#Exercise 3: Digging into DNS

In order to answer the following questions, you will make DNS queries using some of the query types you have encountered in the above exercise. Some questions require you to make multiple DNS queries. Before you proceed, read the manpage of dig (type man dig in the terminal). Make sure you
understand how you can explicitly specify the following:

- nameserver to query
- type of DNS query to make (the default query types are those you saw in exercise 1)
- performing reverse queries

Note: Include the output of all the dig commands you have used in your answers.
To send a query to a particular name server (say x.x.x.x) you should use the following command:

```
dig @x.x.x.x hostname
```

Question 1. What is the IP address of www.cecs.anu.edu.au . What type of DNS query is sent to get this answer?

Answer:

The IP address is 150.203.161.98. Type A DNS query is sent to get this answer.

```
z5187292@vx1:/tmp_amd/reed/export/reed/1/z5187292$ dig www.cecs.anu.edu.au

; <<>> DiG 9.7.3 <<>> www.cecs.anu.edu.au
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61084
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 3, ADDITIONAL: 6

;; QUESTION SECTION:
;www.cecs.anu.edu.au.           IN      A

;; ANSWER SECTION:
www.cecs.anu.edu.au.    3600    IN      CNAME   rproxy.cecs.anu.edu.au.
rproxy.cecs.anu.edu.au. 3600    IN      A       150.203.161.98

;; AUTHORITY SECTION:
cecs.anu.edu.au.        3600    IN      NS      ns3.cecs.anu.edu.au.
cecs.anu.edu.au.        3600    IN      NS      ns2.cecs.anu.edu.au.
cecs.anu.edu.au.        3600    IN      NS      ns4.cecs.anu.edu.au.

;; ADDITIONAL SECTION:
ns2.cecs.anu.edu.au.    1966    IN      A       150.203.161.36
ns2.cecs.anu.edu.au.    3600    IN      AAAA    2001:388:1034:2905::24
ns3.cecs.anu.edu.au.    1966    IN      A       150.203.161.50
ns3.cecs.anu.edu.au.    3600    IN      AAAA    2001:388:1034:2905::32
ns4.cecs.anu.edu.au.    1966    IN      A       150.203.161.38
ns4.cecs.anu.edu.au.    3600    IN      AAAA    2001:388:1034:2905::26

;; Query time: 53 msec
;; SERVER: 129.94.242.45#53(129.94.242.45)
;; WHEN: Fri Mar  8 16:38:11 2019
;; MSG SIZE  rcvd: 260
```

Question 2. What is the canonical name for the CECS ANU web server? What is its IP address? Suggest a reason for having an alias for this server.

Answer:

As the picture above, I find the canoical name is reproxy.cecs.anu.edu.au.`

The IP address is 150.203.161.98.

Reason: Convenient domain name management.

For example, in this example, if both www.cecs.anu.edu.au and rproxy.cecs.anu.edu.au use type A record to record. when IP address of this server change, we should change two type A records to fix it. But if using an alias, we only need to change one type A record because other type CName record will change as it change.

```
;; ANSWER SECTION:
www.cecs.anu.edu.au.    2990    IN      CNAME   rproxy.cecs.anu.edu.au.
rproxy.cecs.anu.edu.au. 3600    IN      A       150.203.161.98
```

Question 3. What can you make of the rest of the response (i.e. the details available in the Authority and Additional sections)?

Answer:

In the Authority part, it list three hostname of authority dns servers. we can get the IP addresses from these authority dns servers by dns request.

In the Additional section part, It list 3 groups of records. it list three set of records that match dns authority server host name with its IP address.(Type A means IPv4 address, and Type AAAA means IPv6 address). Stats section at the bottom displays few dig command statistics including how much time it took to execute this query.

Question 4. What is the IP address of the local nameserver for your machine?

Answer:

The IP address of the local nameserver for my machine is 129.94.242.45.

```
;; Query time: 22 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Mar  8 17:39:59 2019
;; MSG SIZE  rcvd: 260
```

Question 5. What are the DNS nameservers for the “cecs.anu.edu.au” domain (note: the domain name is cecs.anu.edu.au and not www.cecs.anu.edu.au)? Find out their IP addresses? What type of DNS query is sent to obtain this information?

Answer:

The DNS nameservers are ns4.cecs.anu.edu.au, ns3.cecs.anu.edu.au, ns2.cecs.anu.edu.au.

Their IP addresses:

ns4.cecs.anu.edu.au – 150.203.161.38(IPv4) / 2001:388:1034:2905::26(IPv6)

ns3.cecs.anu.edu.au – 150.203.161.50(IPv4) / 2001:388:1034:2905::32(IPv6)

ns2.cecs.anu.edu.au – 150.203.161.36(IPv4) / 2001:388:1034:2905::24(IPv6)

Type NS DNS query is sent to obtain authority DNS nameservers.

Type A and type AAA DNS query is sent to obtain their IP addresses.

```
;; ANSWER SECTION:
www.cecs.anu.edu.au.    2990    IN      CNAME   rproxy.cecs.anu.edu.au.
rproxy.cecs.anu.edu.au. 3600    IN      A       150.203.161.98

;; AUTHORITY SECTION:
cecs.anu.edu.au.        3600    IN      NS      ns4.cecs.anu.edu.au.
cecs.anu.edu.au.        3600    IN      NS      ns3.cecs.anu.edu.au.
cecs.anu.edu.au.        3600    IN      NS      ns2.cecs.anu.edu.au.

;; ADDITIONAL SECTION:
ns2.cecs.anu.edu.au.    2990    IN      A       150.203.161.36
ns2.cecs.anu.edu.au.    2990    IN      AAAA    2001:388:1034:2905::24
ns3.cecs.anu.edu.au.    2990    IN      A       150.203.161.50
ns3.cecs.anu.edu.au.    2990    IN      AAAA    2001:388:1034:2905::32
ns4.cecs.anu.edu.au.    2990    IN      A       150.203.161.38
ns4.cecs.anu.edu.au.    2990    IN      AAAA    2001:388:1034:2905::26
```

Question 6. What is the DNS name associated with the IP address 149.171.158.109? What type of DNS query is sent to obtain this information?

Answer:

The DNS name are engplws008.ad.unsw.edu.au, engplws008.eng.unsw.edu.au, www.engineering.unsw.edu.au.

Type PTR DNS query is sent.

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig -x 149.171.158.109

; <<>> DiG 9.7.3 <<>> -x 149.171.158.109
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27489
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 3, ADDITIONAL: 6

;; QUESTION SECTION:
;109.158.171.149.in-addr.arpa.  IN      PTR

;; ANSWER SECTION:
109.158.171.149.in-addr.arpa. 3345 IN   PTR     engplws008.ad.unsw.edu.au.
109.158.171.149.in-addr.arpa. 3345 IN   PTR     engplws008.eng.unsw.edu.au.
109.158.171.149.in-addr.arpa. 3345 IN   PTR     www.engineering.unsw.edu.au.

;; AUTHORITY SECTION:
158.171.149.in-addr.arpa. 10545 IN      NS      ns2.unsw.edu.au.
158.171.149.in-addr.arpa. 10545 IN      NS      ns1.unsw.edu.au.
158.171.149.in-addr.arpa. 10545 IN      NS      ns3.unsw.edu.au.

;; ADDITIONAL SECTION:
ns1.unsw.edu.au.        3028    IN      A       129.94.0.192
ns1.unsw.edu.au.        2955    IN      AAAA    2001:388:c:35::1
ns2.unsw.edu.au.        3028    IN      A       129.94.0.193
ns2.unsw.edu.au.        2955    IN      AAAA    2001:388:c:35::2
ns3.unsw.edu.au.        3028    IN      A       192.155.82.178
ns3.unsw.edu.au.        2955    IN      AAAA    2600:3c01::f03c:91ff:fe73:5f10

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Mar  8 18:52:56 2019
;; MSG SIZE  rcvd: 330
```

Question 7. Run dig and query the CSE nameserver (129.94.242.33) for the mail servers for Yahoo! Mail (again the domain name is yahoo.com, not www.yahoo.com). Did you get an

authoritative answer? Why? (HINT: Just because a response contains information in the authoritative part of the DNS response message does not mean it came from an authoritative name server. You should examine the flags in the response to determine the answer).

Answer:

No. Because from picture below, I find the flags in the response don' t contain 'AA' which represents authority answer. It means that the result we get response from a cache server.

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @129.94.242.33 yahoo.com
MX

; <<>> DiG 9.7.3 <<>> @129.94.242.33 yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 11399
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 8

;; QUESTION SECTION:
;yahoo.com.                     IN      MX

;; ANSWER SECTION:
yahoo.com.              1800    IN      MX      1 mta5.am0.yahoodns.net.
yahoo.com.              1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              1800    IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              88679   IN      NS      ns4.yahoo.com.
yahoo.com.              88679   IN      NS      ns5.yahoo.com.
yahoo.com.              88679   IN      NS      ns1.yahoo.com.
yahoo.com.              88679   IN      NS      ns3.yahoo.com.
yahoo.com.              88679   IN      NS      ns2.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          144816  IN      A       68.180.131.16
ns1.yahoo.com.          2319    IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          315095  IN      A       68.142.255.16
ns2.yahoo.com.          139917  IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          241081  IN      A       203.84.221.53
ns3.yahoo.com.          75372   IN      AAAA    2406:8600:b8:fe03::1003
ns4.yahoo.com.          318375  IN      A       98.138.11.157
ns5.yahoo.com.          326779  IN      A       119.160.253.83

;; Query time: 151 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Fri Mar  8 19:13:19 2019
;; MSG SIZE  rcvd: 360
```

Question 8. Repeat the above (i.e. Question 7) but use one of the nameservers obtained in Question 5. What is the result?

Answer:

we can't get response from this nameserver obtained in Question 5. The reason maybe that this dns server only response to some certain query in AU due to sercurity considerations.

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @150.203.161.50 yahoo.com


; <<>> DiG 9.7.3 <<>> @150.203.161.50 yahoo.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 38465
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 0
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;yahoo.com.                     IN      A

;; Query time: 7 msec
;; SERVER: 150.203.161.50#53(150.203.161.50)
;; WHEN: Fri Mar  8 19:25:33 2019
;; MSG SIZE  rcvd: 27
```

Question 9. Obtain the authoritative answer for the mail servers for Yahoo! mail. What type of DNS query is sent to obtain this information?

Answer:

From Question7, I find one of nameservers is ns1.yahoo.com(60.180.131.16). So we use it to get authoritative answer, as the picture below.

The Type is MX.

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @68.180.131.16 yahoo.com

; <<>> DiG 9.7.3 <<>> @68.180.131.16 yahoo.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47439
;; flags: qr aa rd; QUERY: 1, ANSWER: 6, AUTHORITY: 5, ADDITIONAL: 8
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;yahoo.com.                     IN      A

;; ANSWER SECTION:
yahoo.com.              1800    IN      A       98.138.219.232
yahoo.com.              1800    IN      A       98.137.246.8
yahoo.com.              1800    IN      A       72.30.35.10
yahoo.com.              1800    IN      A       98.137.246.7
yahoo.com.              1800    IN      A       72.30.35.9
yahoo.com.              1800    IN      A       98.138.219.231

;; AUTHORITY SECTION:
yahoo.com.              172800  IN      NS      ns3.yahoo.com.
yahoo.com.              172800  IN      NS      ns1.yahoo.com.
yahoo.com.              172800  IN      NS      ns4.yahoo.com.
yahoo.com.              172800  IN      NS      ns2.yahoo.com.
yahoo.com.              172800  IN      NS      ns5.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          1209600 IN      A       68.180.131.16
ns2.yahoo.com.          1209600 IN      A       68.142.255.16
ns3.yahoo.com.          1209600 IN      A       203.84.221.53
ns4.yahoo.com.          1209600 IN      A       98.138.11.157
ns5.yahoo.com.          1209600 IN      A       119.160.253.83
ns1.yahoo.com.          86400   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          86400   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          86400   IN      AAAA    2406:8600:b8:fe03::1003

;; Query time: 145 msec
;; SERVER: 68.180.131.16#53(68.180.131.16)
;; WHEN: Fri Mar  8 19:35:34 2019
;; MSG SIZE  rcvd: 377
```

Question 10. In this exercise you simulate the iterative DNS query process to find the IP address of your machine (e.g. lyre00.cse.unsw.edu.au). First, find the name server (query type NS) of the "." domain (root domain). Query this nameserver to find the authoritative name server for the "au." domain. Query this second server to find the authoritative nameserver for the "edu.au." domain. Now query this nameserver to find the authoritative nameserver for "unsw.edu.au". Next query the nameserver of unsw.edu.au to find the authoritative name server of cse.unsw.edu.au. Now query the nameserver of cse.unsw.edu.au to find the IP address of your host. How many DNS servers do you have to query to get the authoritative answer?

Answer:

First, find the root domain's nameserver, as picture below

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig . NS

; <<>> DiG 9.7.3 <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41468
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 13

;; QUESTION SECTION:
;.                              IN      NS

;; ANSWER SECTION:
.                       42728   IN      NS      c.root-servers.net.
.                       42728   IN      NS      a.root-servers.net.
.                       42728   IN      NS      m.root-servers.net.
.                       42728   IN      NS      h.root-servers.net.
.                       42728   IN      NS      j.root-servers.net.
.                       42728   IN      NS      l.root-servers.net.
.                       42728   IN      NS      g.root-servers.net.
.                       42728   IN      NS      e.root-servers.net.
.                       42728   IN      NS      d.root-servers.net.
.                       42728   IN      NS      f.root-servers.net.
.                       42728   IN      NS      b.root-servers.net.
.                       42728   IN      NS      k.root-servers.net.
.                       42728   IN      NS      i.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net.     223235  IN      A       198.41.0.4
a.root-servers.net.     393055  IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net.     118988  IN      A       199.9.14.201
b.root-servers.net.     63943   IN      AAAA    2001:500:200::b
c.root-servers.net.     149507  IN      A       192.33.4.12
c.root-servers.net.     234827  IN      AAAA    2001:500:2::c
d.root-servers.net.     89043   IN      A       199.7.91.13
d.root-servers.net.     234827  IN      AAAA    2001:500:2d::d
e.root-servers.net.     85560   IN      A       192.203.230.10
e.root-servers.net.     149507  IN      AAAA    2001:500:a8::e
f.root-servers.net.     235313  IN      A       192.5.5.241
f.root-servers.net.     63943   IN      AAAA    2001:500:2f::f
g.root-servers.net.     235313  IN      A       192.112.36.4

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Mar  8 19:46:08 2019
;; MSG SIZE  rcvd: 508
```

Second, find the authoritative name server for “au.” domain, as picture below

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @198.41.0.4 lyre00.cse.un
sw.edu.au NX

; <<>> DiG 9.7.3 <<>> @198.41.0.4 lyre00.cse.unsw.edu.au NX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 19373
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 10, ADDITIONAL: 15
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
au.                     172800  IN      NS      d.au.
au.                     172800  IN      NS      v.au.
au.                     172800  IN      NS      u.au.
au.                     172800  IN      NS      q.au.
au.                     172800  IN      NS      t.au.
au.                     172800  IN      NS      s.au.
au.                     172800  IN      NS      r.au.
au.                     172800  IN      NS      b.au.
au.                     172800  IN      NS      a.au.
au.                     172800  IN      NS      c.au.

;; ADDITIONAL SECTION:
d.au.                   172800  IN      A       162.159.25.38
d.au.                   172800  IN      AAAA    2400:cb00:2049:1::a29f:1926
v.au.                   172800  IN      A       202.12.31.53
v.au.                   172800  IN      AAAA    2001:dd8:12::53
u.au.                   172800  IN      A       211.29.133.32
q.au.                   172800  IN      A       65.22.196.1
q.au.                   172800  IN      AAAA    2a01:8840:be::1
t.au.                   172800  IN      A       65.22.199.1
t.au.                   172800  IN      AAAA    2a01:8840:c1::1
s.au.                   172800  IN      A       65.22.198.1
s.au.                   172800  IN      AAAA    2a01:8840:c0::1
r.au.                   172800  IN      A       65.22.197.1
r.au.                   172800  IN      AAAA    2a01:8840:bf::1
b.au.                   172800  IN      A       58.65.253.73
a.au.                   172800  IN      A       58.65.254.73

;; Query time: 159 msec
;; SERVER: 198.41.0.4#53(198.41.0.4)
;; WHEN: Fri Mar  8 20:08:38 2019
;; MSG SIZE  rcvd: 512
```

Third, find the “edu.au.” domain, as picture below

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @162.159.25.38 lyre00.cse
.unsw.edu.au NX

; <<>> DiG 9.7.3 <<>> @162.159.25.38 lyre00.cse.unsw.edu.au NX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 4525
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 8
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
edu.au.                 86400   IN      NS      s.au.
edu.au.                 86400   IN      NS      r.au.
edu.au.                 86400   IN      NS      t.au.
edu.au.                 86400   IN      NS      q.au.

;; ADDITIONAL SECTION:
q.au.                   86400   IN      A       65.22.196.1
r.au.                   86400   IN      A       65.22.197.1
s.au.                   86400   IN      A       65.22.198.1
t.au.                   86400   IN      A       65.22.199.1
q.au.                   86400   IN      AAAA    2a01:8840:be::1
r.au.                   86400   IN      AAAA    2a01:8840:bf::1
s.au.                   86400   IN      AAAA    2a01:8840:c0::1
t.au.                   86400   IN      AAAA    2a01:8840:c1::1

;; Query time: 16 msec
;; SERVER: 162.159.25.38#53(162.159.25.38)
;; WHEN: Fri Mar  8 20:11:59 2019
;; MSG SIZE  rcvd: 280
```

Then, find the “unsw.edu.au” domain, as picture below

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @65.22.196.1 lyre00.cse.u
nsw.edu.au NX

; <<>> DiG 9.7.3 <<>> @65.22.196.1 lyre00.cse.unsw.edu.au NX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26123
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 5
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
unsw.edu.au.            900     IN      NS      ns2.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns3.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns1.unsw.edu.au.

;; ADDITIONAL SECTION:
ns1.unsw.edu.au.        900     IN      A       129.94.0.192
ns2.unsw.edu.au.        900     IN      A       129.94.0.193
ns3.unsw.edu.au.        900     IN      A       192.155.82.178
ns1.unsw.edu.au.        900     IN      AAAA    2001:388:c:35::1
ns2.unsw.edu.au.        900     IN      AAAA    2001:388:c:35::2

;; Query time: 7 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Fri Mar  8 20:13:46 2019
;; MSG SIZE  rcvd: 198
```

Next, find the “cse.unsw.edu.au” domain, as picture below

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @129.94.0.192 lyre00.cse.
unsw.edu.au NX

; <<>> DiG 9.7.3 <<>> @129.94.0.192 lyre00.cse.unsw.edu.au NX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57968
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 4
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
cse.unsw.edu.au.        10800   IN      NS      maestro.orchestra.cse.unsw.edu.a
u.
cse.unsw.edu.au.        10800   IN      NS      beethoven.orchestra.cse.unsw.edu
.au.

;; ADDITIONAL SECTION:
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.242.2
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.172.11
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.208.3
maestro.orchestra.cse.unsw.edu.au. 10800 IN A   129.94.242.33

;; Query time: 3 msec
;; SERVER: 129.94.0.192#53(129.94.0.192)
;; WHEN: Fri Mar  8 20:15:10 2019
;; MSG SIZE  rcvd: 160
```

Finally, find the IP address of lyre00.cse.unsw.edu.au.

```
z5187292@vx2:/tmp_amd/reed/export/reed/1/z5187292$ dig @129.94.242.2 lyre00.cse.
unsw.edu.au A

; <<>> DiG 9.7.3 <<>> @129.94.242.2 lyre00.cse.unsw.edu.au A
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 48863
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 2

;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; ANSWER SECTION:
lyre00.cse.unsw.edu.au. 3600    IN      A       129.94.210.20

;; AUTHORITY SECTION:
cse.unsw.edu.au.        3600    IN      NS      beethoven.orchestra.cse.unsw.edu
.au.
cse.unsw.edu.au.        3600    IN      NS      maestro.orchestra.cse.unsw.edu.a
u.

;; ADDITIONAL SECTION:
maestro.orchestra.cse.unsw.edu.au. 3600 IN A    129.94.242.33
beethoven.orchestra.cse.unsw.edu.au. 3600 IN A  129.94.242.2

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Mar  8 20:17:43 2019
;; MSG SIZE  rcvd: 144
```

In conclusion, The IP address of lyre00.cse.unsw.edu.au is 129.94.210.20. As mentioned above, there is 5 DNS servers I have to query to get the authoritative answer.

Question 11. Can one physical machine have several names and/or IP addresses associated with it?

Answer:

Yes. Becauser a physical machine may have many network interfaces, and every IP addreses can have alias name in nameserver as mentioned before.

#Exercise 4: A Simple Web Server

Here is my code:

```
from socket import *
import sys

fail_content = "HTTP/1.1 404 Not Found Content-Type: text/html \r\n"
html_head = '''
HTTP/1.1 200 ok
Content-Type: text/html\r\n'''
image_head = '''
HTTP/1.1 200 ok
Content-Type: image/png\r\n'''
```

```
if __name__ == '__main__':
    try:
        HOST = sys.argv[1]
        PORT = int(sys.argv[2])
    except ValueError:
        print("Invalid: must have two parameters.")
        sys.exit(-1)

    sock = socket(AF_INET, SOCK_STREAM)
    sock.bind((HOST, PORT))
    sock.listen(5)

    while True:
        conn, addr = sock.accept()
        request = conn.recv(1024).decode()
        req_head = request.split(' ')
        method = req_head[0]

        try:
            src = req_head[1][1::]
            print(src)
        except:
            conn.sendall((fail_content+'''\r\n 404 Error''').encode())
            continue

        try:
            if src.endswith('.html'):
                f = open(str(src), 'r')
            elif src.endswith('.png'):
                f = open(str(src), 'rb')
            else:
                raise FileNotFoundError
            content = f.read()
            f.close()
        except FileNotFoundError:
            conn.sendall((fail_content+'''\r\n404 Error''').encode())
            continue

        if src.endswith('.html'):
            conn.sendall((html_head+'\r\n'+content).encode())
        elif src.endswith('.png'):
            conn.sendall((image_head+'\r\n').encode()+content)
        conn.close()
    sock.close()
```