Exercise 3

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391/Desktop$ dig www.cecs.anu.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> www.cecs.anu.edu.au
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 11650
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 3, ADDITIONAL: 7

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.cecs.anu.edu.au.           IN      A

;; ANSWER SECTION:
www.cecs.anu.edu.au.    36      IN      CNAME   rproxy.cecs.anu.edu.au.
rproxy.cecs.anu.edu.au. 3355    IN      A       150.203.161.98

;; AUTHORITY SECTION:
cecs.anu.edu.au.        42      IN      NS      ns2.cecs.anu.edu.au.
cecs.anu.edu.au.        42      IN      NS      ns4.cecs.anu.edu.au.
cecs.anu.edu.au.        42      IN      NS      ns3.cecs.anu.edu.au.

;; ADDITIONAL SECTION:
ns2.cecs.anu.edu.au.    3478    IN      A       150.203.161.36
ns2.cecs.anu.edu.au.    2817    IN      AAAA    2001:388:1034:2905::24
ns3.cecs.anu.edu.au.    36      IN      A       150.203.161.50
ns3.cecs.anu.edu.au.    2817    IN      AAAA    2001:388:1034:2905::32
ns4.cecs.anu.edu.au.    36      IN      A       150.203.161.38
ns4.cecs.anu.edu.au.    36      IN      AAAA    2001:388:1034:2905::26

;; Query time: 5 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Mon Mar 09 14:07:40 AEDT 2020
;; MSG SIZE  rcvd: 271
```

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

The IP address of www.cecs.anu.edu.au is 150.203.161.98.

From the QUESTION SECTION we can see that type A DNS query is sent to get this answer

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

The canonical name for the CECS ANU web server is rproxy.cecs.anu.edu.au

Reason:

When multiple domain names point to the same server IP, you can point a domain name as an A record to the server IP and alias other domain names to the domain name previously made as an A record, so you don't need to trouble when the server IP address changes. The change of one domain name to one that only needs to change the domain name of the A record and the other domain names of aliases will also be automatically changed to the new IP address.

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

The AUTHORITY SECTION contains NS resource records for cecs.anu.edu.au domain name, and there are 3 three authoritative name servers:

ns2.cecs.anu.edu.au

ns4.cecs.anu.edu.au

ns3.cecs.anu.edu.au

The additional section contains IPv4(type A) and IPv6(type AAAA) addresses of the nameservers in the authority section.

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

The IP address of the local nameserver for my machine is 129.94.242.2.

Question 5. What are the DNS nameservers for the “cecs.anu.edu.au” domain (note: the d domain 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?

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig cecs.anu.edu.au NS

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> cecs.anu.edu.au NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12954
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 7

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

;; ANSWER SECTION:
cecs.anu.edu.au.        300     IN      NS      ns3.cecs.anu.edu.au.
cecs.anu.edu.au.        300     IN      NS      ns4.cecs.anu.edu.au.
cecs.anu.edu.au.        300     IN      NS      ns2.cecs.anu.edu.au.

;; ADDITIONAL SECTION:
ns2.cecs.anu.edu.au.    556     IN      A       150.203.161.36
ns2.cecs.anu.edu.au.    707     IN      AAAA    2001:388:1034:2905::24
ns3.cecs.anu.edu.au.    3118    IN      A       150.203.161.50
ns3.cecs.anu.edu.au.    1217    IN      AAAA    2001:388:1034:2905::32
ns4.cecs.anu.edu.au.    3118    IN      A       150.203.161.38
ns4.cecs.anu.edu.au.    433     IN      AAAA    2001:388:1034:2905::26

;; Query time: 41 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Mon Mar 09 14:56:22 AEDT 2020
;; MSG SIZE  rcvd: 230
```

domain	ns2.cecs.anu.edu.au.	ns3.cecs.anu.edu.au	ns4.cecs.anu.edu.au
IPv4 addresses	150.203.161.36	150.203.161.50	150.203.161.38
IPv6 addresses	2001:388:1034:2905::24	2001:388:1034:2905::32	2001:388:1034:2905::26

The type of DNS query sent is nameserver: NS.

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?

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig -x 111.68.101.54

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> -x 111.68.101.54
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17130
;; 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. 367 IN      PTR     webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 34172  IN      NS      ns1.hec.gov.pk.
101.68.111.in-addr.arpa. 34172  IN      NS      ns2.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.         367     IN      A       103.4.93.5
ns2.hec.gov.pk.         367     IN      A       103.4.93.6

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Mon Mar 09 15:00:54 AEDT 2020
;; MSG SIZE  rcvd: 172
```

The DNS name associated with the IP address 111.68.101.54 is webserver.seecs.nust.edu.pk

The type of DNS query is sent to obtain this information is PTR

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)

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig MX @129.94.242.33 yahoo.c
om

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> MX @129.94.242.33 yahoo.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 29761
;; 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.              588     IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              588     IN      MX      1 mta7.am0.yahoodns.net.
yahoo.com.              588     IN      MX      1 mta5.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              100     IN      NS      ns5.yahoo.com.
yahoo.com.              100     IN      NS      ns1.yahoo.com.
yahoo.com.              100     IN      NS      ns3.yahoo.com.
yahoo.com.              100     IN      NS      ns2.yahoo.com.
yahoo.com.              100     IN      NS      ns4.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          256913  IN      A       68.180.131.16
ns1.yahoo.com.          83022   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          78899   IN      A       68.142.255.16
ns2.yahoo.com.          83022   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          1459    IN      A       27.123.42.42
ns3.yahoo.com.          120579  IN      AAAA    2406:8600:f03f:1f8::1003
ns4.yahoo.com.          96975   IN      A       98.138.11.157
ns5.yahoo.com.          14950   IN      A       202.165.97.53
ns5.yahoo.com.          11010   IN      AAAA    2406:2000:ff60::53

;; Query time: 5 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Mon Mar 09 15:22:07 AEDT 2020
;; MSG SIZE  rcvd: 399
```

No, I didn't get an authoritative answer because there is no AA in flags of the header.

Because the dig command is sent from CSE nameserver and the CSE nameserver is not the authoritative DNS server of yahoo so the server of yahoo would not give the authoritative answer to CSE nameserver.

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

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig MX @150.203.161.50 yahoo.
com

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> MX @150.203.161.50 yahoo.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 27206
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;yahoo.com.                     IN      MX

;; Query time: 8 msec
;; SERVER: 150.203.161.50#53(150.203.161.50)
;; WHEN: Mon Mar 09 15:30:56 AEDT 2020
;; MSG SIZE  rcvd: 38
```

I used 150.203.161.50(ns3.cecs.anu.edu.au) and there is no response.

The result statues is REFUSED.

Because the ANU nameserver do not reply to DNS queries which is not sent from ANU network.

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

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig MX @ns2.yahoo.com yahoo.c
om

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> MX @ns2.yahoo.com yahoo.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59479
;; flags: qr aa rd; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 10
;; 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 mta5.am0.yahoodns.net.
yahoo.com.              1800    IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              172800  IN      NS      ns3.yahoo.com.
yahoo.com.              172800  IN      NS      ns2.yahoo.com.
yahoo.com.              172800  IN      NS      ns5.yahoo.com.
yahoo.com.              172800  IN      NS      ns1.yahoo.com.
yahoo.com.              172800  IN      NS      ns4.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.          1800    IN      A       27.123.42.42
ns4.yahoo.com.          1209600 IN      A       98.138.11.157
ns5.yahoo.com.          86400   IN      A       202.165.97.53
ns1.yahoo.com.          86400   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          86400   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          1800    IN      AAAA    2406:8600:f03f:1f8::1003
ns5.yahoo.com.          86400   IN      AAAA    2406:2000:ff60::53

;; Query time: 149 msec
;; SERVER: 68.142.255.16#53(68.142.255.16)
;; WHEN: Mon Mar 09 15:45:43 AEDT 2020
;; MSG SIZE  rcvd: 399
```

We can get authoritative answer by using yahoo nameserver(ns2.yahoo.com).

The type of DNS query is sent to obtain this information MX.

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?

First, we can query for the IP address of the root nameservers.

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig . NS

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 4184
;; 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:
.                       9138    IN      NS      j.root-servers.net.
.                       9138    IN      NS      e.root-servers.net.
.                       9138    IN      NS      f.root-servers.net.
.                       9138    IN      NS      g.root-servers.net.
.                       9138    IN      NS      c.root-servers.net.
.                       9138    IN      NS      i.root-servers.net.
.                       9138    IN      NS      b.root-servers.net.
.                       9138    IN      NS      d.root-servers.net.
.                       9138    IN      NS      l.root-servers.net.
.                       9138    IN      NS      a.root-servers.net.
.                       9138    IN      NS      m.root-servers.net.
.                       9138    IN      NS      h.root-servers.net.
.                       9138    IN      NS      k.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net.     98639   IN      A       198.41.0.4
a.root-servers.net.     37684   IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net.     172301  IN      A       199.9.14.201
b.root-servers.net.     2193    IN      AAAA    2001:500:200::b
c.root-servers.net.     161212  IN      A       192.33.4.12
c.root-servers.net.     365102  IN      AAAA    2001:500:2::c
d.root-servers.net.     154865  IN      A       199.7.91.13
d.root-servers.net.     365102  IN      AAAA    2001:500:2d::d
e.root-servers.net.     18744   IN      A       192.203.230.10
e.root-servers.net.     52277   IN      AAAA    2001:500:a8::e
f.root-servers.net.     155464  IN      A       192.5.5.241
f.root-servers.net.     2193    IN      AAAA    2001:500:2f::f
g.root-servers.net.     74716   IN      A       192.112.36.4
g.root-servers.net.     2193    IN      AAAA    2001:500:12::d0d
h.root-servers.net.     158203  IN      A       198.97.190.53
h.root-servers.net.     365102  IN      AAAA    2001:500:1::53
i.root-servers.net.     10389   IN      A       192.36.148.17
i.root-servers.net.     2193    IN      AAAA    2001:7fe::53
j.root-servers.net.     368817  IN      A       192.58.128.30
j.root-servers.net.     513688  IN      AAAA    2001:503:c27::2:30
k.root-servers.net.     155464  IN      A       193.0.14.129
k.root-servers.net.     518556  IN      AAAA    2001:7fd::1
l.root-servers.net.     10935   IN      A       199.7.83.42
l.root-servers.net.     365102  IN      AAAA    2001:500:9f::42
m.root-servers.net.     78548   IN      A       202.12.27.33
m.root-servers.net.     2193    IN      AAAA    2001:dc3::35

;; Query time: 1 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Mon Mar 09 15:53:52 AEDT 2020
;; MSG SIZE  rcvd: 811
```

Secondly, we can choose the first nameserver (198.41.0.4) to find the authoritative nameserver of the au. domain:

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig @198.41.0.4 lyre00.cse.un
sw.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @198.41.0.4 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12282
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 9, ADDITIONAL: 19
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
au.                     172800  IN      NS      m.au.
au.                     172800  IN      NS      d.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      n.au.
au.                     172800  IN      NS      a.au.
au.                     172800  IN      NS      c.au.

;; ADDITIONAL SECTION:
m.au.                   172800  IN      A       156.154.100.24
m.au.                   172800  IN      AAAA    2001:502:2eda::24
d.au.                   172800  IN      A       162.159.25.38
d.au.                   172800  IN      AAAA    2400:cb00:2049:1::a29f:1926
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
n.au.                   172800  IN      A       156.154.101.24
n.au.                   172800  IN      AAAA    2001:502:ad09::24
a.au.                   172800  IN      A       58.65.254.73
a.au.                   172800  IN      AAAA    2407:6e00:254:306::73
c.au.                   172800  IN      A       162.159.24.179
c.au.                   172800  IN      AAAA    2400:cb00:2049:1::a29f:18b3

;; Query time: 119 msec
;; SERVER: 198.41.0.4#53(198.41.0.4)
;; WHEN: Mon Mar 09 15:59:26 AEDT 2020
;; MSG SIZE  rcvd: 591
```

Then, we can choose the first nameserver (156.154.100.24) to find the authoritative nameserver of the edu.au. domain:

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig @156.154.100.24 lyre00.cs
e.unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @156.154.100.24 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 62094
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 9
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; AUTHORITY SECTION:
edu.au.                 86400   IN      NS      t.au.
edu.au.                 86400   IN      NS      r.au.
edu.au.                 86400   IN      NS      q.au.
edu.au.                 86400   IN      NS      s.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: 14 msec
;; SERVER: 156.154.100.24#53(156.154.100.24)
;; WHEN: Mon Mar 09 16:00:54 AEDT 2020
;; MSG SIZE  rcvd: 291
```

After that, we can choose the first nameserver (65.22.196.1) to find the authoritative nameserver of the unsw.edu.au domain:

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig @65.22.196.1 lyre00.cse.u
nsw.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @65.22.196.1 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 20046
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 6
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; 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      ns1.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns3.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: 54 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Mon Mar 09 16:02:26 AEDT 2020
;; MSG SIZE  rcvd: 209
```

After that, we can choose the first nameserver (129.94.0.192) to find the authoritative nameserver of the unsw.edu.au domain:

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig @129.94.0.192 lyre00.cse.unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @129.94.0.192 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 22647
;; 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:
;lyre00.cse.unsw.edu.au.                IN      A

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

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

;; Query time: 4 msec
;; SERVER: 129.94.0.192#53(129.94.0.192)
;; WHEN: Mon Mar 09 16:09:03 AEDT 2020
;; MSG SIZE  rcvd: 171
```

At last, we can choose the first nameserver (129.94.208.3) to find the IP address of my machine.

```
z5239391@vx2:/tmp_amd/cage/export/cage/3/z5239391$ dig @129.94.208.3 lyre00.cse.unsw.edu.au

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @129.94.208.3 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 11454
;; 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      beethoven.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.        3600    IN      NS      maestro.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: 129.94.208.3#53(129.94.208.3)
;; WHEN: Mon Mar 09 16:12:13 AEDT 2020
;; MSG SIZE  rcvd: 155
```

I queried 6 servers to get the authoritative answer.

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

Yes, one physical machine can have several names and/or IP addresses associated with it

Because a physical machine can have several network interfaces, and one network interface can have several IP addresses associated with it at any given time.

Exercise 4

The code is included in the .tar file.