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Exercise 3:
Question 1:

- The IP address of www.eecs.berkeley.edu is 23.185.0.1
- The type of DNS query is sent to get this answer is A

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 12410
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 7

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

;; ANSWER SECTION:
www.eecs.berkeley.edu.  37765   IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 383  IN      CNAME   fe1.edge.pantheon.io.
fe1.edge.pantheon.io.   83      IN      A       23.185.0.1
```

Question 2:

- From the result as above:
  We can say the canonical name for the eecs.berkeley web server can be either live-eecs.pantheonsite.io or fe1.edge.pantheon.io
- The reason for having an alias for this server it is easier for clients remember, also it is useful for the clients want to use other services (eg mail.google.com, map.google.com,…)

Question 3:

- In the Authority section, it shows the authoritative name servers for the domain.
- In the Additional sections, it shows the corresponding IP addresses for the authoritative name servers. (including IPv4 and IPv6).

```
;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   122464  IN      A       205.251.192.233
ns-644.awsdns-16.net.   66548   IN      A       205.251.194.132
ns-644.awsdns-16.net.   66336   IN      AAAA    2600:9000:5302:8400::1
ns-1213.awsdns-23.org.  122545  IN      A       205.251.196.189
ns-2013.awsdns-59.co.uk. 47114  IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 47114  IN      AAAA    2600:9000:5307:dd00::1

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 30 01:33:56 AEST 2020
;; MSG SIZE  rcvd: 397
```

Question 4:

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

```
;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 30 01:33:56 AEST 2020
;; MSG SIZE  rcvd: 397
```

Question 5:

- The DNS nameservers for the domain and their corresponding IP addresses are:

```
;; AUTHORITY SECTION:
eecs.berkeley.edu.      49703   IN      NS      adns2.berkeley.edu.
eecs.berkeley.edu.      49703   IN      NS      adns1.berkeley.edu.
eecs.berkeley.edu.      49703   IN      NS      adns3.berkeley.edu.
eecs.berkeley.edu.      49703   IN      NS      ns.CS.berkeley.edu.
eecs.berkeley.edu.      49703   IN      NS      ns.eecs.berkeley.edu.

;; ADDITIONAL SECTION:
ns.CS.berkeley.edu.     41251   IN      A       169.229.60.61
ns.eecs.berkeley.edu.   70534   IN      A       169.229.60.153
adns1.berkeley.edu.     7383    IN      A       128.32.136.3
adns1.berkeley.edu.     7383    IN      AAAA    2607:f140:ffff:fffe::3
adns2.berkeley.edu.     7383    IN      A       128.32.136.14
adns2.berkeley.edu.     7383    IN      AAAA    2607:f140:ffff:fffe::e
adns3.berkeley.edu.     7383    IN      A       192.107.102.142
adns3.berkeley.edu.     4494    IN      AAAA    2607:f140:a000:d::abc
```

The nameservers in the authority section and their IP address in the additional section.

- The type of DNS query is NS

Question 6:

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

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> -x 111.68.101.54 PTR
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 64904
;; 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. 2295 IN     PTR     webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 11492  IN      NS      ns2.hec.gov.pk.
101.68.111.in-addr.arpa. 11492  IN      NS      ns1.hec.gov.pk.

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 30 01:36:11 AEST 2020
;; MSG SIZE  rcvd: 140
```

Question 7: dig @129.94.242.33 yahoo.com MX

- I did not get authoritative answer. Because the flags are: qr rd ra;
    - As we can see the flag "ra" is not represent authoritative answer.
- Because the authoritative answer only comes from a nameserver that is considered authoritative for the domain which it's returning a record.

```
; <<>> 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: 47384
;; 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.              139     IN      MX      1 mta5.am0.yahoodns.net.
yahoo.com.              139     IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              139     IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              57103   IN      NS      ns3.yahoo.com.
yahoo.com.              57103   IN      NS      ns1.yahoo.com.
yahoo.com.              57103   IN      NS      ns2.yahoo.com.
yahoo.com.              57103   IN      NS      ns4.yahoo.com.
yahoo.com.              57103   IN      NS      ns5.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          207488  IN      A       68.180.131.16
ns1.yahoo.com.          57103   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          125507  IN      A       68.142.255.16
ns2.yahoo.com.          38166   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.          492     IN      A       27.123.42.42
ns3.yahoo.com.          492     IN      AAAA    2406:8600:f03f:1f8::1003
ns4.yahoo.com.          35205   IN      A       98.138.11.157
ns5.yahoo.com.          31728   IN      A       202.165.97.53
ns5.yahoo.com.          31573   IN      AAAA    2406:2000:ff60::53

;; Query time: 0 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Tue Jun 30 01:36:57 AEST 2020
;; MSG SIZE  rcvd: 399
```

Question 8:

- Command: dig @adns2.berkeley.edu yahoo.com MX

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @adns2.berkeley.edu yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 63234
;; 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: 128.32.136.14#53(128.32.136.14)
;; WHEN: Tue Jun 30 00:59:12 AEST 2020
;; MSG SIZE  rcvd: 38
```

- We did not get response. The reason might be the DNS queries that are sent from devices that are not part of the Berkeley network.

Question 9:

- Command: dig @ns1.yahoo.com yahoo.com MX
- The type of DNS query is sent to obtain this information is MX

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns1.yahoo.com yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 16255
;; 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      ns5.yahoo.com.
yahoo.com.              172800  IN      NS      ns1.yahoo.com.
yahoo.com.              172800  IN      NS      ns3.yahoo.com.
yahoo.com.              172800  IN      NS      ns4.yahoo.com.
yahoo.com.              172800  IN      NS      ns2.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 30 01:10:48 AEST 2020
;; MSG SIZE  rcvd: 399
```

Question 10:

- Get root nameserver by using command: dig . NS

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 24988
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 22

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

;; ANSWER SECTION:
.                       67193   IN      NS      c.root-servers.net.
.                       67193   IN      NS      a.root-servers.net.
.                       67193   IN      NS      e.root-servers.net.
.                       67193   IN      NS      i.root-servers.net.
.                       67193   IN      NS      m.root-servers.net.
.                       67193   IN      NS      f.root-servers.net.
.                       67193   IN      NS      k.root-servers.net.
.                       67193   IN      NS      l.root-servers.net.
.                       67193   IN      NS      h.root-servers.net.
.                       67193   IN      NS      g.root-servers.net.
.                       67193   IN      NS      b.root-servers.net.
.                       67193   IN      NS      j.root-servers.net.
.                       67193   IN      NS      d.root-servers.net.
```

- We need to get namesever for the hostname by sending DNS query to root nameserver (say k.root-servers.net) by using command: dig @k.root-servers.net vx2.cse.unsw.edu.au

```
;; AUTHORITY SECTION:
au.                     172800  IN      NS      r.au.
au.                     172800  IN      NS      n.au.
au.                     172800  IN      NS      t.au.
au.                     172800  IN      NS      a.au.
au.                     172800  IN      NS      m.au.
au.                     172800  IN      NS      d.au.
au.                     172800  IN      NS      c.au.
au.                     172800  IN      NS      q.au.
au.                     172800  IN      NS      s.au.
```

- Find the nameserver for the "edu.au." domain using command: dig @a.au vx2.cse.unsw.edu.au NS

```
;; AUTHORITY SECTION:
edu.au.                 86400   IN      NS      s.au.
edu.au.                 86400   IN      NS      r.au.
edu.au.                 86400   IN      NS      t.au.
edu.au.                 86400   IN      NS      q.au.
```

- Find the nameserver for domain "unsw.edu.au" using command: dig @s.au vx2.cse.unsw.edu.au NS

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

- Find the nameserver for domain “cse.unsw.edu.au” using command:
  dig @ns3.unsw.edu.au vx2.cse.edu.au NX

```
;vx2.cse.unsw.edu.              IN      NS

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

- Find the IP address of the host using command:
  dig @beethoven.orchestra.cse.unsw.edu.au vx2.cse.unsw.edu A

```
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @beethoven.orchestra.cse.unsw.edu.au vx2.cse.edu.au A
; (3 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 31397
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;vx2.cse.edu.au.                        IN      A

;; ANSWER SECTION:
vx2.cse.edu.au.         14400   IN      A       192.252.158.119

;; AUTHORITY SECTION:
cse.edu.au.             899     IN      NS      ns2.s1038.sureserver.com.
cse.edu.au.             899     IN      NS      ns1.s1038.sureserver.com.

;; Query time: 546 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Tue Jun 30 01:30:37 AEST 2020
;; MSG SIZE  rcvd: 115
```

The IP address is 129.94.242.115