Exercise 3: Digging into DNS (marked, include in the lab report)

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

```
weber % dig www.eecs.berkeley.edu A

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu A
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30036
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 5

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

;; ANSWER SECTION:
www.eecs.berkeley.edu.  2092    IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 600  IN      CNAME   fel.edge.pantheon.io.
fel.edge.pantheon.io.   300     IN      A       23.185.0.1

;; AUTHORITY SECTION:
edge.pantheon.io.       300     IN      NS      ns-2013.awsdns-59.co.uk.
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-1213.awsdns-23.org.

;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   39966   IN      A       205.251.192.233
ns-644.awsdns-16.net.   58729   IN      A       205.251.194.132
ns-1213.awsdns-23.org.  32706   IN      A       205.251.196.189
ns-2013.awsdns-59.co.uk. 28190  IN      A       205.251.199.221

;; Query time: 18 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 29 03:21:57 AEST 2021
;; MSG SIZE  rcvd: 341
```

The IP address is: `23.185.0.1`

The type of DNS query is A. (Name: host domain name; Value: IP address)

Question 2. What is the canonical name for the eecs.berkeley webserver (i.e. www.eecs.berkeley.edu)? Suggest a reason for having an alias for this server.

(1) The canonical name for the eecs.berkeley webserver is live-eecs.pantheonsite.io.

(2) An alias for this server is more easier to remember.

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

(a) The part of Authority Section presents the corresponding authoritative domain name resolution server.

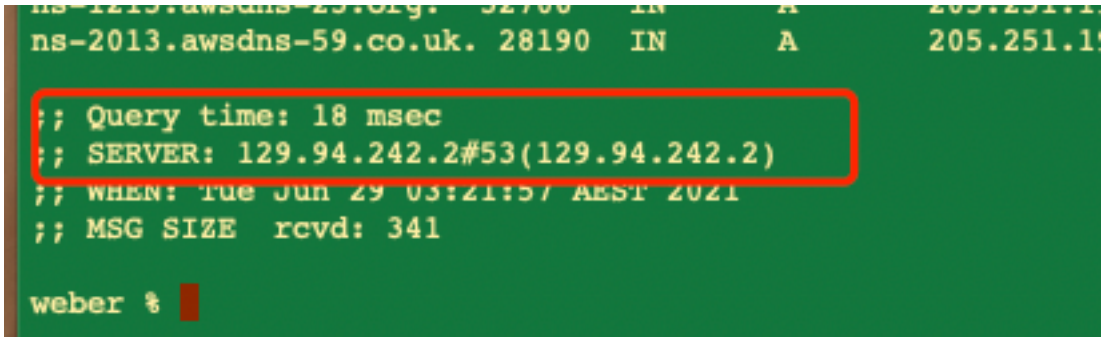
NS: records for the edge.pantheon.io domain name.

(b) Additional Section includes some potentially useful information that is cached. For example, the IP address of the corresponding authoritative domain name resolution server.

The A records are for IPv4 addresses. (The AAAA records are for IPv6 addresses.

)

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



The IP address of local nameserver for CSE is `129.94.242.2`

Question 5. What are the DNS nameservers for the "eecs.berkeley.edu." domain (note: the domain name is eecs.berkeley.edu and not www.eecs.berkeley.edu . This is an example of what is referred to as the apex/naked domain)? Find out their IP addresses? What type of DNS query is sent to obtain this information?

```
weber % dig eecs.berkeley.edu NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> eecs.berkeley.edu NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 2730
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 6

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

;; ANSWER SECTION:
eecs.berkeley.edu.      63338   IN      NS      adns3.berkeley.edu.
eecs.berkeley.edu.      63338   IN      NS      ns.CS.berkeley.edu.
eecs.berkeley.edu.      63338   IN      NS      adns1.berkeley.edu.
eecs.berkeley.edu.      63338   IN      NS      ns.eecs.berkeley.edu.
eecs.berkeley.edu.      63338   IN      NS      adns2.berkeley.edu.

;; ADDITIONAL SECTION:
ns.CS.berkeley.edu.     66425   IN      A       169.229.60.61
ns.CS.berkeley.edu.     66488   IN      AAAA    2607:f140:f000:1260::30
ns.eecs.berkeley.edu.   41936   IN      A       169.229.60.153
ns.eecs.berkeley.edu.   66428   IN      AAAA    2607:f140:f000:2160::30
adns3.berkeley.edu.     2427    IN      A       192.107.102.142

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 29 03:50:13 AEST 2021
;; MSG SIZE  rcvd: 247
```

(a) The name servers are:

`adns3.berkeley.edu.`

`ns.CS.berkeley.edu.`

`adns1.berkeley.edu.`

`ns.eecs.berkeley.edu.`

`adns2.berkeley.edu.`

(b) The IP addresses are:

`169.229.60.61 (IPv4)`

`2607:f140:f000:1260::30 (IPv6)`

`169.229.60.153 (IPv4)`

`2607:f140:f000:2160::30 (IPv6)`

`192.107.102.142 (IPv4)`

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?

```
weber % 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: 44966
;; 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. 3052   IN      NS      ns2.hec.gov.pk.
101.68.111.in-addr.arpa. 3052   IN      NS      ns1.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.         261     IN      A       103.4.93.5
ns2.hec.gov.pk.         3600    IN      A       103.4.93.6

;; Query time: 175 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 29 04:02:11 AEST 2021
;; MSG SIZE  rcvd: 172
```

(a) The DNS corresponding to 111.68.101.54 is `webserver.seecs.nust.edu.pk.`

(b) The type of DNS query 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?

```
weber % 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: 41671
;; 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.              800     IN      MX      1 mta5.am0.yahoodns.net.
yahoo.com.              800     IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              800     IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              22489   IN      NS      ns5.yahoo.com.
yahoo.com.              22489   IN      NS      ns1.yahoo.com.
yahoo.com.              22489   IN      NS      ns2.yahoo.com.
yahoo.com.              22489   IN      NS      ns4.yahoo.com.
yahoo.com.              22489   IN      NS      ns3.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          288950  IN      A       68.180.131.16
ns1.yahoo.com.          46280   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          117897  IN      A       68.142.255.16
ns2.yahoo.com.          12581   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          298     IN      A       27.123.42.42
ns4.yahoo.com.          28656   IN      A       98.138.11.157
ns5.yahoo.com.          47425   IN      A       202.165.97.53
ns5.yahoo.com.          17105   IN      AAAA    2406:2000:ff60::53

;; Query time: 0 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Tue Jun 29 04:12:38 AEST 2021
;; MSG SIZE  rcvd: 371
```

We cannot get authoritative answer. Because the flags do not contain the keyword “aa”, specifically it has authority for only the cse.unsw.edu.au domain and not for the Yahoo domain. And hence, if we want to get aa, we need to query with the authority name server of Yahoo.

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

```
weber % dig @ns.CS.berkeley.edu yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns.CS.berkeley.edu yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 18174
;; 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: 166 msec
;; SERVER: 169.229.60.61#53(169.229.60.61)
;; WHEN: Tue Jun 29 04:21:49 AEST 2021
;; MSG SIZE  rcvd: 38
```

There is not a response when we try with ns.CS.berkeley.edu.

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

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> yohoo.com NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 5302
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 10

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

;; ANSWER SECTION:
yohoo.com.              172799  IN      NS      ns3.yahoo.com.
yohoo.com.              172799  IN      NS      ns4.yahoo.com.
yohoo.com.              172799  IN      NS      ns5.yahoo.com.
yohoo.com.              172799  IN      NS      ns2.yahoo.com.
yohoo.com.              172799  IN      NS      ns1.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          514653  IN      A       68.180.131.16
ns1.yahoo.com.          45317   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          116934  IN      A       68.142.255.16
ns2.yahoo.com.          11618   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          1136    IN      A       27.123.42.42
ns3.yahoo.com.          1136    IN      AAAA    2406:8600:f03f:1f8::1003
ns4.yahoo.com.          369385  IN      A       98.138.11.157
ns5.yahoo.com.          16142   IN      A       202.165.97.53
ns5.yahoo.com.          46462   IN      AAAA    2406:2000:ff60::53

;; Query time: 346 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 29 04:28:41 AEST 2021
;; MSG SIZE  rcvd: 326
```

Through the commend dig yahoo.com NS, we can one of its IP addresses is 68.180.131.16.

Then,

```
weber % dig @68.180.131.16 yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @68.180.131.16 yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 30113
;; 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 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.              172800  IN      NS      ns4.yahoo.com.
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.

;; 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: 145 msec
;; SERVER: 68.180.131.16#53(68.180.131.16)
;; WHEN: Tue Jun 29 04:31:14 AEST 2021
;; MSG SIZE  rcvd: 399
```

By this query we can get the authoritative answer for the mail servers. And the type of DNS is 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).

Step (1): First query for the IP address of the root nameservers.

```
weber % dig . NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26207
;; 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:
.                       186920  IN      NS      b.root-servers.net.
.                       186920  IN      NS      l.root-servers.net.
.                       186920  IN      NS      h.root-servers.net.
.                       186920  IN      NS      i.root-servers.net.
.                       186920  IN      NS      d.root-servers.net.
.                       186920  IN      NS      k.root-servers.net.
.                       186920  IN      NS      a.root-servers.net.
.                       186920  IN      NS      c.root-servers.net.
.                       186920  IN      NS      m.root-servers.net.
.                       186920  IN      NS      j.root-servers.net.
.                       186920  IN      NS      e.root-servers.net.
.                       186920  IN      NS      f.root-servers.net.
.                       186920  IN      NS      g.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net.     22673   IN      A       198.41.0.4
a.root-servers.net.     187802  IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net.     298054  IN      A       199.9.14.201
b.root-servers.net.     298054  IN      AAAA    2001:500:200::b
c.root-servers.net.     383252  IN      A       192.33.4.12
c.root-servers.net.     136525  IN      AAAA    2001:500:2::c
d.root-servers.net.     31557   IN      A       199.7.91.13
d.root-servers.net.     57620   IN      AAAA    2001:500:2d::d
e.root-servers.net.     205246  IN      A       192.203.230.10
e.root-servers.net.     104700  IN      AAAA    2001:500:a8::e
f.root-servers.net.     549392  IN      A       192.5.5.241
f.root-servers.net.     57620   IN      AAAA    2001:500:2f::f
g.root-servers.net.     57620   IN      A       192.112.36.4
g.root-servers.net.     57620   IN      AAAA    2001:500:12::d0d
h.root-servers.net.     569052  IN      A       198.97.190.53
h.root-servers.net.     569052  IN      AAAA    2001:500:1::53
i.root-servers.net.     383252  IN      A       192.36.148.17
i.root-servers.net.     57619   IN      AAAA    2001:7fe::53
j.root-servers.net.     149265  IN      A       192.58.128.30
j.root-servers.net.     57620   IN      AAAA    2001:503:c27::2:30
k.root-servers.net.     359393  IN      A       193.0.14.129
k.root-servers.net.     136525  IN      AAAA    2001:7fd::1
l.root-servers.net.     575525  IN      A       199.7.83.42
l.root-servers.net.     136525  IN      AAAA    2001:500:9f::42
m.root-servers.net.     64583   IN      A       202.12.27.33
m.root-servers.net.     136526  IN      AAAA    2001:dc3::35

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 29 04:47:37 AEST 2021
;; MSG SIZE  rcvd: 811
```

Step (2): Next query one of the roots nameservers as follows:

```
weber % dig @198.41.0.4 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @198.41.0.4 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 42289
;; 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      NS

;; 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       37.209.192.5
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       37.209.194.5
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: 146 msec
;; SERVER: 198.41.0.4#53(198.41.0.4)
;; WHEN: Tue Jun 29 04:53:13 AEST 2021
;; MSG SIZE  rcvd: 591
```

Step (3): Query the a.au nameserver as follows.

```
weber % dig @58.65.254.73 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-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: 39128
;; 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      t.au.
edu.au.                 86400   IN      NS      r.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: 158 msec
;; SERVER: 58.65.254.73#53(58.65.254.73)
;; WHEN: Tue Jun 29 04:55:55 AEST 2021
;; MSG SIZE  rcvd: 291
```

Step (4): Now we get the edu.au. nameservers above, so query one of them below:

```
weber % dig @65.22.196.1 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-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: 54794
;; 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:
;lyre00.cse.unsw.edu.au.                IN      NS

;; AUTHORITY SECTION:
unsw.edu.au.            900     IN      NS      ns1.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns3.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns2.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: Tue Jun 29 04:58:16 AEST 2021
;; MSG SIZE  rcvd: 209
```

Step (5): We get the UNSW nameservers above, the query one of them below.

```
weber % dig @129.94.0.192 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.0.192 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 53120
;; 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.        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   129.94.208.3
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
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: Tue Jun 29 05:00:58 AEST 2021
;; MSG SIZE  rcvd: 171
```

Step (6): Now we are now being referred to the CSE nameservers. Then query one of them by a type A address as follows.

```
weber % dig @129.94.208.3 lyre00.cse.unsw.edu.au A

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.208.3 lyre00.cse.unsw.edu.au A
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12797
;; 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: Tue Jun 29 05:04:44 AEST 2021
;; MSG SIZE  rcvd: 155
```

According to the results above, the IP address for lyre00.cse.unsw.edu.au is 129.94.210.20. And we did 5 DNS query in this process.

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

Yes. There may be more than one network interface in a physical machine. As a result, a physical machine can have multiple IP addresses, and each IP address can have multiple "aliases", which are host names. Therefore, a physical machine has multiple names and IP addresses associated with it.

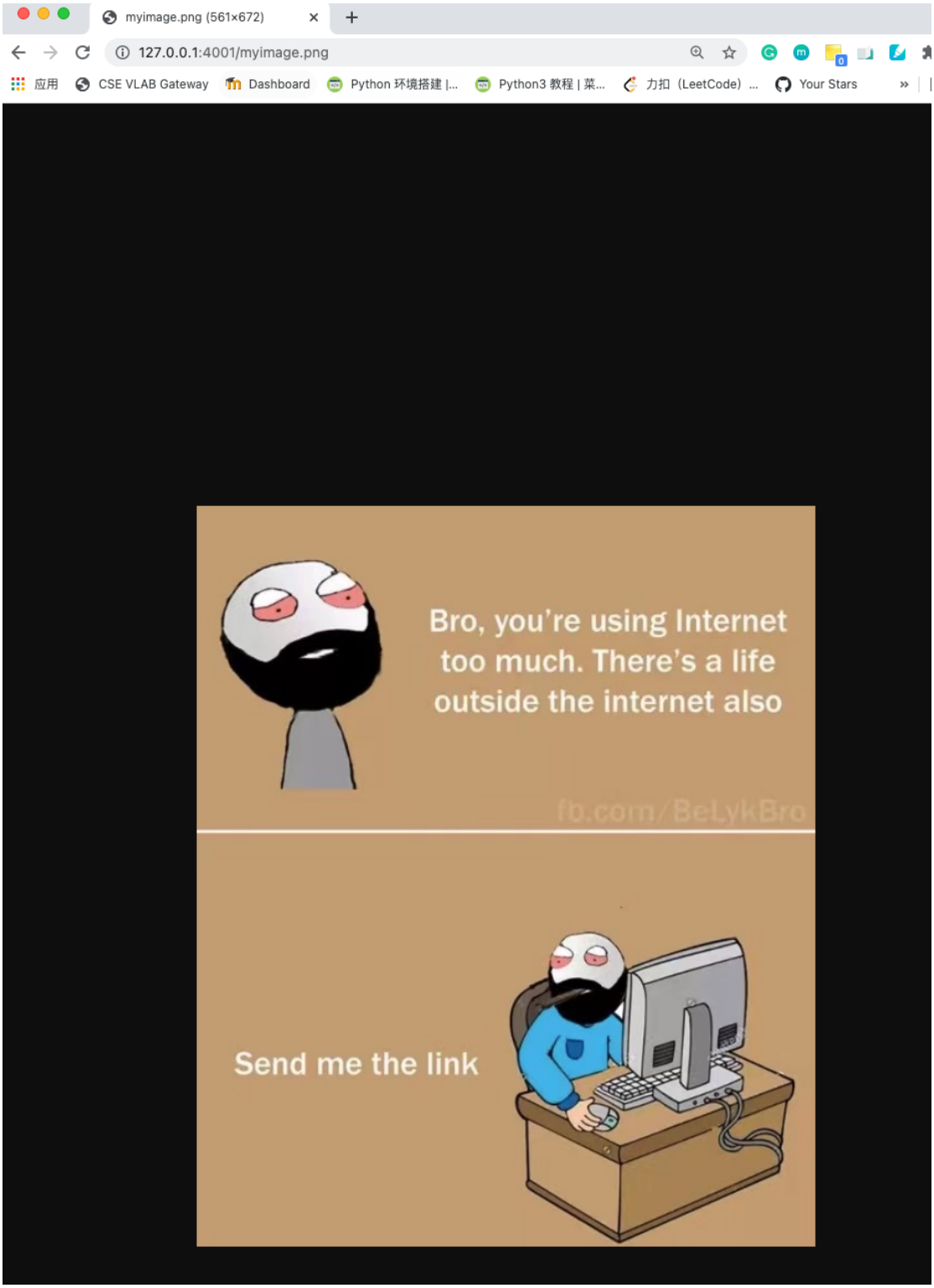
Exercise 4: A Simple Web Server (Marked, submit your code)

The following results are based on the local environment：

```
(a)     http://127.0.0.1:4001/index.html
```

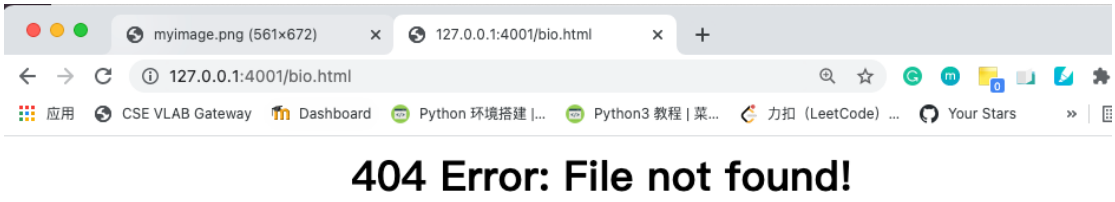
```
(base) MacBook-Pro-Hankin:lab3 guohaojin$ python3 WebServer.py 4001
The server is ready to receive ...
GET /index.html HTTP/1.1
Host: 127.0.0.1:4001
Connection: keep-alive
sec-ch-ua: " Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"
sec-ch-ua-mobile: ?0
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.9
Sec-Fetch-Site: none
Sec-Fetch-Mode: navigate
Sec-Fetch-User: ?1
Sec-Fetch-Dest: document
Accept-Encoding: gzip, deflate, br
Accept-Language: zh-CN,zh;q=0.9,en;q=0.8
Cookie: csrftoken=Z4NxUtWhwO4DiuaX1mVZSoQNWeeP2XaUVP1t2pBBX4BOtqffuBiFtVe8bWz0bmDo
```

(b) http://127.0.0.1:4001/myimage.png


myimage.png (561×672)
127.0.0.1:4001/myimage.png
应用
CSE VLAB Gateway
Dashboard
Python 环境搭建 |...
Python3 教程 | 菜...
力扣 (LeetCode) ...
Your Stars
Bro, you're using Internet too much. There's a life outside the internet also
fb.com/BeLykBro
Send me the link

```
(base) MacBook-Pro-Hankin:lab3 guohaojin$ python3 WebServer.py 4001
The server is ready to receive ...
GET /myimage.png HTTP/1.1
Host: 127.0.0.1:4001
Connection: keep-alive
Cache-Control: max-age=0
sec-ch-ua: " Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"
sec-ch-ua-mobile: ?0
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.9
Sec-Fetch-Site: none
Sec-Fetch-Mode: navigate
Sec-Fetch-User: ?1
Sec-Fetch-Dest: document
Accept-Encoding: gzip, deflate, br
Accept-Language: zh-CN,zh;q=0.9,en;q=0.8
Cookie: csrftoken=Z4NxUtWhwO4DiuaX1mVZSoQNWeeP2XaUVP1t2pBBX4BOtqffuBiFtVe8bWz0bmDo
```

(c) http://127.0.0.1:4001/bio.html




```
GET /bio.html HTTP/1.1
Host: 127.0.0.1:4001
Connection: keep-alive
sec-ch-ua: " Not;A Brand";v="99", "Google Chrome";v="91", "Chromium";v="91"
sec-ch-ua-mobile: ?0
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_7) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/avif,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3;q=0.9
Sec-Fetch-Site: none
Sec-Fetch-Mode: navigate
Sec-Fetch-User: ?1
Sec-Fetch-Dest: document
Accept-Encoding: gzip, deflate, br
Accept-Language: zh-CN,zh;q=0.9,en;q=0.8
Cookie: csrftoken=Z4NxUtWhwO4DiuaX1mVZSoQNWeeP2XaUVP1t2pBBX4BOtqffuBiFtVe8bWz0bmDo
```