

## Exercise 1:

1.

```
grieg % nslookup www.koala.com.au
Server:      129.94.242.2
Address:     129.94.242.2#53

Non-authoritative answer:
Name:   www.koala.com.au
Address: 104.21.45.210
Name:   www.koala.com.au
Address: 172.67.219.46
Name:   www.koala.com.au
Address: 2606:4700:3032::ac43:db2e
Name:   www.koala.com.au
Address: 2606:4700:3031::6815:2dd2
```

129.94.242.2 and Non-authoritative answer' s address are all the address of the website. Because a domain name corresponds to multiple physical addresses (servers), when a user accesses it, it will be answered by one of the computers according to certain rules. If it supports IPV6 then it will have an IPV6 address (2606:4700:3032: : ac43:db2e is a IPV6 address) .

2.

```
grieg % nslookup 127.0.0.1
1.0.0.127.in-addr.arpa  name = localhost.
```

The name of this address is called localhost. A network number of 127 is not a network address. Ping 127.0.0.1 can be used to test whether the native TCP/IP protocol stack is normal.

## Exercise 2:

[www.unsw.edu.au](http://www.unsw.edu.au) is reachable.

[www.mit.edu](http://www.mit.edu) is reachable.

[www.intel.com.au](http://www.intel.com.au) is reachable.

[www.tpg.com.au](http://www.tpg.com.au) is reachable.

[www.amazon.com](http://www.amazon.com) is reachable.

[www.tsinghua.edu.cn](http://www.tsinghua.edu.cn) is reachable.

[www.getfittest.com.au](http://www.getfittest.com.au) is not reachable. I think the 'getfittest' maybe not a domain name.

[www.hola.hp](http://www.hola.hp) is not reachable. I think the reason is 'hp' is not a domain name like 'com'. [www.kremlin.ru](http://www.kremlin.ru) is not reachable, but the addresses are reachable from the Web browser. It should be that the server has set relevant policies to restrict the ICMP echo request message at the network layer; and the http protocol is used to access the web page, so this phenomenon occurs.

8.8.8.8 is pingable but the browser can not access, it may be the reason that it is only the IP address of a free DNS server provided by Google

## Exercise 3:

1.

```
grieg % traceroute www.columbia.edu
traceroute to www.columbia.edu (128.59.105.24), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.134 ms 0.081 ms 0.080 ms
 2 129.94.39.17 (129.94.39.17) 0.895 ms 0.866 ms 0.864 ms
 3 172.17.31.154 (172.17.31.154) 1.598 ms 2.016 ms 1.987 ms
 4 po-3-1902.ombcr1.gw.unsw.edu.au (129.94.24.20) 1.194 ms 1.166 ms 1.195 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.207 ms 1.139 ms 1.112 ms
 6 138.44.5.0 (138.44.5.0) 1.296 ms 1.388 ms 1.355 ms
 7 et-1-1-0.pe1.mcp.nsw.aarnet.net.au (113.197.15.4) 1.699 ms 1.874 ms 1.841 ms
 8 et-0-2-bdr1.gum.gum.aarnet.net.au (113.197.14.137) 71.692 ms 71.612 ms 71.560 ms
 9 138.44.228.5 (138.44.228.5) 185.601 ms 185.555 ms 185.517 ms
10 fourhundredge-0-0-22.4079.core2.salt.net.internet2.edu (163.253.1.115) 238.079 ms 238.022 ms 238.019 ms
11 fourhundredge-0-0-0-4079.core1.salt.net.internet2.edu (163.253.1.130) 236.415 ms 236.377 ms 236.339 ms
12 fourhundredge-0-0-0-4079.core1.denver.net.internet2.edu (163.253.1.170) 236.608 ms 236.588 ms 236.535 ms
13 fourhundredge-0-0-0-4079.core1.kans.net.internet2.edu (163.253.1.243) 236.789 ms 237.855 ms 237.751 ms
14 fourhundredge-0-0-0-3.4079.core2.chic.net.internet2.edu (163.253.1.244) 236.541 ms 237.804 ms fourhundredge-0-0-0-22.4079.core2.chic.net.internet2.edu (163.253.1.97) 237.783 ms
15 fourhundredge-0-0-0-3.4079.core2.eqch.net.internet2.edu (163.253.2.19) 236.970 ms 237.772 ms 237.740 ms
16 fourhundredge-0-0-0-4079.core2.clev.net.internet2.edu (163.253.2.16) 237.233 ms 237.101 ms 237.012 ms
17 buf-9208-I2-CLIV.nysernet.net (199.109.11.33) 238.315 ms 238.175 ms 238.364 ms
18 syr-55a1-buf-9208.nysernet.net (199.109.7.213) 241.064 ms 241.792 ms 241.803 ms
19 nyc32-55a1-syr-55a1.nysernet.net (199.109.7.206) 247.067 ms 247.043 ms 247.454 ms
20 nyc32-9208-nyc32-55a1.nysernet.net (199.109.7.201) 247.060 ms 246.963 ms 247.233 ms
21 columbia.nyc-9208.nysernet.net (199.109.4.14) 247.192 ms 246.793 ms 246.757 ms
22 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5) 247.248 ms 247.151 ms 247.202 ms
23 cc-core-1-x-cc-core-1.net.columbia.edu (128.59.255.21) 247.301 ms 247.117 ms 247.145 ms
24 columbiauniversity.info (128.59.105.24) 247.144 ms 247.090 ms 247.067 ms
grieg %
```

There are 23 routers between my workstation and [www.columbia.edu](http://www.columbia.edu). (the last one is not the router, but server.) I think the first five routers are all UNSW routers. The packets crossed the Pacific Ocean between the seventh and tenth routers. Through ping, it is found that the return time from the seventh router is longer, so the physical location of the router is checked from the seventh router, and it is found that the location of the tenth router has crossed the Pacific Ocean. So the packets cross the Pacific Ocean between the seventh and tenth routers.

2.(i)

```

grieg % traceroute www.ucla.edu
traceroute to www.ucla.edu (99.86.38.37), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.133 ms 0.124 ms 0.123 ms
 2 129.94.39.17 (129.94.39.17) 0.893 ms 0.899 ms 0.894 ms
 3 172.17.31.154 (172.17.31.154) 1.967 ms 1.520 ms 1.461 ms
 4 po-3-1902.ombcr1.gw.unsw.edu.au (129.94.24.20) 1.295 ms 1.171 ms 1.198 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.115 ms 1.141 ms 1.112 ms
 6 138.44.5.0 (138.44.5.0) 1.293 ms 1.263 ms 1.295 ms
 7 ae1.170.bdri1.b.sea.aarnet.net.au (113.197.15.63) 140.741 ms 140.747 ms 140.769 ms
 8 xe-4-1-1.mpr1.seal.us.above.net (64.125.193.129) 140.796 ms 140.759 ms 140.753 ms
 9 ae27.cs1.seal.us.eth.zayo.com (64.125.29.0) 140.791 ms 140.937 ms 140.789 ms
10 ae28.mpr2.seal.us.zip.zayo.com (64.125.29.103) 140.852 ms 140.852 ms 140.771 ms
11 99.82.182.102 (99.82.182.102) 140.891 ms 141.526 ms 141.429 ms
12 150.222.136.61 (150.222.136.61) 151.731 ms 142.420 ms 142.684 ms
13 52.95.52.234 (52.95.52.234) 144.292 ms 52.95.52.59 (52.95.52.59) 142.522 ms 52.95.54.236 (52.95.54.236) 144.234 ms
14 205.251.225.249 (205.251.225.249) 141.846 ms 205.251.225.253 (205.251.225.253) 141.584 ms 205.251.225.233 (205.251.225.233) 141.930 ms
15 52.95.55.6 (52.95.55.6) 152.411 ms 52.95.54.56 (52.95.54.56) 154.519 ms 52.95.55.154 (52.95.55.154) 153.976 ms
16 205.251.225.49 (205.251.225.49) 141.007 ms 205.251.225.31 (205.251.225.31) 140.979 ms 205.251.225.45 (205.251.225.45) 141.119 ms
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 server-99-86-38-37.seal19.r.cloudfront.net (99.86.38.37) 140.862 ms 140.969 ms 140.982 ms
grieg %

```

(ii)

```

grieg % traceroute www.u-tokyo.ac.jp
traceroute to www.u-tokyo.ac.jp (210.152.243.234), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.068 ms 0.069 ms 0.075 ms
 2 129.94.39.17 (129.94.39.17) 0.876 ms 0.871 ms 0.791 ms
 3 172.17.31.154 (172.17.31.154) 1.617 ms 1.983 ms 1.977 ms
 4 po-3-1902.ombcr1.gw.unsw.edu.au (129.94.24.20) 1.164 ms 1.097 ms 1.151 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.222 ms 1.116 ms 1.109 ms
 6 138.44.5.0 (138.44.5.0) 1.382 ms 1.295 ms 1.306 ms
 7 et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.733 ms 1.770 ms 1.802 ms
 8 ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177) 155.228 ms 155.200 ms 155.170 ms
 9 paloa1to0.iiij.net (198.32.176.24) 156.642 ms 156.897 ms 156.705 ms
10 osk011bb00.IIJ.Net (58.138.84.225) 274.622 ms 274.559 ms osk004bb01.IIJ.Net (58.138.88.189) 266.663 ms
11 osk004ip57.IIJ.Net (58.138.81.74) 274.596 ms osk004ip57.IIJ.Net (58.138.81.78) 266.721 ms osk004ip56.IIJ.Net (58.138.106.154) 274.508 ms
12 210.138.106.238 (210.138.106.238) 266.779 ms 270.802 ms 266.695 ms
13 124.83.228.54 (124.83.228.54) 270.658 ms 266.838 ms 124.83.228.58 (124.83.228.58) 270.767 ms
14 124.83.252.170 (124.83.252.170) 277.377 ms 124.83.252.178 (124.83.252.178) 276.601 ms 124.83.252.170 (124.83.252.170) 281.006 ms
15 158.205.134.22 (158.205.134.22) 280.942 ms 158.205.134.26 (158.205.134.26) 276.646 ms 158.205.134.22 (158.205.134.22) 277.020 ms
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grieg %

```

(iii)

```

grieg % traceroute www.lancaster.ac.uk
traceroute to www.lancaster.ac.uk (148.88.65.80), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.102 ms 0.071 ms 0.081 ms
 2 129.94.39.17 (129.94.39.17) 0.865 ms 0.816 ms 0.878 ms
 3 172.17.31.154 (172.17.31.154) 4.086 ms 4.101 ms 4.046 ms
 4 po-3-1902.ombcr1.gw.unsw.edu.au (129.94.24.20) 1.248 ms 1.218 ms 1.211 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.182 ms 1.154 ms 1.144 ms
 6 138.44.5.0 (138.44.5.0) 1.950 ms 2.695 ms 2.669 ms
 7 et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233) 92.873 ms 92.677 ms 92.653 ms
 8 138.44.226.7 (138.44.226.7) 259.891 ms 259.798 ms 259.759 ms
 9 janet-gw.mx1.lon.uk.geant.net (62.40.124.198) 259.762 ms 259.710 ms 259.685 ms
10 ae29.londpg-sbr2.ja.net (146.97.33.2) 260.157 ms 260.106 ms 260.842 ms
11 ae31.erdis-sbr2.ja.net (146.97.33.22) 263.966 ms 264.273 ms 264.207 ms
12 ae29.manckh-sbr2.ja.net (146.97.33.42) 265.853 ms 265.935 ms 265.790 ms
13 ae25.manckh-ban1.ja.net (146.97.35.50) 265.951 ms 266.036 ms 265.987 ms
14 lancaster-uni.ja.net (146.97.40.178) 283.689 ms 283.650 ms 283.612 ms
15 * * *
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19 * * *
20 * * *
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22 * * *
23 * * *
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25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
grieg %

```

My machine's paths to these three destinations diverged on the sixth router (138.44.5.0).

```

person:      Steve Maddocks
remarks:     Director Operations
address:     AARNet Pty Ltd
address:     26 Dick Perry Avenue
address:     Kensington
address:     Perth
address:     WA 6151
country:     AU
phone:       +61-8-9289-2210
fax-no:      +61-2-6222-7509
e-mail:      steve.maddocks@aarnet.edu.au
nic-hdl:     SM6-AP
mnt-by:      MAINT-AARNET-AP
last-modified: 2011-02-01T08:37:06Z
source:      APNIC

```

Using the command 'whois 138.44.5.0' can find that this one is the ISP of the UNSW.

According to the next question, It can be seen that the physical distance from the local terminal to speedtest.com.sg and from speedtest.com.sg to the local terminal should be the same, but the number of hops on the path is not the same. So the number of hops on each path proportional to the physical distance is difference.

3.

The image displays two screenshots of a Linux terminal and a web browser. The top screenshot shows a terminal window with the command `traceroute to hax.at (185.126.20.70), 30 hops max, 60 byte packets`. The output shows the path from the user's machine to the destination, with various intermediate hops and their respective IP addresses and round-trip times. The bottom screenshot shows a web browser window displaying the traceroute results for the same destination, with a visual representation of the path and the same data as the terminal output.

The top screenshot shows a terminal window with the command `traceroute to hax.at (185.126.20.70), 30 hops max, 60 byte packets`. The output shows the path from the user's machine to the destination, with various intermediate hops and their respective IP addresses and round-trip times. The bottom screenshot shows a web browser window displaying the traceroute results for the same destination, with a visual representation of the path and the same data as the terminal output.

It can be seen that the net will go through different routing nodes and some of the same routing nodes, because the network can get a url through different paths, so the routing nodes through are not guaranteed to be exactly the same.

## Exercise 4:

1.

```

z5338602@vx07:~/COMP9331$ cat www.tu-berlin.de_avg.txt
50 278.236 278.077
250 278.347 278.184
500 278.494 278.237
750 278.520 278.386
1000 278.616 278.500
1250 278.741 278.575
1500 278.774 278.626
z5338602@vx07:~/COMP9331$ cat www.upm.edu.my_avg.txt
50 100.366 99.954
250 100.206 100.112
500 100.418 100.219
750 101.035 100.304
1000 101.042 100.486
1250 100.673 100.536
1500 100.790 100.639
z5338602@vx07:~/COMP9331$ cat www.uq.edu.au_avg.txt
ttl=240
ttl=240
ttl=240
16.894
17.113
17.368
50 17.160 ttl=240
250 17.313 17.026
500 17.372 ttl=240
750 17.565 17.175
1000 17.550 17.301
1250 17.607 ttl=240
1500 17.752 17.469

```

Host	Distance	RTT	T	Radio
<a href="http://www.uq.edu.au">www.uq.edu.au</a>	735km	17.5ms	2.45ms	7.14
<a href="http://www.upm.edu.my">www.upm.edu.my</a>	6750km	101ms	22.5ms	4.49
www.tu-berlin.de	16105km	278.6ms	53.7ms	5.19

2.

The delay to reach the destination is not constant. Delay includes four parts: transmission delay, processing delay, propagation delay and queueing delay. And the processing delay and queueing delay and transmission delay are all related to the packages size and the number of routers it passes through. The more routers it passes or larger the packages is, the more delay. So it is not constant.

3.

The processing delay, queueing delay and transmission delay depend on the packet size. If it is huge, it may take more time to unpack and or the information in it. The propagation delay does not depend on the packet size.