This project uses a public DNS server `Proxyserver` from dnslib to do direct query and implements a local DNS with cache using recursive searching. It uses DNS server from dnslib to send request and receive response. To run the program:

```
python3 dns.py –name $name to search$ –flag $flag$
```

`name` can be multiple domain names, `flag` indicate whether ask the public server for the IP address. 0 for public server and 1 for recursive searching. default value is 1. Here shows two demos of output. (Note that the output could be different due to some refusals from visiting ip)

Recursive searching will print out ip address passby, A type and CNAME type result Pubilc server will directly return the DNS packet.

demo1:

```
csc3150@csc3150:~/ece4016$ python3 dns.py –name www.baidu.com www.example.com www.baidu.com
------------Search for www.baidu.com. CNAME type begins------------
No. 1 research pass through ip: 198.41.0.4
No. 2 research pass through ip: 192.12.94.30
No. 3 research pass through ip: 220.181.33.31
------------Search for www.baidu.com. A type begins------------
No. 1 research pass through ip: 198.41.0.4
No. 2 research pass through ip: 192.5.6.30
No. 3 research pass through ip: 220.181.33.31
No. 4 research pass through ip: 198.41.0.4
No. 5 research pass through ip: 192.12.94.30
No. 6 research pass through ip: 110.242.68.134
No. 7 research pass through ip: 180.76.76.95
-------------------Result--------------------
www.a.shifen.com.is an alias for www.baidu.com.
www.a.shifen.com. has address 163.177.151.109
www.a.shifen.com. has address 163.177.151.110

------------Search for www.example.com. CNAME type begins------------
No. 1 research pass through ip: 198.41.0.4
No. 2 research pass through ip: 192.12.94.30
No. 3 research pass through ip: 198.41.0.4
No. 4 research pass through ip: 192.5.6.30
No. 5 research pass through ip: 199.43.135.53
-----Time out in recursive search, another trying-----
No. 6 research pass through ip: 199.43.133.53
No. 7 research pass through ip: 199.43.135.53
-----Time out in recursive search, another trying-----
No. 8 research pass through ip: 199.43.133.53
------------Search for www.example.com. A type begins------------
No. 1 research pass through ip: 198.41.0.4
No. 2 research pass through ip: 192.5.6.30
No. 3 research pass through ip: 199.43.135.53
-------------------Result--------------------
Do not exist an alias for www.example.com.
www.example.com. has address 93.184.216.34

----------------Result from cache--------------
-------------------Result--------------------
www.a.shifen.com.is an alias for www.baidu.com.
www.a.shifen.com. has address 163.177.151.109
www.a.shifen.com. has address 163.177.151.110
```

demo2:

```
csc3150@csc3150:~/ece4016$ python3 dns.py —name www.baidu.com www.example.com www.baidu.com —flag 0
2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Request: [127.0.0.1:42324] (udp) / 'www.baidu.com.' (A)
2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Reply: [127.0.0.1:42324] (udp) / 'www.baidu.com.' (A) / RRs: CNAME,CN
AME,A
---------------------Direct Search forwww.baidu.com-------------------
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 33859
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 0
;; QUESTION SECTION:
;www.baidu.com.                  IN      A
;; ANSWER SECTION:
www.baidu.com.          1075    IN      CNAME   www.a.shifen.com.
www.a.shifen.com.       30      IN      CNAME   www.wshifen.com.
www.wshifen.com.        300     IN      A       103.235.46.40

2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Request: [127.0.0.1:38716] (udp) / 'www.example.com.' (A)
2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Reply: [127.0.0.1:38716] (udp) / 'www.example.com.' (A) / RRs: A
---------------------Direct Search forwww.example.com-------------------
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27019
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0
;; QUESTION SECTION:
;www.example.com.                IN      A
;; ANSWER SECTION:
www.example.com.        21205   IN      A       93.184.216.34

2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Request: [127.0.0.1:56770] (udp) / 'www.baidu.com.' (A)
2022-10-13 06:03:04 [DNSHandler:ProxyResolver] Reply: [127.0.0.1:56770] (udp) / 'www.baidu.com.' (A) / RRs: CNAME,CN
AME,A
---------------------Direct Search forwww.baidu.com-------------------
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 43135
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 0, ADDITIONAL: 0
;; QUESTION SECTION:
;www.baidu.com.                  IN      A
;; ANSWER SECTION:
www.baidu.com.          1195    IN      CNAME   www.a.shifen.com.
www.a.shifen.com.       30      IN      CNAME   www.wshifen.com.
www.wshifen.com.        78      IN      A       103.235.46.40
```