geant.net [62.40.124.70]
 11  134 ms  134 ms  134 ms  te2-1-paris1-rtr-021.noc.renater.fr [193.51.177.27]
 12  171 ms  134 ms  134 ms  te1-1-inria-rtr-021.noc.renater.fr [193.51.177.107]
 13  134 ms  142 ms  146 ms  inria-rocquencourt-gi3-2-inria-rtr-021.noc.renater.fr [193.51.184.177]
 14   *      *      *      Request timed out.
 15  135 ms  135 ms  135 ms  ezp3.inria.fr [128.93.162.84]

Trace complete.
```

a.

I counted 45 echo packets sent. 3 for each hop.

b.

These packets are different because they are replies from the destination rather than TTL exceeded error packets. They are different because the ping request reached the destination, allowing it to respond, rather than exceeding TTL en route.

6.

```
lind40-05.cselabs.umn.edu - PuTTY
[11:01:54] /home/schod005/Documents/CSCI4211/HW3> ./app-client 9876 9999
Receiving host list:
128.101.37.20 4769
128.101.37.21 33987

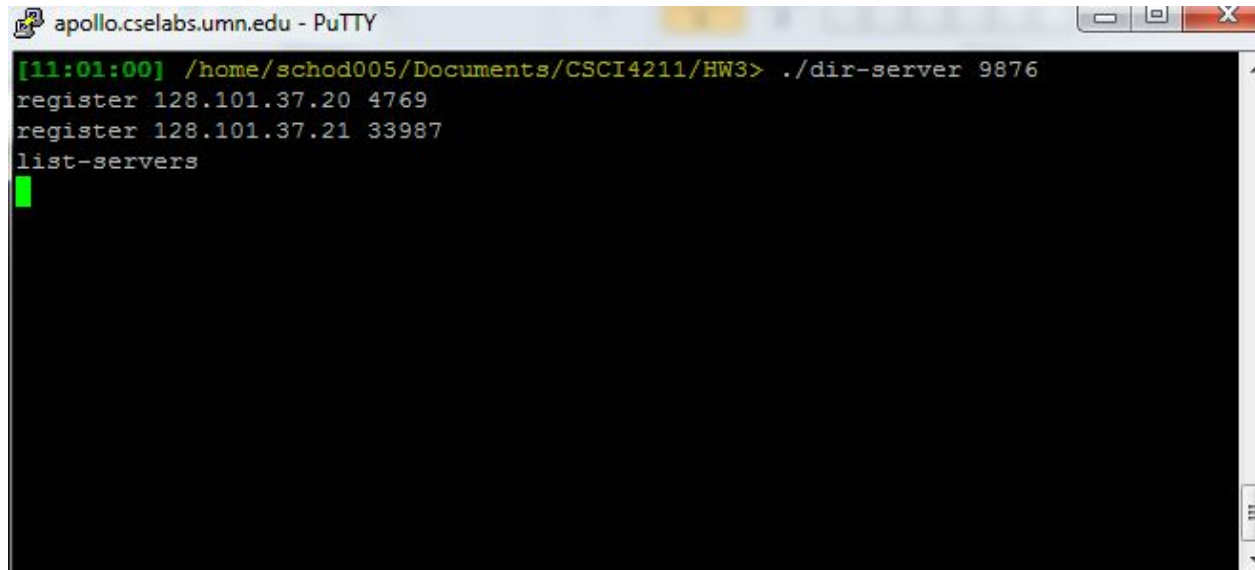
Connecting to 128.101.37.20:4769
Sent 10 KB 10 times
Average time: 0.000866545 seconds
Uploading to db-server
success
Sent 100 KB 10 times
Average time: 0.00229136 seconds
Uploading to db-server
success
Sent 1000 KB 10 times
Average time: 0.0112117 seconds
Uploading to db-server
success
Sent 10000 KB 10 times
Average time: 0.109281 seconds
Uploading to db-server
success

Connecting to 128.101.37.21:33987
Sent 10 KB 10 times
Average time: 0.000849255 seconds
Uploading to db-server
success
Sent 100 KB 10 times
Average time: 0.00330019 seconds
Uploading to db-server
success
Sent 1000 KB 10 times
Average time: 0.0129386 seconds
Uploading to db-server
success
Sent 10000 KB 10 times
Average time: 0.113688 seconds
Uploading to db-server
success

Getting records from db-server
success
134.84.62.105 128.101.37.20 4769 10 0.000867
134.84.62.105 128.101.37.20 4769 100 0.002291
134.84.62.105 128.101.37.20 4769 1000 0.011212
134.84.62.105 128.101.37.20 4769 10000 0.109281
134.84.62.105 128.101.37.21 33987 10 0.000849
134.84.62.105 128.101.37.21 33987 100 0.003300
134.84.62.105 128.101.37.21 33987 1000 0.012939
134.84.62.105 128.101.37.21 33987 10000 0.113688
```

```
cse-kh4250-20.cselabs.umn.edu - PuTTY  
[11:01:11] /home/schod005/Documents/CSCI4211/HW3> ./app-server 9876  
128.101.37.20 4769  
success  
Read 10 KB 10 times  
Read 100 KB 10 times  
Read 1000 KB 10 times  
Read 10000 KB 10 times  
█
```

```
cse-kh4250-21.cselabs.umn.edu - PuTTY  
[11:01:16] /home/schod005/Documents/CSCI4211/HW3> ./app-server 9876  
128.101.37.21 33987  
success  
Read 10 KB 10 times  
Read 100 KB 10 times  
Read 1000 KB 10 times  
Read 10000 KB 10 times  
█
```



The image shows a PuTTY terminal window titled "apollo.cselabs.umn.edu - PuTTY". The terminal displays the following commands and output:

```
[11:01:00] /home/schod005/Documents/CSCI4211/HW3> ./dir-server 9876
register 128.101.37.20 4769
register 128.101.37.21 33987
list-servers
█
```

A green cursor is visible on the line following the "list-servers" command.