

Part A:

These are the different runtimes I get for pinging the different servers. The first ping was to localhost, second to stonybrook.edu, third was to Japan (M.root), fourth was to Amsterdam (K.root), and the fifth was sent to Sweden(L.root). As seen below in the screenshots, the localhost had the lowest round trip times with an average of 0.1 ms. Stonybrook.edu had the second lowest round trip times with an average of 21.1 ms. This is probably because of network latency. When you ping localhost your computer sends a request to the network stack of your own computer which gets returned really fast. However, when you ping to a root server located outside the US, your request has to travel across multiple networks, and networks from other ISP's. There can be network latency from this which increases the round trip time of the request. Network latency can also have other factors including congestion, and quality of internet connection.

```
Pinging 127.0.0.1 using Python:
Reply from 127.0.0.1; time = 0.1
Reply from 127.0.0.1; time = 0.1
Reply from 127.0.0.1; time = 0.2
Reply from 127.0.0.1; time = 0.3
^C
--- 127.0.0.1 ping statistics ---
round-trip min/avg/max 0.1/0.2/0.3 ms
```

```
Pinging stonybrook.edu using Python:
Reply from 172.30.32.25; time = 7.7
Reply from 172.30.32.25; time = 9.0
Reply from 172.30.32.25; time = 8.4
Reply from 172.30.32.25; time = 7.4
Reply from 172.30.32.25; time = 25.2
Reply from 172.30.32.25; time = 43.9
Reply from 172.30.32.25; time = 46.0
^C
--- stonybrook.edu ping statistics ---
round-trip min/avg/max 7.4/21.1/46.0 ms
```

```
Pinging K.root-servers.net using Python:
Reply from 193.0.14.129; time = 101.1
Reply from 193.0.14.129; time = 98.9
Reply from 193.0.14.129; time = 99.1
Reply from 193.0.14.129; time = 106.5
Reply from 193.0.14.129; time = 106.4
Reply from 193.0.14.129; time = 104.9
Reply from 193.0.14.129; time = 105.1
^C
--- K.root-servers.net ping statistics ---
round-trip min/avg/max 98.9/103.1/106.5 ms
```

```
Pinging M.root-servers.net using Python:
Reply from 202.12.27.33; time = 81.8
Reply from 202.12.27.33; time = 80.9
Reply from 202.12.27.33; time = 88.9
Reply from 202.12.27.33; time = 81.8
Reply from 202.12.27.33; time = 81.0
^C
--- M.root-servers.net ping statistics ---
round-trip min/avg/max 80.9/82.9/88.9 ms
```

```
Pinging L.root-servers.net using Python:
Reply from 199.7.83.42; time = 66.9
Reply from 199.7.83.42; time = 66.3
Reply from 199.7.83.42; time = 65.8
Reply from 199.7.83.42; time = 71.7
Reply from 199.7.83.42; time = 62.8
Reply from 199.7.83.42; time = 73.2
Reply from 199.7.83.42; time = 70.8
^C
--- L.root-servers.net ping statistics ---
round-trip min/avg/max 62.8/68.2/73.2 ms
```

Part B:

Based on the ARP messages that I got from running my program, the IP address of my router is 172.24.205.52 and my MAC address is a0:78:17:86:02:1e.

This can be found by looking at the Target IP address and Target MAC address fields in the ARP request message. The target IP address field represents the IP address of the device that the ARP request is being sent to. The target MAC address field represents the MAC address of the device that the ARP request is being sent to.

```
Packet (Length: 56)
Layer ETH:
  Destination: a0:78:17:86:02:1e
  Address: a0:78:17:86:02:1e
  ....0. .... = LG bit: Globally unique address (factory default)
  ....0. .... = IG bit: Individual address (unicast)
  Source: 4e:ab:4c:9a:86:a8
  ....1. .... = LG bit: Locally administered address (this is NOT the factory default)
  ....0. .... = IG bit: Individual address (unicast)
  Type: ARP (0x0806)
  Trailer: 00000000000000000000000000000000
  Address: 4e:ab:4c:9a:86:a8
Layer ARP:
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: request (1)
  Sender MAC address: 4e:ab:4c:9a:86:a8
  Sender IP address: 172.24.197.230
  Target MAC address: a0:78:17:86:02:1e
  Target IP address: 172.24.205.52
```