

ECE4016 Assignment1  
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1. Brief introduction:

This is a local DNS server which can either use public server for searching or recursive searching from root server. By typing into the choice (0 or 1) at the beginning stage, users can choose to use the one they want. (0 for public server, 1 for recursive server)

```
tcj@ChujundeMacBook-Pro ECE4016 % /usr/local/bin/python3 /Users/tcj/Desktop/ECE4016/localdns.py
please input your choice:
Use public server-----0
Use Recursive server-----1:
```

2. How to use:

- Using cache

If the user has searched the website before, the data will be stored in the cache. If the output comes from the cache. It will output like this

1. User end terminal

```
; <<>> DiG 9.10.6 <<>> www.baidu.com @127.0.0.1 -p 1234
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 48150
;; flags: rd; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;www.baidu.com.                IN      A

;; ANSWER SECTION:
www.baidu.com.                60      IN      A      163.177.151.109

;; Query time: 3 msec
;; SERVER: 127.0.0.1#1234(127.0.0.1)
;; WHEN: Sat Oct 15 15:34:22 CST 2022
;; MSG SIZE  rcvd: 47
```

```
tcj@ChujundeMacBook-Pro ~ %
```

2. Server end terminal

```
/usr/local/bin/python3 /Users/tcj/Desktop/ECE4016/localdns.py
tcj@ChujundeMacBook-Pro ECE4016 % /usr/local/bin/python3 /Users/tcj/Desktop/ECE4016/localdns.py
please input your choice:
Use public server-----0
Use Recursive server-----1: 0
0
{<DNSLabel: 'www.baidu.com.'>: '163.177.151.109'}
From Public Server

From Cache


```

Showing hints at the last line

- Using public server

1. Press 0

2. The output in user end terminal

```
tcj@ChujundeMacBook-Pro ~ % dig www.baidu.com @127.0.0.1 -p 1234

; <<>> DiG 9.10.6 <<>> www.baidu.com @127.0.0.1 -p 1234
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 2308
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 1

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

;; ANSWER SECTION:
www.baidu.com.                1188    IN      CNAME   www.a.shifen.com.
www.a.shifen.com.            159     IN      A       163.177.151.110
www.a.shifen.com.            159     IN      A       163.177.151.109

;; Query time: 8 msec
;; SERVER: 127.0.0.1#1234(127.0.0.1)
;; WHEN: Sat Oct 15 15:31:09 CST 2022
;; MSG SIZE rcvd: 101
```

### 3. The output in server end terminal

```
tcj@ChujundeMacBook-Pro ECE4016 % /usr/local/bin/python3 /Users/tcj/Desktop/ECE4016/localdns.py
please input your choice:
Use public server-----0
Use Recursive server-----1: 0
0
{<DNSLabel: 'www.baidu.com.'>: '163.177.151.109'}
From Public Server
```

Showing hints at the last line

- Using the recursive server

#### 1. User end terminal

```
[tcj@ChujundeMacBook-Pro ~ % dig www.baidu.com @127.0.0.1 -p 1234

; <<>> DiG 9.10.6 <<>> www.baidu.com @127.0.0.1 -p 1234
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr aa rd ra ad; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.baidu.com.                IN      A

;; ANSWER SECTION:
www.baidu.com.                0       IN      CNAME   www.a.shifen.com.
www.a.shifen.com.            0       IN      A       163.177.151.109

;; Query time: 4280 msec
;; SERVER: 127.0.0.1#1234(127.0.0.1)
;; WHEN: Sat Oct 15 15:40:26 CST 2022
;; MSG SIZE rcvd: 74

tcj@ChujundeMacBook-Pro ~ % ]
```

#### 2. Server end terminal

Server 7 packet message:

```
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr aa rd; QUERY: 1, ANSWER: 2, AUTHORITY: 5, ADDITIONAL: 10
;; QUESTION SECTION:
;www.a.shifen.com.          IN      A
;; ANSWER SECTION:
www.a.shifen.com.          300     IN      A      163.177.151.109
www.a.shifen.com.          300     IN      A      163.177.151.110
;; AUTHORITY SECTION:
a.shifen.com.              1200    IN      NS      ns1.a.shifen.com.
a.shifen.com.              1200    IN      NS      ns2.a.shifen.com.
a.shifen.com.              1200    IN      NS      ns3.a.shifen.com.
a.shifen.com.              1200    IN      NS      ns4.a.shifen.com.
a.shifen.com.              1200    IN      NS      ns5.a.shifen.com.
;; ADDITIONAL SECTION:
ns1.a.shifen.com.          300     IN      A      110.242.68.42
ns2.a.shifen.com.          600     IN      A      220.181.33.32
ns3.a.shifen.com.          300     IN      A      36.152.45.198
ns3.a.shifen.com.          300     IN      A      112.80.255.253
ns4.a.shifen.com.          300     IN      A      14.215.177.229
ns4.a.shifen.com.          300     IN      A      111.20.4.28
ns5.a.shifen.com.          600     IN      A      180.76.76.95
ns5.a.shifen.com.          600     IN      AAAA    240e:bf:b801:1006:0:ff:b04f:346b
ns5.a.shifen.com.          600     IN      AAAA    240e:940:603:a:0:ff:b08d:239d
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 1232
```

From Recursive Server

3. About recording the servers used during the searching process  
(next page)

```
Server 1 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; QUESTION SECTION:
;www.baidu.com.                IN      A
;; AUTHORITY SECTION:
com.      172800 IN      NS      a.gtld-servers.net.
com.      172800 IN      NS      g.gtld-servers.net.
com.      172800 IN      NS      k.gtld-servers.net.
com.      172800 IN      NS      m.gtld-servers.net.
com.      172800 IN      NS      j.gtld-servers.net.
com.      172800 IN      NS      b.gtld-servers.net.
com.      172800 IN      NS      i.gtld-servers.net.
com.      172800 IN      NS      d.gtld-servers.net.
com.      172800 IN      NS      h.gtld-servers.net.
com.      172800 IN      NS      c.gtld-servers.net.
com.      172800 IN      NS      f.gtld-servers.net.
com.      172800 IN      NS      e.gtld-servers.net.
com.      172800 IN      NS      l.gtld-servers.net.
;; ADDITIONAL SECTION:
m.gtld-servers.net. 172800 IN      A      192.55.83.30
l.gtld-servers.net. 172800 IN      A      192.41.162.30
k.gtld-servers.net. 172800 IN      A      192.52.178.30
j.gtld-servers.net. 172800 IN      A      192.48.79.30
i.gtld-servers.net. 172800 IN      A      192.43.172.30
h.gtld-servers.net. 172800 IN      A      192.54.112.30
g.gtld-servers.net. 172800 IN      A      192.42.93.30
f.gtld-servers.net. 172800 IN      A      192.35.51.30
e.gtld-servers.net. 172800 IN      A      192.12.94.30
d.gtld-servers.net. 172800 IN      A      192.31.80.30
c.gtld-servers.net. 172800 IN      A      192.26.92.30
b.gtld-servers.net. 172800 IN      A      192.33.14.30
a.gtld-servers.net. 172800 IN      A      192.5.6.30
m.gtld-servers.net. 172800 IN      AAAA   2001:501:b1f9::30
l.gtld-servers.net. 172800 IN      AAAA   2001:500:d937::30
k.gtld-servers.net. 172800 IN      AAAA   2001:503:d2d::30
j.gtld-servers.net. 172800 IN      AAAA   2001:502:7694::30
i.gtld-servers.net. 172800 IN      AAAA   2001:503:39c1::30
h.gtld-servers.net. 172800 IN      AAAA   2001:502:8ccc::30
g.gtld-servers.net. 172800 IN      AAAA   2001:503:eea3::30
f.gtld-servers.net. 172800 IN      AAAA   2001:503:d414::30
e.gtld-servers.net. 172800 IN      AAAA   2001:502:1ca1::30
d.gtld-servers.net. 172800 IN      AAAA   2001:500:856e::30
c.gtld-servers.net. 172800 IN      AAAA   2001:503:83eb::30
b.gtld-servers.net. 172800 IN      AAAA   2001:503:231d::2:30
a.gtld-servers.net. 172800 IN      AAAA   2001:503:a83e::2:30
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 1232
Server 2 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 5, ADDITIONAL: 10
;; QUESTION SECTION:
;www.baidu.com.                IN      A
;; AUTHORITY SECTION:
baidu.com. 172800 IN      NS      ns2.baidu.com.
baidu.com. 172800 IN      NS      ns3.baidu.com.
baidu.com. 172800 IN      NS      ns4.baidu.com.
baidu.com. 172800 IN      NS      ns1.baidu.com.
baidu.com. 172800 IN      NS      ns7.baidu.com.
;; ADDITIONAL SECTION:
ns2.baidu.com. 172800 IN      A      220.181.33.31
ns3.baidu.com. 172800 IN      A      112.80.248.64
ns3.baidu.com. 172800 IN      A      36.152.45.193
ns4.baidu.com. 172800 IN      A      111.45.3.226
ns4.baidu.com. 172800 IN      A      14.215.178.80
ns1.baidu.com. 172800 IN      A      110.242.68.134
ns7.baidu.com. 172800 IN      A      180.76.76.92
ns7.baidu.com. 172800 IN      AAAA   240e:940:603:4:0:ff:b01b:589a
ns7.baidu.com. 172800 IN      AAAA   240e:bf:b801:1002:0:ff:b024:2
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 4096

Server 3 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; QUESTION SECTION:
;www.baidu.com.                IN      A
;; ANSWER SECTION:
www.baidu.com. 1200 IN      CNAME   www.a.shifen.com.
;; ADDITIONAL SECTION:
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 1232

Server 4 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; QUESTION SECTION:
;www.a.shifen.com.            IN      A
;; AUTHORITY SECTION:
com.      172800 IN      NS      e.gtld-servers.net.
com.      172800 IN      NS      f.gtld-servers.net.
com.      172800 IN      NS      m.gtld-servers.net.
com.      172800 IN      NS      d.gtld-servers.net.
com.      172800 IN      NS      b.gtld-servers.net.
com.      172800 IN      NS      j.gtld-servers.net.
com.      172800 IN      NS      c.gtld-servers.net.
com.      172800 IN      NS      l.gtld-servers.net.
com.      172800 IN      NS      i.gtld-servers.net.
com.      172800 IN      NS      a.gtld-servers.net.
com.      172800 IN      NS      h.gtld-servers.net.
com.      172800 IN      NS      k.gtld-servers.net.
com.      172800 IN      NS      g.gtld-servers.net.
;; ADDITIONAL SECTION:
m.gtld-servers.net. 172800 IN      A      192.55.83.30
l.gtld-servers.net. 172800 IN      A      192.41.162.30
k.gtld-servers.net. 172800 IN      A      192.52.178.30
j.gtld-servers.net. 172800 IN      A      192.48.79.30
i.gtld-servers.net. 172800 IN      A      192.43.172.30
h.gtld-servers.net. 172800 IN      A      192.54.112.30
g.gtld-servers.net. 172800 IN      A      192.42.93.30
f.gtld-servers.net. 172800 IN      A      192.35.51.30
e.gtld-servers.net. 172800 IN      A      192.12.94.30
d.gtld-servers.net. 172800 IN      A      192.31.80.30
c.gtld-servers.net. 172800 IN      A      192.26.92.30
b.gtld-servers.net. 172800 IN      A      192.33.14.30
a.gtld-servers.net. 172800 IN      A      192.5.6.30
m.gtld-servers.net. 172800 IN      AAAA   2001:501:b1f9::30
l.gtld-servers.net. 172800 IN      AAAA   2001:500:d937::30
k.gtld-servers.net. 172800 IN      AAAA   2001:503:d2d::30
j.gtld-servers.net. 172800 IN      AAAA   2001:502:7694::30
```

```

Server 5 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 7
;; QUESTION SECTION:
;www.a.shifen.com.                IN      A
;; AUTHORITY SECTION:
shifen.com.      172800 IN      NS      dns.baidu.com.
shifen.com.      172800 IN      NS      ns2.baidu.com.
shifen.com.      172800 IN      NS      ns3.baidu.com.
shifen.com.      172800 IN      NS      ns4.baidu.com.
;; ADDITIONAL SECTION:
dns.baidu.com.   172800 IN      A      110.242.68.134
ns2.baidu.com.   172800 IN      A      220.181.33.31
ns3.baidu.com.   172800 IN      A      112.80.248.64
ns3.baidu.com.   172800 IN      A      36.152.45.193
ns4.baidu.com.   172800 IN      A      111.45.3.226
ns4.baidu.com.   172800 IN      A      14.215.178.80
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 4096

Server 6 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 5, ADDITIONAL: 10
;; QUESTION SECTION:
;www.a.shifen.com.                IN      A
;; AUTHORITY SECTION:
a.shifen.com.    1200 IN      NS      ns2.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns3.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns1.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns5.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns4.a.shifen.com.
;; ADDITIONAL SECTION:
ns5.a.shifen.com. 1200 IN      A      180.76.76.95
ns4.a.shifen.com. 1200 IN      A      14.215.177.229
ns4.a.shifen.com. 1200 IN      A      111.20.4.28
ns3.a.shifen.com. 1200 IN      A      36.152.45.198
ns3.a.shifen.com. 1200 IN      A      112.80.255.253
ns2.a.shifen.com. 1200 IN      A      220.181.33.32
ns1.a.shifen.com. 1200 IN      A      110.242.68.42
ns5.a.shifen.com. 600  IN      AAAA    240e:bfb001:1006:0:ff:b04f:346b
ns5.a.shifen.com. 600  IN      AAAA    240e:940:603:a:0:ff:b08d:239d
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 1232

Server 7 packet message:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37575
;; flags: qr aa rd; QUERY: 1, ANSWER: 2, AUTHORITY: 5, ADDITIONAL: 10
;; QUESTION SECTION:
;www.a.shifen.com.                IN      A
;; ANSWER SECTION:
www.a.shifen.com. 300  IN      A      163.177.151.109
www.a.shifen.com. 300  IN      A      163.177.151.110
;; AUTHORITY SECTION:
a.shifen.com.    1200 IN      NS      ns1.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns2.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns3.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns4.a.shifen.com.
a.shifen.com.    1200 IN      NS      ns5.a.shifen.com.
;; ADDITIONAL SECTION:
ns1.a.shifen.com. 300  IN      A      110.242.68.42
ns2.a.shifen.com. 600  IN      A      220.181.33.32
ns3.a.shifen.com. 300  IN      A      36.152.45.198
ns3.a.shifen.com. 300  IN      A      112.80.255.253
ns4.a.shifen.com. 300  IN      A      14.215.177.229
ns4.a.shifen.com. 300  IN      A      111.20.4.28
ns5.a.shifen.com. 600  IN      A      180.76.76.95
ns5.a.shifen.com. 600  IN      AAAA    240e:bfb001:1006:0:ff:b04f:346b
ns5.a.shifen.com. 600  IN      AAAA    240e:940:603:a:0:ff:b08d:239d
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 1232

From Recursive Server

```

output of www.example.com

```

[tcj@ChujundeMacBook-Pro ~ % dig www.example.com @127.0.0.1 -p 1234

; <<>> DiG 9.10.6 <<>> www.example.com @127.0.0.1 -p 1234
;; global options: +cmd
;; Got answer:
;; -->HEADER<-- opcode: QUERY, status: NOERROR, id: 37475
;; flags: qr aa rd ra ad; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.example.com.                IN      A

;; ANSWER SECTION:
www.example.com.      0      IN      A      93.184.216.34

;; Query time: 496 msec
;; SERVER: 127.0.0.1#1234(127.0.0.1)
;; WHEN: Sat Oct 15 15:46:34 CST 2022
;; MSG SIZE rcvd: 49

```

Server 3 packet message:

```
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37475
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 1
;; QUESTION SECTION:
;www.example.com.          IN      A
;; ANSWER SECTION:
www.example.com.          86400   IN      A      93.184.216.34
;; AUTHORITY SECTION:
example.com.              86400   IN      NS      a.iana-servers.net.
example.com.              86400   IN      NS      b.iana-servers.net.
;; ADDITIONAL SECTION:
;; OPT PSEUDOSECTION
; EDNS: version: 0, flags: ; udp: 4096
```

From Recursive Server