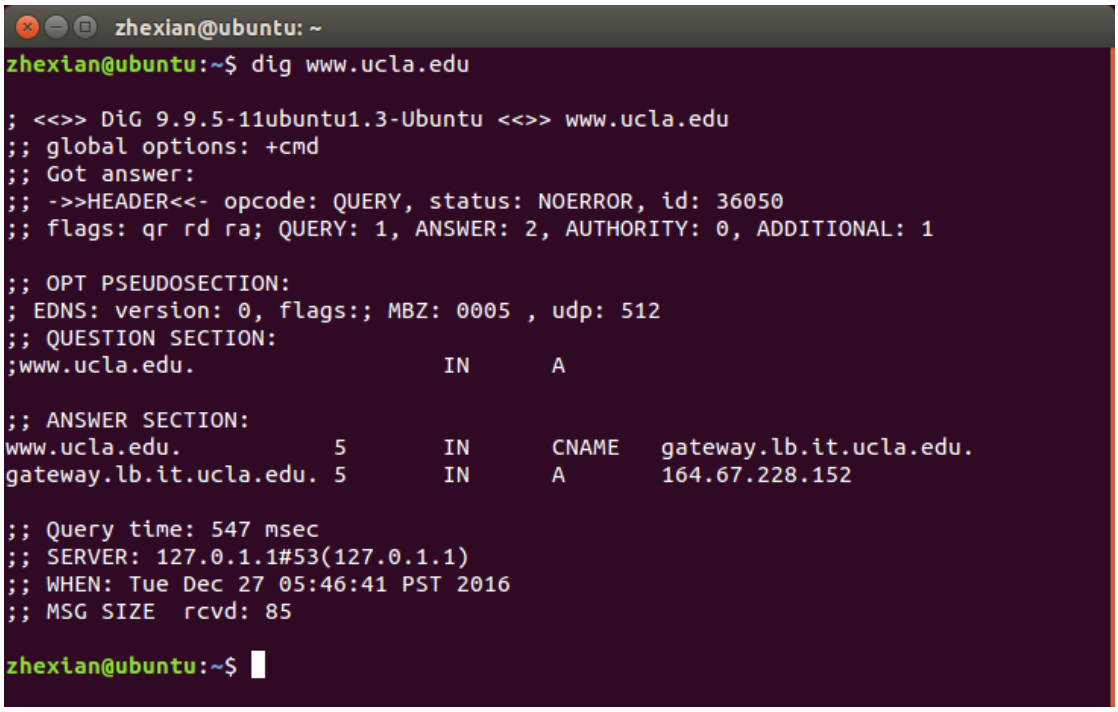
Computer Networks Assignment #6 Zhang Zhexian (0545080) zhangzhexian@outlook.com

1. [Chapter 6 Hands-on 1] Read first the "dig" manual of BIND9 (including the later versions), especially the "+trace" and "+recursive" options, and answer the following questions.
   a. A query generated by dig is by default a recursive query (so that a local name server continues the query on behalf of the client). Why is it used by dig (or resolver routines in other applications)? Also, issue a recursive query to www.ucla.edu, and explain each RR in all five sections of the reply.

Dig uses recursive query to free local name server to resolve other incoming queries. When "+trace" is enabled, "dig" will not use recursive but iterative query to resolve the name it is being looked up. It will follow referral from the root servers, showing answers from each server that was used to resolve the look up.

Below shows the reply when dig to www.ucla.edu:



In the answer section, the first RR has the following sections:

1. www.ucla.edu. is the domain name being queried
2. 5 is the Time to Live (TLL) in seconds
3. IN stands for Internet, which is the class
4. CNAME is the return type meaning the RR is for resolving name aliasing
5. Gateway.lb.it.ucla.edu. is the canonical name of the queried address

For the second RR:

1. Gateway.lb.it.ucla.edu. is the domain name being queried

2. 5 is the Time to Live (TLL) in seconds
3. IN stands for Internet, which is the class
4. A is the return type meaning the RR is for resolving IP address
5. 164.67.228.152 is the IP address of the queried domain

b. Describe each consulted name server in an iterative query for www.ucla.edu using dig.

```
zhexian@ubuntu: ~
zhexian@ubuntu:~$ dig +trace www.ucla.edu

; <<>> DiG 9.9.5-11ubuntu1.3-Ubuntu <<>> +trace www.ucla.edu
;; global options: +cmd
.                       5       IN      NS      f.root-servers.net.
.                       5       IN      NS      d.root-servers.net.
.                       5       IN      NS      m.root-servers.net.
.                       5       IN      NS      i.root-servers.net.
.                       5       IN      NS      a.root-servers.net.
.                       5       IN      NS      h.root-servers.net.
.                       5       IN      NS      c.root-servers.net.
.                       5       IN      NS      g.root-servers.net.
.                       5       IN      NS      l.root-servers.net.
.                       5       IN      NS      b.root-servers.net.
.                       5       IN      NS      j.root-servers.net.
.                       5       IN      NS      e.root-servers.net.
.                       5       IN      NS      k.root-servers.net.
.                       5       IN      RRSIG   NS 8 0 518400 20170109050000 201
61227040000 39291 . cNmtI52MLTMWgCz0YyDRNco1ib0g70CUVL8zjoFmQk0quoGvzC0dr3bA xSR
mY54Z7rg7kzls5lb6c6W4Uxr7gj7L5RpvZVd3KsPulEThy3c+NwFJ xnL8LHLarqmIY8UDJGwQo/JjU0
NY1cqGbyAVZ0VkAu3brpLPDtaTc+P6 jquj0oFmDNqYepcWE3HcYtuaKVuMxbKQEX+f47IUkw3d2J8Bf
gWItPqF Zz0T2mok6e6Ed9K4Qxno7oKXUmQL7RuV9WqwGC1n9XM8rg/ivD/BJXlS j6kbfg8zGS8Bciv
goI4mcxCGNQSjYHum0SSJmRPaED4WKauTB9nOGIKi hpJCvg==
;; Received 525 bytes from 127.0.1.1#53(127.0.1.1) in 331 ms
```

```
zhexian@ubuntu: ~

edu.                    172800  IN      NS      d.edu-servers.net.
edu.                    172800  IN      NS      f.edu-servers.net.
edu.                    172800  IN      NS      l.edu-servers.net.
edu.                    172800  IN      NS      c.edu-servers.net.
edu.                    172800  IN      NS      g.edu-servers.net.
edu.                    172800  IN      NS      a.edu-servers.net.
edu.                    86400   IN      DS      28065 8 2 4172496CDE85534E511290
40355BD04B1FCFEBAE996DFDDE652006F6 F8B2CE76
edu.                    86400   IN      RRSIG   DS 8 1 86400 20170109050000 2016
1227040000 39291 . btXtZrxq2tnbRY7G1AjQmYd2o3SM3Y5j3BkH4A5LfmPr6lLcNmNgBAFN wpyf
QU8KO+toW4O2XNHJSZaStYHG5H3KQL9VKFvLi/fjD4uJB0u8yvYS ev3WLC/YW8F1jtQy2lBxZ3YmnJk
zPSltm6gmeoNlLkOPnQRijAiWJbp1 8deMPNhQn0wyrcJrasQdxFK6uLapH5QXM7ODMYu0D/zrgcbAnM
4oOEw1 t7vZzVOiJ+ALLcByt7q3Js9qOm6jhcXB0Ead2Y5XxDnrS+D7F4A5hjgt PoBGq9IxdcgCdL2G
YGDqlm1aMV+3H1/u01ECJcI9/A3lzwmO4kLWr68+ Q23RpQ==
;; Received 611 bytes from 192.112.36.4#53(g.root-servers.net) in 1201 ms

ucla.edu.               172800  IN      NS      ns1.dns.ucla.edu.
ucla.edu.               172800  IN      NS      ns2.dns.ucla.edu.
ucla.edu.               172800  IN      NS      ns3.dns.ucla.edu.
ucla.edu.               172800  IN      NS      ns4.dns.ucla.edu.
9DHS4EP5G85PF9NUFK06HEK0O48QGK77.edu. 86400 IN NSEC3 1 1 0 - 9G02JP54J3AMJ86QEDN
5OCO12HPHGM6F NS SOA RRSIG DNSKEY NSEC3PARAM
9DHS4EP5G85PF9NUFK06HEK0O48QGK77.edu. 86400 IN RRSIG NSEC3 8 2 86400 20170103140
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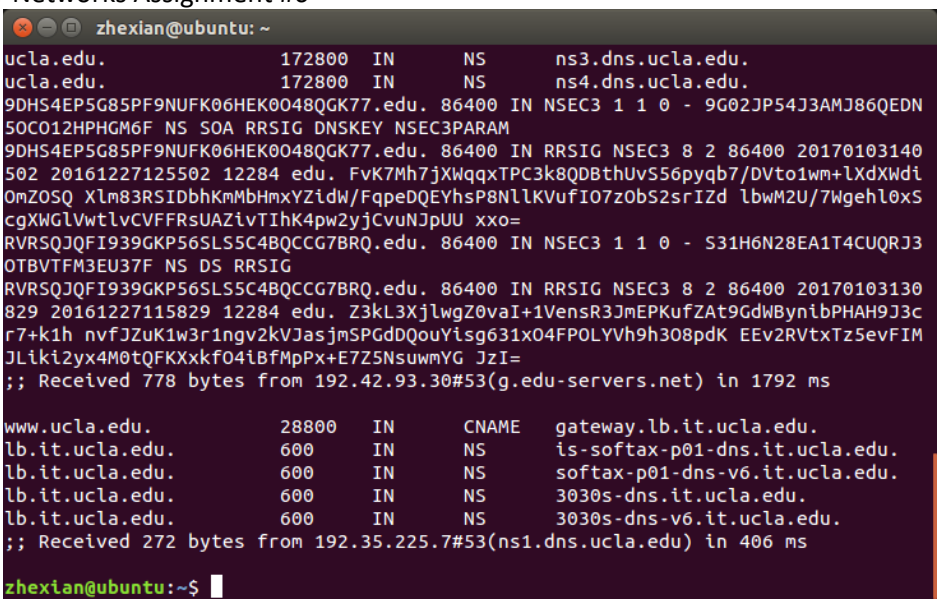
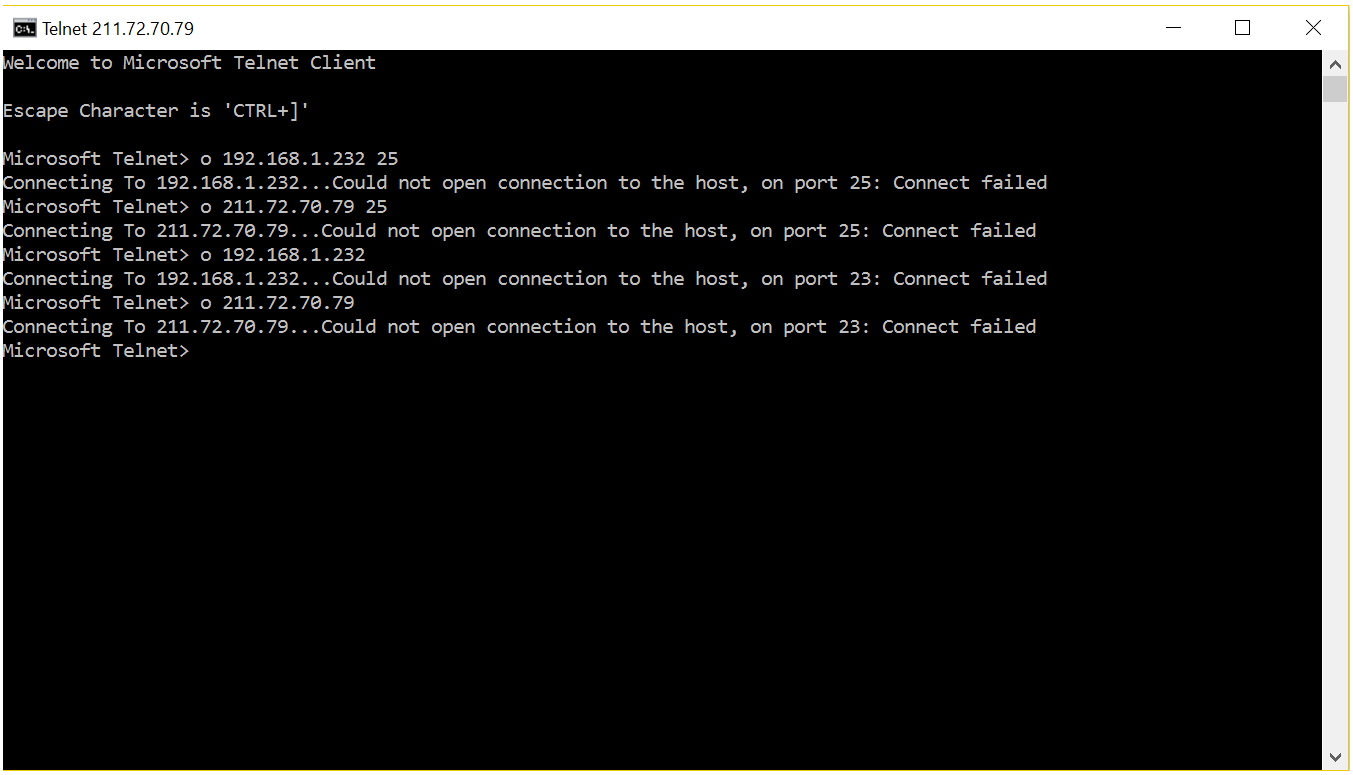


As shown in the screen shots above, for the name server for "." (root server), there are 13 of them to choose from; for ".edu", there are 7 name servers; for "ucla.edu", there are 6; and for "www.ucla.edu", 4 name servers are used to resolve the IP address of the queried domain.

2. [Chapter 6 Hands-on 3] Read the SMTP and POP3 commands. Then telnet to your SMTP server (port 25) and send a message to yourself. After that, telnet to your POP3 server (port 110) and retrieve the message. Record everything that happens in the sessions.

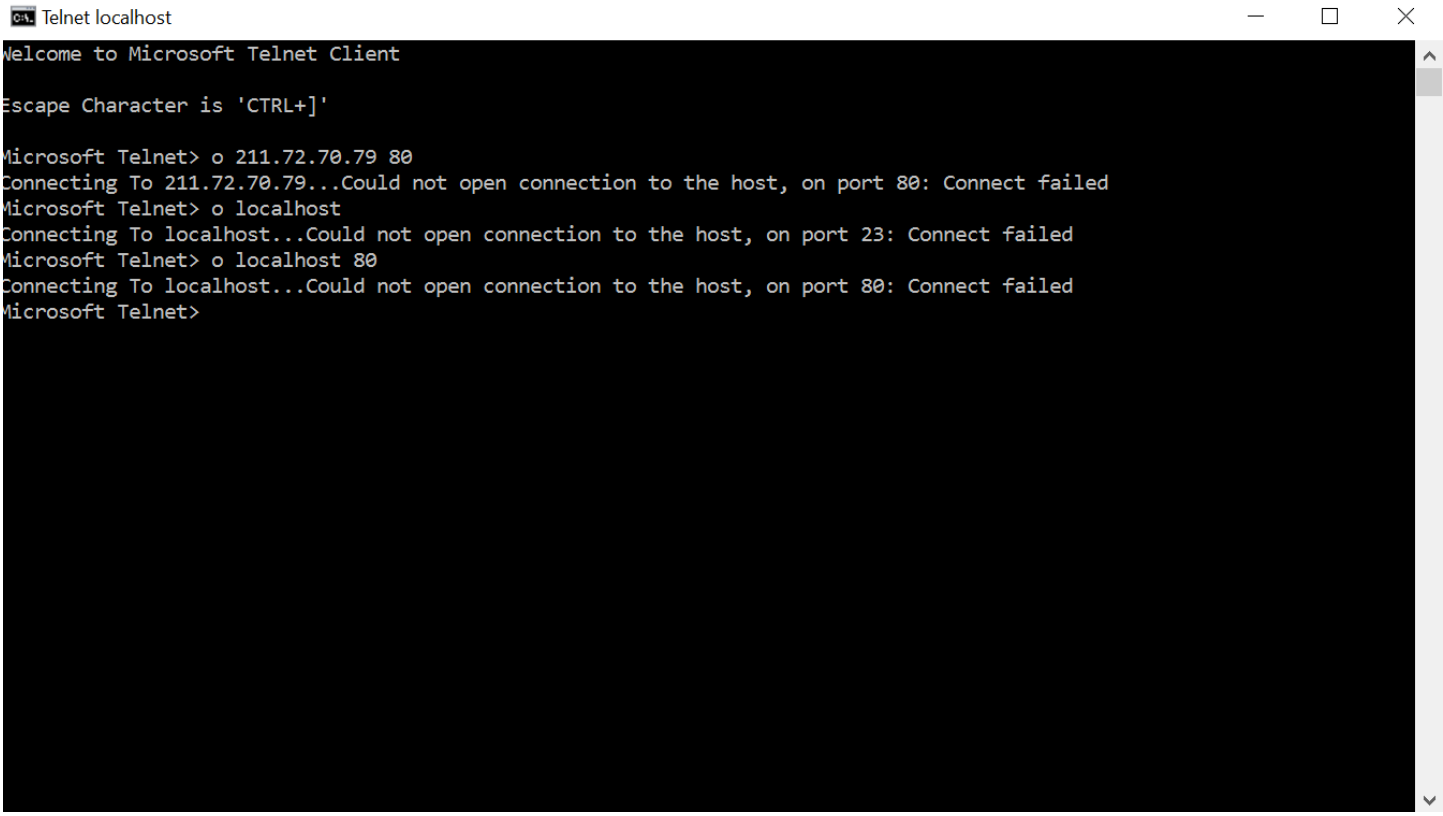
   Here is the screen shot when trying to telnet to my own SMTP and POP3 server.



Similar failed connection is encountered in a Ubuntu virtual machine I ran as well.

3. [Chapter 6 Hands-on 5] Telnet to your Web server (port 80) and get a document using HTTP 1.0. Observe the HTTP response headers. Record everything that happens in the session.

   Similar to the previous hands-on exercise, the connection is not successful.



4. [Chapter 6 Written 5] What RRs may be used in the following situations? Explain each of them using an example.

   a. In the process of a forward query.

      Type A, address record. When querying for any domain name (e.g. www.ucla.edu), type A RR will returns the 32-bit IPv4 address (164.67.228.152) that maps to the hostname.

   b. In the process of a reverse query.

      Type PTR, reverse-lookup pointer records. As opposed to forward DNS resolution (e.g. A DNS records), the PTR record is used to look up domain names based on an IP address. Example is querying 164.67.228.152 to get www.ucla.edu.

   c. Resolve the domain name B, which is an alias of domain name A.

      Type CNAM, canonical name record. The CNAME record specifies a domain name that must be queried in order to resolve the original DNS query. For www.ucla.edu, the CNAME record is gateway.lb.it.ucla.edu.

   d. In mail forwarding.

MX, mail exchange record. It maps a domain name to a list of message transfer agents for that domain. For example, for website.io, the MX server is 5ae5434eabd2b44cbba2e6541e679b.pamx1.hotmail.com.

5. [Chapter 6 Written 7] Webmail is Web browser based and includes support for POP3 and IMAP4. Describe the differences between POP3-based Webmail and IMAP4-based Webmail.

	POP3-based Webmail	**IMAP4-based Webmail**
Number of commands	Less commands	More commands
Flexibility	Less flexible	More flexible
Usage	Mainly for downloading the emails locally (for example, Outlook)	Mainly for viewing the emails online through web mail providers.

6. [Chapter 6 Written 16] Describe the processes of setting up an active and a passive connection for FTP, respectively (including the command and parameters used). Assume that the control connection has already been established on port 21.

   For active FTP connection: The client issues “PORT IP-address port-number” through the control connection to the server. The server replies 200 and then connects to the client to establish the data connection.

   For passive FTP connection: The client issues “PASV” through the control connection to the server. The server replies with the IP address and port number on which it would listen. The client then connects to the specified port to establish the data connection.

7. [Chapter 6 Written 26] How do audio and video messages get synchronized in streaming?

   Inter-stream synchronization is used to synchronize audio and video messages in streaming.

   Since a multimedia session is mainly made up of video and audio streams, inappropriate synchronization between streams would lead to mismatch between, for example, the lips and the voice of the speaker.

   The synchronization is done by assigning master stream to one type of the message, and slave stream to the other type, so the two messages may be synchronized.

   A jitter buffer is also used to wait for both audio and video message portion is arrived and the timing synchronized before sending them out.