

Exercise 1:

Question 1:

```
z5266153@corelli:~/Documents/comp3331$ 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: 16761
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 9

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

;; ANSWER SECTION:
www.eecs.berkeley.edu.  47502  IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 538    IN      CNAME   fe1.edge.pantheon.io.
fe1.edge.pantheon.io.    238    IN      A       23.185.0.1
```

The IP address of www.eecs.berkeley.edu is 23.185.0.1 and to get this answer an A type query need to be sent.

Question 2:

```
z5266153@corelli:~/Documents/comp3331$ dig www.eecs.berkeley.edu CNAME

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu CNAME
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 38558
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 13, ADDITIONAL: 27

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

;; ANSWER SECTION:
www.eecs.berkeley.edu.  47277  IN      CNAME   live-eecs.pantheonsite.io.

;; AUTHORITY SECTION:
```

The canonical name for the eecs.berkeley web server is live-eecs.pantheonsite.io. By using canonical name, the user will have a easy to remember domain name instead of the canonical name.

Question 3:

```
;; AUTHORITY SECTION:
edge.pantheon.io.      300      IN      NS      ns-233.awsdns-29.com.
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-1213.awsdns-23.org.

;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.  40801   IN      A       205.251.192.233
ns-233.awsdns-29.com.  40801   IN      AAAA    2600:9000:5300:e900::1
ns-644.awsdns-16.net.  36557   IN      A       205.251.194.132
ns-644.awsdns-16.net.  36557   IN      AAAA    2600:9000:5302:8400::1
ns-1213.awsdns-23.org. 37850   IN      A       205.251.196.189
ns-1213.awsdns-23.org. 37850   IN      AAAA    2600:9000:5304:bd00::1
ns-2013.awsdns-59.co.uk. 35339   IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 35339   IN      AAAA    2600:9000:5307:dd00::1

;; Query time: 12 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Sat Mar 13 03:06:57 AEDT 2021
;; MSG SIZE rcvd: 453
```

The Authority section contains the information of name servers under `www.eecs.berkeley.edu`. And Additional sections contains the IP vision 4 and IP vision 6 for these name servers. Query time section is the time to make this query. Server section is the IP address of my local nameserver. When section is the query time. MES size section is the size of the received dig message.

Question 4:

```
;; SERVER: 129.94.242.33#53(129.94.242.33)
```

The IP address of my local nameserver is 129.94.242.33

Question 5:

```
z5266153@corelli:~/Documents/comp3331$ 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: 3567
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 9

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

;; ANSWER SECTION:
eecs.berkeley.edu.      86400   IN      NS      ns.eecs.berkeley.edu.
eecs.berkeley.edu.      86400   IN      NS      adns2.berkeley.edu.
eecs.berkeley.edu.      86400   IN      NS      adns1.berkeley.edu.
eecs.berkeley.edu.      86400   IN      NS      adns3.berkeley.edu.
eecs.berkeley.edu.      86400   IN      NS      ns.CS.berkeley.edu.

;; ADDITIONAL SECTION:
ns.CS.berkeley.edu.     51362   IN      A       169.229.60.61
ns.eecs.berkeley.edu.   40999   IN      AAAA    2607:f140:f000:2160::30
adns1.berkeley.edu.     10799   IN      A       128.32.136.3
adns1.berkeley.edu.     10799   IN      AAAA    2607:f140:ffff:fffe::3
adns2.berkeley.edu.     10799   IN      A       128.32.136.14
adns2.berkeley.edu.     10799   IN      AAAA    2607:f140:ffff:fffe::e
adns3.berkeley.edu.     10799   IN      A       192.107.102.142
adns3.berkeley.edu.     10799   IN      AAAA    2607:f140:a000:d::abc
```

The name servers' IP vision4 and IP vision6 is visible in the above image ADDITIONAL SECTION. To obtain this information a NS type DNS query has been send.

Question 6:

```
z5266153@corelli:~/Documents/comp3331$ 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: 58682
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 1

;; 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. 1766 IN      PTR      webserver.seecs.nust.edu.pk.
```

The DNS name associated with the IP address 111.68.101.54 is webserver.seecs.nust.edu.pk. And a PTR type DNS query has been send to obtain this information.

Question 7:

```
z5266153@corelli:~/Documents/comp3331$ 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: 25065
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 8

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

;; ANSWER SECTION:
yahoo.com.      1003      IN      MX      1 mta7.am0.yahoodns.net.
yahoo.com.      1003      IN      MX      1 mta5.am0.yahoodns.net.
yahoo.com.      1003      IN      MX      1 mta6.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.      23879     IN      NS      ns2.yahoo.com.
yahoo.com.      23879     IN      NS      ns3.yahoo.com.
yahoo.com.      23879     IN      NS      ns5.yahoo.com.
yahoo.com.      23879     IN      NS      ns1.yahoo.com.
yahoo.com.      23879     IN      NS      ns4.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.  211500    IN      A       68.180.131.16
ns1.yahoo.com.  85683     IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.  282650    IN      A       68.142.255.16
ns2.yahoo.com.  78308     IN      AAAA    2001:4998:140::1002
ns4.yahoo.com.  293933    IN      A       98.138.11.157
ns5.yahoo.com.  3193      IN      A       202.165.97.53
ns5.yahoo.com.  3193      IN      AAAA    2406:2000:ff60::53
```

This is not an authoritative answer, cause the flags in the headers section doesn't contain aa.

Question 8:

```
z5266153@corelli:~$ dig @169.229.60.61 yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @169.229.60.61 yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 7342
;; 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: 167 msec
;; SERVER: 169.229.60.61#53(169.229.60.61)
;; WHEN: Sat Mar 13 03:42:31 AEDT 2021
;; MSG SIZE rcvd: 38
```

The result contains 0 answer which means the nameserver of eecs.berkeley.edu. doesn't know or cached this query question.

Question 9:

```
z5266153@corelli:~$ dig @ns1.yahoo.com. yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns1.yahoo.com. yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 62530
;; 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 mta5.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta7.am0.yahoodns.net.
```

The authoritative answer for the mail servers for Yahoo! Mail is in the above image, and the flags in header section contain aa which means it is authoritative answer. And a MX type DNS query has been send to obtain this information.

Question 10:

```
z5266153@corelli:~$ hostname -f
corelli.orchestra.cse.unsw.EDU.AU
```

```
z5266153@corelli:~$ dig . NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 43373
;; 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:
.                193855  IN      NS      e.root-servers.net.
.                193855  IN      NS      m.root-servers.net.
.                193855  IN      NS      l.root-servers.net.
.                193855  IN      NS      d.root-servers.net.
.                193855  IN      NS      f.root-servers.net.
.                193855  IN      NS      c.root-servers.net.
.                193855  IN      NS      k.root-servers.net.
.                193855  IN      NS      j.root-servers.net.
.                193855  IN      NS      b.root-servers.net.
.                193855  IN      NS      i.root-servers.net.
.                193855  IN      NS      h.root-servers.net.
.                193855  IN      NS      a.root-servers.net.
.                193855  IN      NS      g.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net. 288783 IN      A      198.41.0.4
a.root-servers.net. 392648 IN      AAAA   2001:503:ba3e::2:30
b.root-servers.net. 70564  IN      A      199.9.14.201
b.root-servers.net. 129384 IN      AAAA   2001:500:200::b
c.root-servers.net. 27026  IN      A      192.33.4.12
c.root-servers.net. 129360 IN      AAAA   2001:500:2::c
d.root-servers.net. 129384 IN      A      199.7.91.13
d.root-servers.net. 129360 IN      AAAA   2001:500:2d::d
e.root-servers.net. 46143  IN      A      192.203.230.10
e.root-servers.net. 129384 IN      AAAA   2001:500:a8::e
f.root-servers.net. 105698 IN      A      192.5.5.241
f.root-servers.net. 129360 IN      AAAA   2001:500:2f::f
```

```
z5266153@corelli:~$ dig @198.41.0.4 corelli.orchestra.cse.unsw.EDU.AU

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @198.41.0.4 corelli.orchestra.cse.unsw.EDU.AU
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 34977
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 9, ADDITIONAL: 19
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags;; udp: 1472
;; QUESTION SECTION:
;corelli.orchestra.cse.unsw.EDU.AU. IN  A

;; AUTHORITY SECTION:
AU.                172800  IN      NS      a.AU.
AU.                172800  IN      NS      c.AU.
AU.                172800  IN      NS      d.AU.
AU.                172800  IN      NS      m.AU.
AU.                172800  IN      NS      n.AU.
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:
a.AU.              172800  IN      A      58.65.254.73
c.AU.              172800  IN      A      162.159.24.179
d.AU.              172800  IN      A      162.159.25.38
m.AU.              172800  IN      A      37.209.192.5
n.AU.              172800  IN      A      37.209.194.5
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
```

z5266153@corelli:~\$ dig @58.65.254.73 corelli.orchestra.cse.unsw.EDU.AU

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @58.65.254.73 corelli.orchestra.cse.unsw.EDU.AU
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 25339
;; 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:
;corelli.orchestra.cse.unsw.EDU.AU. IN  A

;; AUTHORITY SECTION:
edu.au.                86400    IN       NS       t.au.
edu.au.                86400    IN       NS       q.au.
edu.au.                86400    IN       NS       r.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: 158 msec
;; SERVER: 58.65.254.73#53(58.65.254.73)
;; WHEN: Sat Mar 13 03:54:11 AEDT 2021
;; MSG SIZE rcvd: 308
```

z5266153@corelli:~\$ dig @65.22.196.1 corelli.orchestra.cse.unsw.EDU.AU

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @65.22.196.1 corelli.orchestra.cse.unsw.EDU.AU
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 28357
;; 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:
;corelli.orchestra.cse.unsw.EDU.AU. IN  A

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

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

;; Query time: 24 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Sat Mar 13 03:55:33 AEDT 2021
;; MSG SIZE rcvd: 231
```

```
z5266153@corelli:~$ dig @129.94.0.192 corelli.orchestra.cse.unsw.EDU.AU

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.0.192 corelli.orchestra.cse.unsw.EDU.AU
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 19684
;; 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:
;corelli.orchestra.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 129.94.242.2
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: 4 msec
;; SERVER: 129.94.0.192#53(129.94.0.192)
;; WHEN: Sat Mar 13 03:55:56 AEDT 2021
;; MSG SIZE rcvd: 172
```

```
z5266153@corelli:~$ dig @129.94.242.2 corelli.orchestra.cse.unsw.EDU.AU

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.242.2 corelli.orchestra.cse.unsw.EDU.AU
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 10776
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 3

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;corelli.orchestra.cse.unsw.EDU.AU. IN A

;; ANSWER SECTION:
corelli.orchestra.cse.unsw.EDU.AU. 3600 IN A 129.94.242.48

;; AUTHORITY SECTION:
orchestra.cse.unsw.EDU.AU. 3600 IN      NS      maestro.orchestra.cse.unsw.EDU.AU.
orchestra.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: 129.94.242.2#53(129.94.242.2)
;; WHEN: Sat Mar 13 03:56:50 AEDT 2021
;; MSG SIZE rcvd: 156
```

I have to query 6 DNS servers to get the authoritative answer.

Question 11:

One physical machine can have several names and/or IP addresses associated with it. For examples, one router can have multiple interfaces which have unique IP address and for one IP address it can have several canonical name.