Lab 3

Exercise 3

man dig returns the usage synopsis of dig.

```
SYNOPSIS
       dig [@server] [-b address] [-c class] [-f filename] [-k filename] [-m] [-p port#] [-q name] [-t type] [-x addr]
           [-y [hmac:]name:key] [-4] [-6] [name] [type] [class] [queryopt...]

       dig [-h]

       dig [global-queryopt...] [query...]
```

Question 1

What is the IP address of www.eecs.berkeley.edu . What type of DNS query is sent to get this answer?

```
z5183946@weber:~/9331$ dig www.eecs.berkeley.edu

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 28496
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 6

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.eecs.berkeley.edu.         IN      A

;; ANSWER SECTION:
www.eecs.berkeley.edu.  42203   IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 600  IN      CNAME   fe1.edge.pantheon.io.
fe1.edge.pantheon.io.   300     IN      A       23.185.0.1

;; AUTHORITY SECTION:
edge.pantheon.io.       300     IN      NS      ns-1213.awsdns-23.org.
edge.pantheon.io.       300     IN      NS      ns-644.awsdns-16.net.
edge.pantheon.io.       300     IN      NS      ns-233.awsdns-29.com.
edge.pantheon.io.       300     IN      NS      ns-2013.awsdns-59.co.uk.

;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   152154  IN      A       205.251.192.233
ns-644.awsdns-16.net.   45102   IN      A       205.251.194.132
ns-1213.awsdns-23.org.  28165   IN      A       205.251.196.189
ns-2013.awsdns-59.co.uk. 41218  IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 127942 IN      AAAA    2600:9000:5307:dd00::1

;; Query time: 99 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Mar 08 02:50:51 AEDT 2022
;; MSG SIZE  rcvd: 369
```

The image above is the output of **dig www.eecs.berkeley.edu**. The IP address is 23.185.0.1. Type A query is sent to the name server to get this answer.

Question 2

What is the canonical name for the eecs.berkeley webserver? Suggest a reason for having an alias for this server.

The canonical name for www.eecs.berkeley.edu is live-eecs.pantheonsite.io and the canonical name for live-eecs.pantheonsite.io is fe1.edge.pantheon.io.

One of the reasons for having an alias is to adapt the changing IP. There are two scenarios: The first one is that multiple websites are bound to one server machine. When the IP address changes, the manager only needs to change the record once by changing the type A record of the server machine instead of updating the record of each website separately. The second case is that the website owner may not own the IP, the IP provider may change the address at any time, then they can use alias to bind their website to the provider. By doing this, no change is required when then provider changes the IP address.

Question 3

What can you make of the rest of the response?

As shown in authority section, there are four servers for answering DNS queries about www.eecs.berkeley.edu which are: ns-644.awsdns-16.net, ns-233.awsdns-29.com, ns-1213.awsdns-23.org, and ns-2013.awsdns-59.co.uk. They are all amazon DNS server.

~~As indicated in the additional section ns-2013.awsdns-59.co.uk also supports IPv6.~~

Update: According to the result in additional section from another run few days later, it shows that all these four DNS servers support IPv6.

```
;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   113710  IN      A       205.251.192.233
ns-233.awsdns-29.com.   31140   IN      AAAA    2600:9000:5300:e900::1
ns-644.awsdns-16.net.   6658    IN      A       205.251.194.132
ns-644.awsdns-16.net.   6658    IN      AAAA    2600:9000:5302:8400::1
ns-1213.awsdns-23.org.  4757    IN      A       205.251.196.189
ns-1213.awsdns-23.org.  4757    IN      AAAA    2600:9000:5304:bd00::1
ns-2013.awsdns-59.co.uk. 2774   IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 469    IN      AAAA    2600:9000:5307:dd00::1
```

Question 4

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

```
z5183946@weber:~/9331$ cat /etc/resolv.conf
domain orchestra.cse.unsw.EDU.AU.
nameserver 129.94.242.2
nameserver 129.94.242.45
nameserver 129.94.242.33
options rotate
search orchestra.cse.unsw.EDU.AU. cse.unsw.EDU.AU. unsw.EDU.AU.
```

From the result of *cat /etc/resolv.conf,* The IP addresses of the local nameserver for my machine are **129.94.242.2**, **129.94.242.45**, and **129.94.242.33**. The primary local nameserver is **129.94.242.2**.

Question 5

What are the DNS nameservers for the "eecs.berkeley.edu." domain? Find out their IP addresses? What type of DNS query is sent to obtain this information?

```
z5183946@weber:~/9331$ dig eecs.berkeley.edu

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 24188
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 5, ADDITIONAL: 10

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;eecs.berkeley.edu.             IN      A

;; ANSWER SECTION:
eecs.berkeley.edu.      10345   IN      A       23.185.0.1

;; AUTHORITY SECTION:
eecs.berkeley.edu.      3850    IN      NS      adns1.berkeley.edu.
eecs.berkeley.edu.      3850    IN      NS      ns.CS.berkeley.edu.
eecs.berkeley.edu.      3850    IN      NS      ns.eecs.berkeley.edu.
eecs.berkeley.edu.      3850    IN      NS      adns2.berkeley.edu.
eecs.berkeley.edu.      3850    IN      NS      adns3.berkeley.edu.

;; ADDITIONAL SECTION:
ns.CS.berkeley.edu.     7657    IN      A       169.229.60.61
ns.CS.berkeley.edu.     10345   IN      AAAA    2607:f140:8:1260::30
ns.eecs.berkeley.edu.   10345   IN      A       169.229.60.153
adns1.berkeley.edu.     4177    IN      A       128.32.136.3
adns1.berkeley.edu.     4177    IN      AAAA    2607:f140:ffff:fffe::3
adns2.berkeley.edu.     5242    IN      A       128.32.136.14
adns2.berkeley.edu.     4177    IN      AAAA    2607:f140:ffff:fffe::e
adns3.berkeley.edu.     5241    IN      A       192.107.102.142
adns3.berkeley.edu.     49443   IN      AAAA    2607:f140:a000:d::abc

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Mar 08 14:24:36 AEDT 2022
;; MSG SIZE  rcvd: 351
```

From the output of *dig eecs.berkeley.edu* we can deduce that the nameservers and their IP addresses as follows:

Name	IPv4	IPv6
adns1.berkeley.edu	128.32.136.3	2607:f140:ffff:fffe::3
ns.CS.berkeley.edu	169.229.60.61	2607:f140:8:1260::30
ns.eecs.berkeley.edu	169.229.60.153	-
adns2.berkeley.edu	128.32.136.14	2607:f140:ffff:fffe::e
adns3.berkeley.edu	192.107.102.142	2607:f140:a000:d::abc

Type **A** query is used to obtain this information.

Question 6

What is the DNS name associated with the IP address 111.68.101.54? What type of DNS query is sent to obtain this information?

```
z5183946@weber:~/9331$ dig -x 111.68.101.54

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> -x 111.68.101.54
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30297
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 3

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;54.101.68.111.in-addr.arpa.    IN      PTR

;; ANSWER SECTION:
54.101.68.111.in-addr.arpa. 578 IN      PTR     webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 32779  IN      NS      ns1.hec.gov.pk.
101.68.111.in-addr.arpa. 32779  IN      NS      ns2.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.         578     IN      A       103.4.93.5
ns2.hec.gov.pk.         578     IN      A       103.4.93.6

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Mar 08 14:35:45 AEDT 2022
;; MSG SIZE  rcvd: 172
```

According to answer section in the output from *dig -x 111.68.101.54,* the DNS name associated with 111.68.101.54 is **webserver.seecs.nust.edu.pk**. **PTR** query is sent to obtain this information.

Question 7

Run dig and query the CSE nameserver (129.94.242.33) for the mail servers for Yahoo! Mail. Did you get an authoritative answer? Why?

```
z5183946@weber:~/9331$ dig @129.94.242.33 yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.242.33 yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 20317
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 10

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; 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.              13085   IN      NS      ns2.yahoo.com.
yahoo.com.              13085   IN      NS      ns4.yahoo.com.
yahoo.com.              13085   IN      NS      ns5.yahoo.com.
yahoo.com.              13085   IN      NS      ns1.yahoo.com.
yahoo.com.              13085   IN      NS      ns3.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          517327  IN      A       68.180.131.16
ns1.yahoo.com.          33018   IN      AAAA    2001:4998:1b0::7961:686f:6f21
ns2.yahoo.com.          604511  IN      A       68.142.255.16
ns2.yahoo.com.          33049   IN      AAAA    2001:4998:1c0::7961:686f:6f21
ns3.yahoo.com.          964     IN      A       27.123.42.42
ns3.yahoo.com.          964     IN      AAAA    2406:8600:f03f:1f8::1003
ns4.yahoo.com.          508604  IN      A       98.138.11.157
ns5.yahoo.com.          21573   IN      A       202.165.97.53
ns5.yahoo.com.          16269   IN      AAAA    2406:2000:1d0::7961:686f:6f21

;; Query time: 105 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Tue Mar 08 14:53:48 AEDT 2022
;; MSG SIZE  rcvd: 399
```

After running *dig @129.94.242.33 yahoo.com MX*, we can see that the answer is **not authoritative** because **aa** (Authoritative Answer) is not included in flags field.

Question 8

Repeat the above but use one of the nameservers obtained in Question 5. What is the result?

For this question, I picked 128.32.136.3 (adns1.berkeley.edu) as the nameserver, and the answer from command *dig @169.229.60.61 yahoo.com MX* shows that the query is refused in the status field. The reason might be that CSE machine doesn't have permission to access that nameserver of Berkeley.

```
z5183946@wagner:~/9331$ dig @adns1.berkeley.edu yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @adns1.berkeley.edu yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 4097
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1220
;; QUESTION SECTION:
;yahoo.com.                     IN      MX

;; Query time: 166 msec
;; SERVER: 128.32.136.3#53(128.32.136.3)
;; WHEN: Wed Mar 09 02:08:32 AEDT 2022
;; MSG SIZE  rcvd: 38
```

Question 9

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

Use the authoritative server of yahoo provides the authoritative answer. It is achieved by sending the **MX** query: *dig @ns1.yahoo.com yahoo.com MX.*

```
z5183946@wagner:~/9331$ dig @ns1.yahoo.com yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns1.yahoo.com yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 18387
;; flags: qr aa rd; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1272
;; QUESTION SECTION:
;yahoo.com.                     IN      MX

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

;; Query time: 147 msec
;; SERVER: 68.180.131.16#53(68.180.131.16)
;; WHEN: Wed Mar 09 02:13:35 AEDT 2022
;; MSG SIZE  rcvd: 117
```

Question 10

To find the IP address of *lyre00.cse.unsw.edu.au* iteratively, we need to find the root nameserver first. The root nameserver can be found by running *dig . NS*:

```
z5183946@wagner:~/9331$ dig . NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 62902
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;.                              IN      NS

;; ANSWER SECTION:
.                       113141  IN      NS      b.root-servers.net.
.                       113141  IN      NS      j.root-servers.net.
.                       113141  IN      NS      c.root-servers.net.
.                       113141  IN      NS      h.root-servers.net.
.                       113141  IN      NS      d.root-servers.net.
.                       113141  IN      NS      e.root-servers.net.
.                       113141  IN      NS      a.root-servers.net.
.                       113141  IN      NS      i.root-servers.net.
.                       113141  IN      NS      l.root-servers.net.
.                       113141  IN      NS      f.root-servers.net.
.                       113141  IN      NS      k.root-servers.net.
.                       113141  IN      NS      g.root-servers.net.
.                       113141  IN      NS      m.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net.     76473   IN      A       198.41.0.4
a.root-servers.net.     360757  IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net.     509848  IN      A       199.9.14.201
b.root-servers.net.     23921   IN      AAAA    2001:500:200::b
c.root-servers.net.     483807  IN      A       192.33.4.12
c.root-servers.net.     23921   IN      AAAA    2001:500:2::c
d.root-servers.net.     357841  IN      A       199.7.91.13
d.root-servers.net.     23921   IN      AAAA    2001:500:2d::d
e.root-servers.net.     483817  IN      A       192.203.230.10
e.root-servers.net.     125350  IN      AAAA    2001:500:a8::e
f.root-servers.net.     376001  IN      A       192.5.5.241
f.root-servers.net.     23921   IN      AAAA    2001:500:2f::f
g.root-servers.net.     483807  IN      A       192.112.36.4
g.root-servers.net.     85041   IN      AAAA    2001:500:12::d0d
h.root-servers.net.     483813  IN      A       198.97.190.53
h.root-servers.net.     23921   IN      AAAA    2001:500:1::53
i.root-servers.net.     483807  IN      A       192.36.148.17
i.root-servers.net.     23921   IN      AAAA    2001:7fe::53
j.root-servers.net.     483813  IN      A       192.58.128.30
j.root-servers.net.     557352  IN      AAAA    2001:503:c27::2:30
k.root-servers.net.     483813  IN      A       193.0.14.129
k.root-servers.net.     23921   IN      AAAA    2001:7fd::1
l.root-servers.net.     357848  IN      A       199.7.83.42
l.root-servers.net.     23921   IN      AAAA    2001:500:9f::42
m.root-servers.net.     51813   IN      A       202.12.27.33
m.root-servers.net.     23921   IN      AAAA    2001:dc3::35

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Wed Mar 09 02:22:04 AEDT 2022
;; MSG SIZE  rcvd: 811
```

Then, query the root server(b.root-servers.net) to get the authoritative name server for the "au." Domain by running *dig @b.root-servers.net au.*:

```
z5183946@wagner:~/9331$ dig @b.root-servers.net au.

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @b.root-servers.net au.
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 9148
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 9
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;au.                            IN      A

;; AUTHORITY SECTION:
au.                     172800  IN      NS      q.au.
au.                     172800  IN      NS      r.au.
au.                     172800  IN      NS      s.au.
au.                     172800  IN      NS      t.au.

;; ADDITIONAL SECTION:
q.au.                   172800  IN      A       65.22.196.1
q.au.                   172800  IN      AAAA    2a01:8840:be::1
r.au.                   172800  IN      A       65.22.197.1
r.au.                   172800  IN      AAAA    2a01:8840:bf::1
s.au.                   172800  IN      A       65.22.198.1
s.au.                   172800  IN      AAAA    2a01:8840:c0::1
t.au.                   172800  IN      A       65.22.199.1
t.au.                   172800  IN      AAAA    2a01:8840:c1::1

;; Query time: 238 msec
;; SERVER: 199.9.14.201#53(199.9.14.201)
;; WHEN: Wed Mar 09 02:26:40 AEDT 2022
;; MSG SIZE  rcvd: 271
```

Query this second server(q.au.) to find the authoritative nameserver for the "edu.au." domain, from the result we can see that q.au. is still responsible for “edu.au” domain.

```
z5183946@wagner:~/9331$ dig @q.au. edu.au. NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @q.au. edu.au. NS
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17814
;; flags: qr aa rd; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;edu.au.                            IN      NS

;; ANSWER SECTION:
edu.au.                 900     IN      NS      s.au.
edu.au.                 900     IN      NS      t.au.
edu.au.                 900     IN      NS      r.au.
edu.au.                 900     IN      NS      q.au.

;; Query time: 24 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Wed Mar 09 02:28:49 AEDT 2022
;; MSG SIZE  rcvd: 99
```

Then query q.au. for "unsw.edu.au":

```
z5183946@wagner:~/9331$ dig @q.au. unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @q.au. unsw.edu.au
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 49812
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 6
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;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: 24 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Wed Mar 09 02:30:31 AEDT 2022
;; MSG SIZE  rcvd: 198
```

Then query *ns1.unsw.edu.au* for authoritative server for cse.unsw.edu.au:

```
z5183946@wagner:~/9331$ dig @ns1.unsw.edu.au. cse.unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns1.unsw.edu.au. cse.unsw.edu.au
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26720
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 5
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;cse.unsw.edu.au.               IN      A

;; AUTHORITY SECTION:
cse.unsw.edu.au.        300     IN      NS      maestro.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.        300     IN      NS      beethoven.orchestra.cse.unsw.edu.au.

;; ADDITIONAL SECTION:
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.242.2
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.172.11
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.208.3
maestro.orchestra.cse.unsw.edu.au. 300 IN A     129.94.242.33

;; Query time: 4 msec
;; SERVER: 129.94.0.192#53(129.94.0.192)
;; WHEN: Wed Mar 09 02:31:46 AEDT 2022
;; MSG SIZE  rcvd: 164
```

Finally, query *maestro.orchestra.cse.unsw.edu.au.* for the IP address for *lyre00.cse.unsw.edu.au*:

```
z5183946@wagner:~/9331$ dig @maestro.orchestra.cse.unsw.edu.au. lyre00.cse.unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @maestro.orchestra.cse.unsw.edu.au. lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26468
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 3

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; 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      maestro.orchestra.cse.unsw.EDU.AU.
cse.unsw.EDU.AU.        3600    IN      NS      beethoven.orchestra.cse.unsw.EDU.AU.

;; 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: 129.94.242.33#53(129.94.242.33)
;; WHEN: Wed Mar 09 02:33:52 AEDT 2022
;; MSG SIZE  rcvd: 177
```

Then we get the desired IP address: **129.94.210.20**.

To get the authoritative answer, there are **4** name servers used, that are:

b.root-servers.net au.

q.au.

ns1.unsw.edu.au.

maestro.orchestra.cse.unsw.edu.au.

With *q.au.* queried twice, for au. and edu.au respectively.

Question 11

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

One physical machine can have multiple names associated with it. The machine manager just needs to set several type A records all having IP address of this machine as value but with different names. They can also use CNAME to create alias easily for one machine.

It can also have several IP addresses associated with. Because each network interface can be assigned with a IP address and a machine may have multiple interface installed.