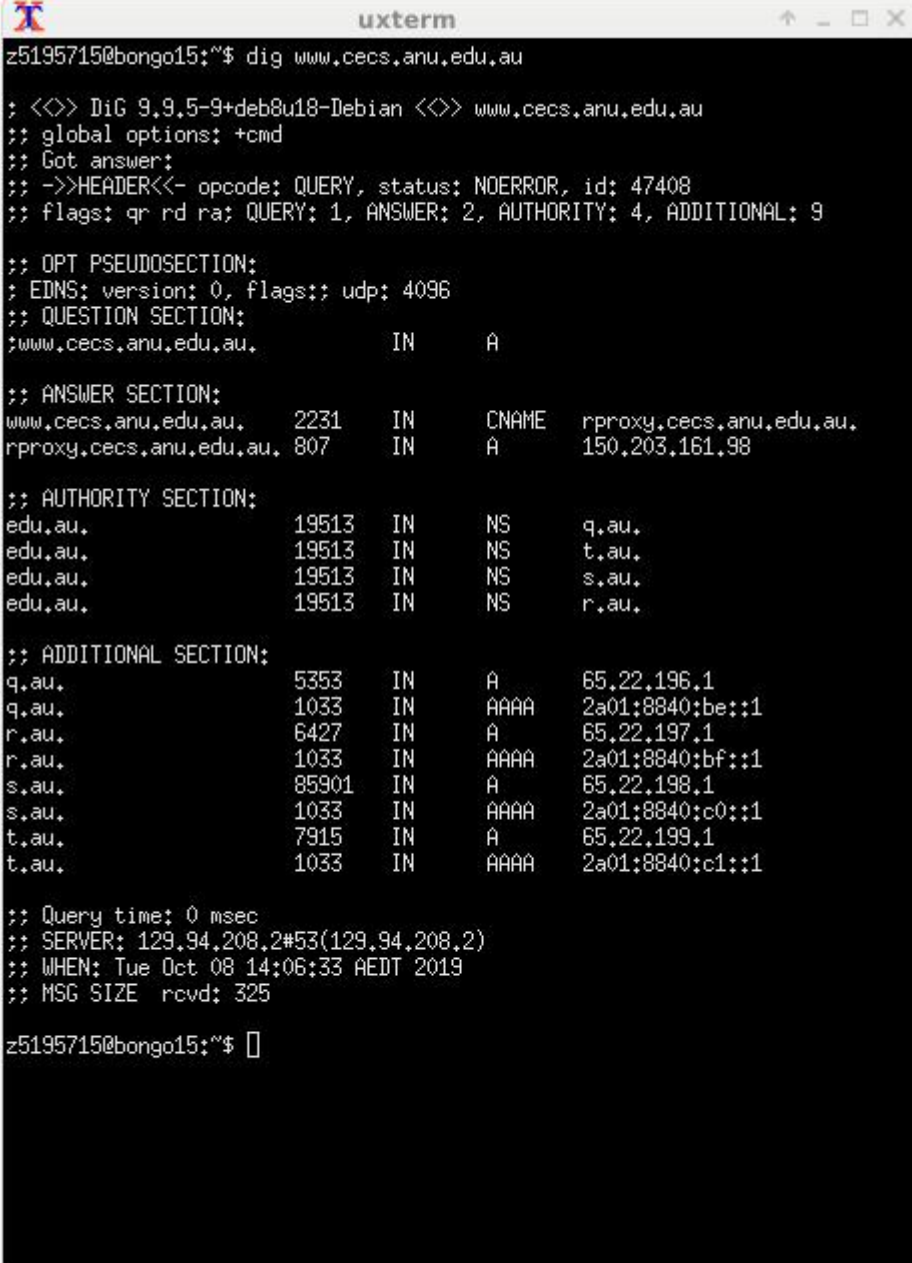


Lab 3

Exercise 3: Digging into DNS



```

uxterm
z5195715@bongo15:~$ 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: 47408
;; flags: qr rd ra; QUERY: 1, ANSWER: 2, AUTHORITY: 4, ADDITIONAL: 9

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

;; ANSWER SECTION:
www.cecs.anu.edu.au.      2231    IN      CNAME   rproxy.cecs.anu.edu.au.
rproxy.cecs.anu.edu.au.  807     IN      A       150.203.161.98

;; AUTHORITY SECTION:
edu.au.                   19513   IN      NS       q.au.
edu.au.                   19513   IN      NS       t.au.
edu.au.                   19513   IN      NS       s.au.
edu.au.                   19513   IN      NS       r.au.

;; ADDITIONAL SECTION:
q.au.                     5353    IN      A       65.22.196.1
q.au.                     1033    IN      AAAA    2a01:8840:be::1
r.au.                     6427    IN      A       65.22.197.1
r.au.                     1033    IN      AAAA    2a01:8840:bf::1
s.au.                     85901   IN      A       65.22.198.1
s.au.                     1033    IN      AAAA    2a01:8840:c0::1
t.au.                     7915    IN      A       65.22.199.1
t.au.                     1033    IN      AAAA    2a01:8840:c1::1

;; Query time: 0 msec
;; SERVER: 129.94.208.2#53(129.94.208.2)
;; WHEN: Tue Oct 08 14:06:33 AEDT 2019
;; MSG SIZE rcvd: 325

z5195715@bongo15:~$ 

```

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

IP address is 150.203.161.98

A type of DNS query.

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

Canonical name is rproxy.cecs.anu.edu.au.

Because canonical name is very long and difficult to remember, an alias makes it easier for users to remember and use.

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

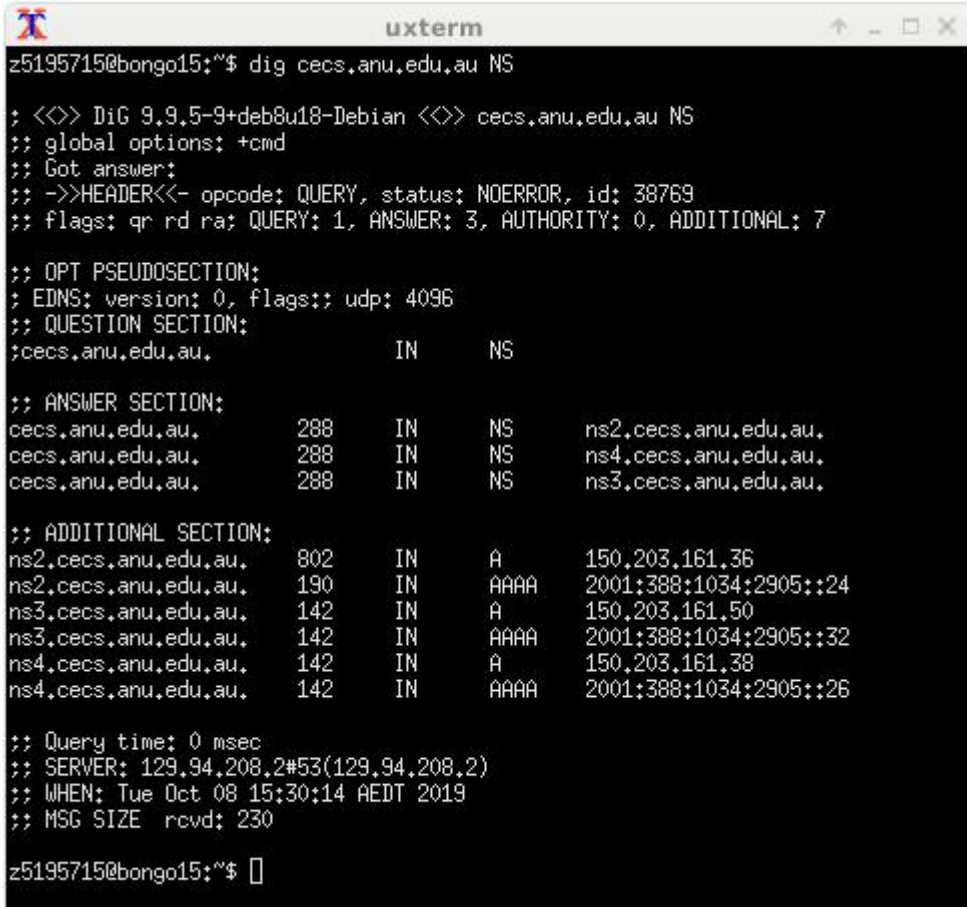
The Authority section includes DNS servers which can provide authoritative answers to the query. In this example, they are q.au, t.au, s.au and r.au.

The Additional section includes the IP addresses of the authoritative DNS servers. An authoritative DNS server has an Ipv4 address and an ipv6 address.

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

It's 129.94.208.2

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?



```
uxterm
z5195715@bongo15:~$ 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: 38769
;; 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.      288     IN      NS      ns2.cecs.anu.edu.au.
cecs.anu.edu.au.      288     IN      NS      ns4.cecs.anu.edu.au.
cecs.anu.edu.au.      288     IN      NS      ns3.cecs.anu.edu.au.

;; ADDITIONAL SECTION:
ns2.cecs.anu.edu.au.  802     IN      A        150.203.161.36
ns2.cecs.anu.edu.au.  190     IN      AAAA     2001:388:1034:2905::24
ns3.cecs.anu.edu.au.  142     IN      A        150.203.161.50
ns3.cecs.anu.edu.au.  142     IN      AAAA     2001:388:1034:2905::32
ns4.cecs.anu.edu.au.  142     IN      A        150.203.161.38
ns4.cecs.anu.edu.au.  142     IN      AAAA     2001:388:1034:2905::26

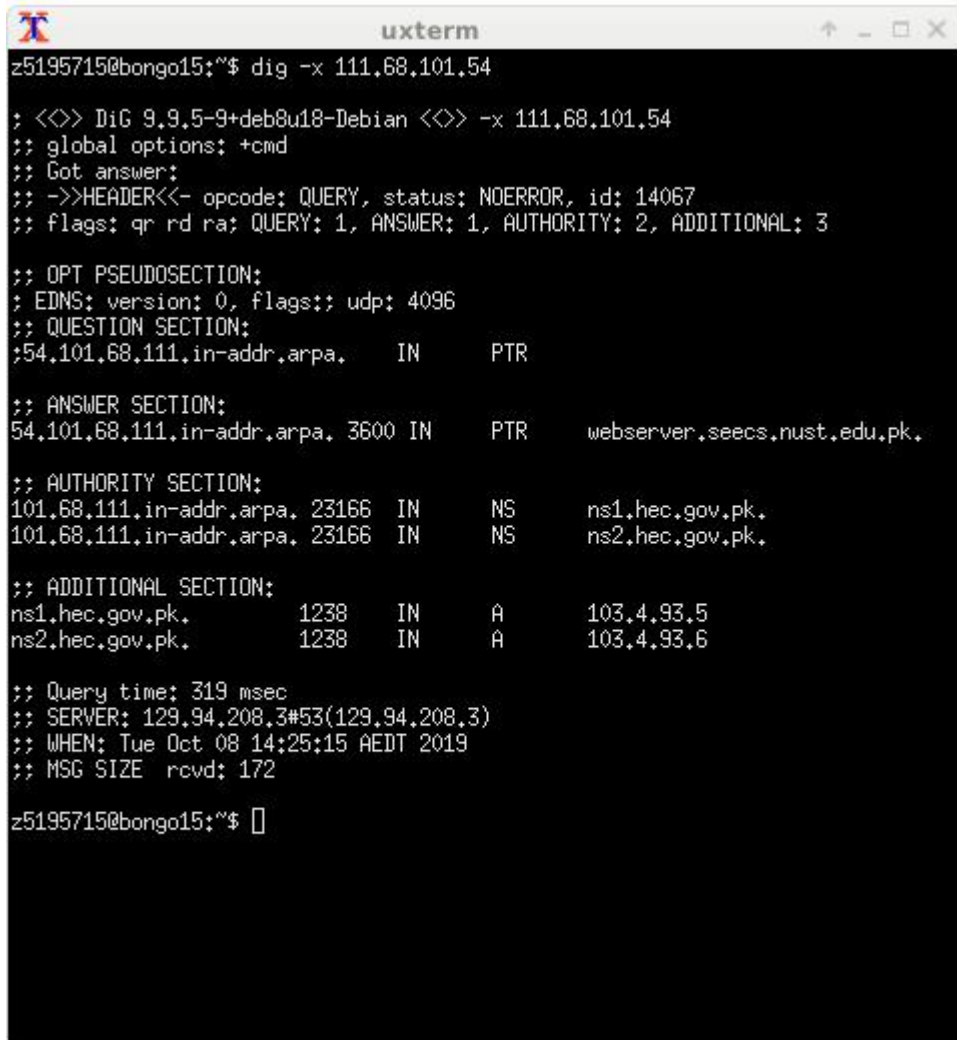
;; Query time: 0 msec
;; SERVER: 129.94.208.2#53(129.94.208.2)
;; WHEN: Tue Oct 08 15:30:14 AEDT 2019
;; MSG SIZE rcvd: 230

z5195715@bongo15:~$
```

Nameservers are ns2.cecs.anu.edu.au (150.203.161.36), ns3.cecs.anu.edu.au (150.203.161.50) and ns4.cecs.anu.edu.au (150.203.161.38).

NS type of DNS query.

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?

A screenshot of a terminal window titled 'uxterm'. The prompt is 'z5195715@bongo15:~\$'. The command entered is 'dig -x 111.68.101.54'. The output shows a DNS query for PTR record 54.101.68.111.in-addr.arpa. The answer section shows the PTR record pointing to 'webserver.seecs.nust.edu.pk.'. The authority section shows two NS records for '101.68.111.in-addr.arpa' pointing to 'ns1.hec.gov.pk.' and 'ns2.hec.gov.pk.'. The additional section shows two A records for 'ns1.hec.gov.pk.' and 'ns2.hec.gov.pk.' with IP addresses 103.4.93.5 and 103.4.93.6 respectively. The query time is 319 msec, the server is 129.94.208.3#53(129.94.208.3), and the message size received is 172 bytes.

```
z5195715@bongo15:~$ 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: 14067
;; 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. 3600 IN    PTR    webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 23166 IN    NS     ns1.hec.gov.pk.
101.68.111.in-addr.arpa. 23166 IN    NS     ns2.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.           1238 IN    A      103.4.93.5
ns2.hec.gov.pk.           1238 IN    A      103.4.93.6

;; Query time: 319 msec
;; SERVER: 129.94.208.3#53(129.94.208.3)
;; WHEN: Tue Oct 08 14:25:15 AEDT 2019
;; MSG SIZE  rcvd: 172

z5195715@bongo15:~$
```

Name is webserver.seecs.nust.edu.pk

PTR type of DNS query.

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)

```
uxterm
z5195715@bongo15:~$ dig @129.94.242.33 yahoo.com MX

: <<> DiG 9.9.5-9+deb8u18-Debian <<> @129.94.242.33 yahoo.com MX
: (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27199
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 9

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

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

;; AUTHORITY SECTION:
yahoo.com.                30679   IN      NS      ns2.yahoo.com.
yahoo.com.                30679   IN      NS      ns1.yahoo.com.
yahoo.com.                30679   IN      NS      ns5.yahoo.com.
yahoo.com.                30679   IN      NS      ns4.yahoo.com.
yahoo.com.                30679   IN      NS      ns3.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.            160618  IN      A       68.180.131.16
ns1.yahoo.com.            22815   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.            160618  IN      A       68.142.255.16
ns2.yahoo.com.            11854   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.            1356    IN      A       27.123.42.42
ns3.yahoo.com.            1157    IN      AAAA    2406:8600:f03f:1f8::1003
ns4.yahoo.com.            462244  IN      A       98.138.11.157
ns5.yahoo.com.            18199   IN      A       119.160.253.83

;; Query time: 148 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Tue Oct 08 14:28:42 AEDT 2019
;; MSG SIZE rcvd: 371

z5195715@bongo15:~$
```

I can't get an authoritative answer because 'aa' cannot be found in flags.

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

```
uxterm
z5195715@bongo15:~$ dig @ns3.cecs.anu.edu.au yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @ns3.cecs.anu.edu.au yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 1049
;; 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: 9 msec
;; SERVER: 150.203.161.50#53(150.203.161.50)
;; WHEN: Tue Oct 08 14:33:24 AEDT 2019
;; MSG SIZE rcvd: 38

z5195715@bongo15:~$
```

I choose ns3.cecs.anu.edu.au. I can't get a response from yahoo. The status is refused. There is a warning that recursion requested but not available.

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

```
uxterm
z5195715@bongo15:~$ dig yahoo.com

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> yahoo.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 46164
;; flags: qr rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 5, ADDITIONAL: 9

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

;; ANSWER SECTION:
yahoo.com.                1261    IN      A       72.30.35.10
yahoo.com.                1261    IN      A       98.137.246.7
yahoo.com.                1261    IN      A       98.137.246.8
yahoo.com.                1261    IN      A       98.138.219.231
yahoo.com.                1261    IN      A       98.138.219.232
yahoo.com.                1261    IN      A       72.30.35.9

;; AUTHORITY SECTION:
yahoo.com.                30287   IN      NS       ns1.yahoo.com.
yahoo.com.                30287   IN      NS       ns3.yahoo.com.
yahoo.com.                30287   IN      NS       ns4.yahoo.com.
yahoo.com.                30287   IN      NS       ns5.yahoo.com.
yahoo.com.                30287   IN      NS       ns2.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.            358454  IN      A        68.180.131.16
ns1.yahoo.com.            22423   IN      AAAA     2001:4998:130::1001
ns2.yahoo.com.            337288  IN      A        68.142.255.16
ns2.yahoo.com.            11462   IN      AAAA     2001:4998:140::1002
ns3.yahoo.com.            172     IN      A        27.123.42.42
ns3.yahoo.com.            172     IN      AAAA     2406:8600:f03f:1f8::1003
ns4.yahoo.com.            175127  IN      A        98.138.11.157
ns5.yahoo.com.            175127  IN      A        119.160.253.83

;; Query time: 5 msec
;; SERVER: 129.94.208.2#53(129.94.208.2)
;; WHEN: Tue Oct 08 14:35:14 AEDT 2019
;; MSG SIZE rcvd: 388

z5195715@bongo15:~$
```

I choose ns1.yahoo.com.

```

uxterm
z5195715@bongo15:~$ dig @ns1.yahoo.com yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @ns1.yahoo.com yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17864
;; flags: qr aa rd; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 9
;; 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 mta7.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta5.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.                172800  IN      NS      ns2.yahoo.com.
yahoo.com.                172800  IN      NS      ns5.yahoo.com.
yahoo.com.                172800  IN      NS      ns3.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.            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.            1800    IN      AAAA    2406:8600:f03f:1f8::1003

;; Query time: 145 msec
;; SERVER: 68.180.131.16#53(68.180.131.16)
;; WHEN: Tue Oct 08 14:43:44 AEDT 2019
;; MSG SIZE rcvd: 371

z5195715@bongo15:~$ 

```

MX type of DNS query is sent.

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 (root 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?

Find the nameserver of . :


```
uxterm
z5195715@bongo15:~$ dig . NS

;<> DiG 9.9.5-9+deb8u18-Debian <> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 63169
;; 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:
.                               272192 IN      NS      f.root-servers.net.
.                               272192 IN      NS      k.root-servers.net.
.                               272192 IN      NS      j.root-servers.net.
.                               272192 IN      NS      h.root-servers.net.
.                               272192 IN      NS      c.root-servers.net.
.                               272192 IN      NS      g.root-servers.net.
.                               272192 IN      NS      l.root-servers.net.
.                               272192 IN      NS      m.root-servers.net.
.                               272192 IN      NS      i.root-servers.net.
.                               272192 IN      NS      d.root-servers.net.
.                               272192 IN      NS      e.root-servers.net.
.                               272192 IN      NS      a.root-servers.net.
.                               272192 IN      NS      b.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net. 154865 IN      A        198.41.0.4
a.root-servers.net. 168337 IN      AAAA     2001:503:ba3e::2:30
b.root-servers.net. 14853  IN      A        199.9.14.201
b.root-servers.net. 75347  IN      AAAA     2001:500:200::b
c.root-servers.net. 87574  IN      A        192.33.4.12
c.root-servers.net. 149839 IN      AAAA     2001:500:2::c
d.root-servers.net. 93781  IN      A        199.7.91.13
d.root-servers.net. 149839 IN      AAAA     2001:500:2d::d
e.root-servers.net. 113689 IN      A        192.203.230.10
e.root-servers.net. 86456  IN      AAAA     2001:500:a8::e
f.root-servers.net. 75347  IN      A        192.5.5.241
f.root-servers.net. 113688 IN      AAAA     2001:500:2f::f
g.root-servers.net. 16640  IN      A        192.112.36.4
g.root-servers.net. 137019 IN      AAAA     2001:500:12::d0d
h.root-servers.net. 101800 IN      A        198.97.190.53
h.root-servers.net. 113689 IN      AAAA     2001:500:1::53
i.root-servers.net. 181828 IN      A        192.36.148.17
i.root-servers.net. 75347  IN      AAAA     2001:7fe::53
j.root-servers.net. 3578   IN      A        192.58.128.30
j.root-servers.net. 75347  IN      AAAA     2001:503:c27::2:30
k.root-servers.net. 101763 IN      A        193.0.14.129
k.root-servers.net. 75347  IN      AAAA     2001:7fd::1
l.root-servers.net. 75347  IN      A        199.7.83.42
l.root-servers.net. 86456  IN      AAAA     2001:500:9f::42
m.root-servers.net. 101800 IN      A        202.12.27.33
m.root-servers.net. 113689 IN      AAAA     2001:dc3::35

;; Query time: 0 msec
;; SERVER: 129.94.208.2#53(129.94.208.2)
;; WHEN: Tue Oct 08 14:48:24 AEDT 2019
;; MSG SIZE rcvd: 811

z5195715@bongo15:~$
```

Find authoritative nameserver for au domain:

```
uxterm
z5195715@bongo15:~$ dig @199.9.14.201 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @199.9.14.201 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57808
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 10, ADDITIONAL: 20
;; WARNING: recursion requested but not available

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

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

;; ADDITIONAL SECTION:
a.au.                172800  IN      A       58.65.254.73
b.au.                172800  IN      A       58.65.253.73
c.au.                172800  IN      A       162.159.24.179
d.au.                172800  IN      A       162.159.25.38
q.au.                172800  IN      A       65.22.196.1
r.au.                172800  IN      A       65.22.197.1
s.au.                172800  IN      A       65.22.198.1
t.au.                172800  IN      A       65.22.199.1
u.au.                172800  IN      A       211.29.133.32
v.au.                172800  IN      A       202.12.31.53
a.au.                172800  IN      AAAA    2407:6e00:254:306::73
b.au.                172800  IN      AAAA    2407:6e00:253:306::73
c.au.                172800  IN      AAAA    2400:cb00:2049:1::a29f:18b3
d.au.                172800  IN      AAAA    2400:cb00:2049:1::a29f:1926
q.au.                172800  IN      AAAA    2a01:8840:be::1
r.au.                172800  IN      AAAA    2a01:8840:bf::1
s.au.                172800  IN      AAAA    2a01:8840:c0::1
t.au.                172800  IN      AAAA    2a01:8840:c1::1
v.au.                172800  IN      AAAA    2001:dd8:12::53

;; Query time: 163 msec
;; SERVER: 199.9.14.201#53(199.9.14.201)
;; WHEN: Tue Oct 08 14:54:14 AEDT 2019
;; MSG SIZE rcvd: 623

z5195715@bongo15:~$
```

Find the authoritative nameserver for the "edu.au.":


```
uxterm
z5195715@bongo15:~$ dig @58.65.254.73 lyre00.cse.unsw.edu.au NS

; <<> DiG 9.9.5-9+deb8u18-Debian <<> 58.65.254.73 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26046
;; 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      NS

;; AUTHORITY SECTION:
edu.au.          86400   IN      NS      s.au.
edu.au.          86400   IN      NS      q.au.
edu.au.          86400   IN      NS      r.au.
edu.au.          86400   IN      NS      t.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: 58.65.254.73#53(58.65.254.73)
;; WHEN: Tue Oct 08 14:57:46 AEDT 2019
;; MSG SIZE rcvd: 291

z5195715@bongo15:~$
```

Find the authoritative nameserver for "unsw.edu.au":

```
uxterm
z5195715@bongo15:~$ ^C
z5195715@bongo15:~$ dig @65.22.196.1 lyre00.cse.unsw.edu.au NS

; <<> DiG 9.9.5-9+deb8u18-Debian <<> @65.22.196.1 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 51785
;; 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      NS

;; 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: 7 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Tue Oct 08 15:18:09 AEDT 2019
;; MSG SIZE rcvd: 209

z5195715@bongo15:~$
```

Find the authoritative name server of cse.unsw.edu.au:

```
uxterm
z5195715@bongo15:~$ dig @192.155.82.178 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u18-Debian <<>> @192.155.82.178 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41451
;; 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      NS

;; 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 129.94.242.2
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: 158 msec
;; SERVER: 192.155.82.178#53(192.155.82.178)
;; WHEN: Tue Oct 08 15:19:22 AEDT 2019
;; MSG SIZE rcvd: 171

z5195715@bongo15:~$
```

Find the IP address of lyre00.cse.unsw.edu.au:

```
uxterm
z5195715@bongo15:~$ dig @129.94.242.2 lyre00.cse.unsw.edu.au

; <<> DiG 9.9.5-9+deb8u18-Debian <<> @129.94.242.2 lyre00.cse.unsw.edu.au
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13
;; 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      129.94.208.3

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Oct 08 15:22:12 AEDT 2019
;; MSG SIZE rcvd: 155

z5195715@bongo15:~$
```

IP address of lyre00 is 129.94.210.20

6 DNS servers are queried.

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

Yes, a machine can have several different names and/or IPs. The different names of a particular machine are called aliases, which helps users to remember and use easily. The reason for a machine to have several IP addresses is that it can work on several networks with different interfaces.

Exercise 4: A Simple Web Server

See WebServer.py