Lab1

Exercise 1

1. IP address of the Google site is: 216.58.196.132; in my opinion, the reason of having several IP addresses as an output is that the google site is quite busy, so it needs multiple IP addresses in order to prevent crashes.

2. The name of 127.0.0.1 is localhost. It is special because it is the localhost; so it cannot communicate with other host.

Exercise 2

Unreachable hosts through ping:

www.getfittest.com.au   ; also unreachable through the web browser;

www.hola.hp   ; also unreachable through the web browser;

www.kremlin.ru   ; but reachable through the web browser.

The others are reachable through the ping

The reason that www.getfittest.com.au and www.hola.hp is unreachable is because they do not exist. However, for www.kremlin.ru , it is reachable through the web browser, the reason for that might be this web disables ping response for security reasons.

Exercise 3

1. Traceroute for www.columbia.edu

There are 21 routers between your workstation and www.columbia.edu.

There are 5 routers along the path are part of the UNSW network.

Between router 7 and 8 which is denoted above, they do packets cross the pacific ocean.

2. Traceroute to www.ucla.edu , www.utokyo.ac.jp and www.lancaster.ac.uk .

To www.ucla.edu

```
weber % traceroute www.ucla.edu
traceroute to www.ucla.edu (164.67.228.152), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.154 ms  0.141 ms  0.127 ms
 2  129.94.39.17 (129.94.39.17)  1.042 ms  1.012 ms  1.100 ms
 3  ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35)  1.927 ms libudnex1-v1-3154.gw.u
nsw.edu.au (149.171.253.34)  4.505 ms ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35
)  1.914 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.402 ms ombcr1-po-6.gw.unsw.edu.au
(149.171.255.169)  1.302 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.436 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.472 ms  1.466 ms unswbr1-te-2-1
3.gw.unsw.edu.au (149.171.255.105)  1.621 ms
 6  138.44.5.0 (138.44.5.0)  1.751 ms  1.620 ms  1.642 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.428 ms  2.414 ms  2.40
7 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.167 ms  95.296 ms  95.275 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.498 ms  146.423 ms  146.44
1 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  163.090 ms  163.07
5 ms  163.045 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  170.742 ms  170.907 ms  17
0.879 ms
12  * * *
13  bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6)  171.252 ms  171.372 ms bd1
1f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  171.392 ms
14  cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55)  171.379 ms  171.278 ms cr00f
2.csb1--dr00f2.csb1.ucla.net (169.232.4.53)  171.244 ms
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

To www.utokyo.ac.jp

```
weber % traceroute www.utokyo.ac.jp
traceroute to www.utokyo.ac.jp (203.137.115.80), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.141 ms  0.136 ms  0.128 ms
 2  129.94.39.17 (129.94.39.17)  1.087 ms  1.113 ms  1.083 ms
 3  libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34)  2.075 ms  2.049 ms ombudnex1-v1
-3154.gw.unsw.edu.au (149.171.253.35)  11.519 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.433 ms ombcr1-po-5.gw.unsw.edu.au
(149.171.255.197)  1.457 ms  1.496 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.412 ms  1.355 ms unswbr1-te-2-1
3.gw.unsw.edu.au (149.171.255.105)  1.453 ms
 6  138.44.5.0 (138.44.5.0)  1.534 ms  1.480 ms  1.453 ms
 7  et-0-3-0.pe1.bkv1.nsw.aarnet.net.au (113.197.15.147)  2.041 ms  1.997 ms  1.998 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  156.265 ms  156.252 ms  156.23
4 ms
 9  paloalto0.iij.net (198.32.176.24)  158.134 ms  158.188 ms  158.246 ms
10  osk004bb00.IIJ.Net (58.138.88.185)  289.001 ms osk004bb01.IIJ.Net (58.138.88.189)
 271.342 ms osk004bb00.IIJ.Net (58.138.88.185)  289.003 ms
11  osk004ix51.IIJ.Net (58.138.106.126)  280.373 ms  280.030 ms  280.002 ms
12  210.130.135.130 (210.130.135.130)  279.863 ms  279.894 ms  271.227 ms
13  124.83.228.93 (124.83.228.93)  271.118 ms  273.287 ms  283.233 ms
14  124.83.228.74 (124.83.228.74)  279.760 ms  279.782 ms  288.711 ms
15  158.205.134.30 (158.205.134.30)  271.356 ms  280.154 ms  271.347 ms
16  * * *
17  * * *
18  * * *
19  158.205.162.2 (158.205.162.2)  281.229 ms  290.376 ms  290.329 ms
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

To www.lancaster.ac.uk

```
weber % 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)  0.175 ms  0.167 ms  0.157 ms
 2  129.94.39.17 (129.94.39.17)  1.100 ms  1.051 ms  1.083 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.786 ms libudnex1-vl-3154.gw.u
nsw.edu.au (149.171.253.34)  1.668 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35
)  1.827 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.296 ms libcr1-po-5.gw.unsw.edu.au
(149.171.255.165)  1.366 ms  1.363 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.380 ms unswbr1-te-1-9.gw.unsw.
edu.au (149.171.255.101)  1.446 ms  1.447 ms
 6  138.44.5.0 (138.44.5.0)  1.645 ms  1.565 ms  1.596 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.217 ms  2.067 ms  2.10
5 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.353 ms  95.271 ms  95.209 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.430 ms  146.383 ms  146.42
4 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.515 ms  146.494 m
s  146.447 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.352 ms  157.281 ms
 157.226 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.331 ms  180.427 ms
 180.306 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.153 ms  188.381 ms
  188.255 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.192 ms  197.219 ms  19
7.235 ms
15  et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54)  204.744 ms  204.656 ms
 204.709 ms
16  ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136)  205.073 ms  205.327 ms  20
5.200 ms
17  internet2.mx1.lon.uk.geant.net (62.40.124.44)  283.263 ms  280.680 ms  280.116 ms
18  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  279.732 ms  279.695 ms  279.835 ms
19  ae29.londpg-sbr2.ja.net (146.97.33.2)  280.339 ms  280.184 ms  280.140 ms
20  ae31.erdiss-sbr2.ja.net (146.97.33.22)  284.037 ms  283.962 ms  283.932 ms
21  ae29.manckh-sbr2.ja.net (146.97.33.42)  286.421 ms  286.019 ms  285.755 ms
22  ae24.lanclu-rbr1.ja.net (146.97.38.58)  288.109 ms  288.168 ms  288.127 ms
23  * * *
24  ismx-issrx.rtr.lancs.ac.uk (148.88.255.17)  290.112 ms  289.875 ms  289.911 ms
25  dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3)  302.018 ms  310.724 ms  303.186 ms
26  www.lancs.ac.uk (148.88.65.80)  289.762 ms !X  289.765 ms !X  289.706 ms !X
```

They diverge from the router 6 which is 138.44.5.0 (138.44.5.0).

The further details of this router are:

```
weber % whois 138.44.5.0

#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/whois_tou.html
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/whois_reporting/index.html
#
# Copyright 1997-2018, American Registry for Internet Numbers, Ltd.
#


NetRange:          138.44.0.0 - 138.44.255.255
CIDR:              138.44.0.0/16
NetName:           APNIC-ERX-138-44-0-0
NetHandle:         NET-138-44-0-0-1
Parent:            NET138 (NET-138-0-0-0-0)
NetType:           Early Registrations, Transferred to APNIC
OriginAS:
Organization:      Asia Pacific Network Information Centre (APNIC)
RegDate:           2003-12-11
Updated:           2009-10-08
Comment:           This IP address range is not registered in the ARIN database.
Comment:           This range was transferred to the APNIC Whois Database as
Comment:           part of the ERX (Early Registration Transfer) project.
Comment:           For details, refer to the APNIC Whois Database via
Comment:           WHOIS.APNIC.NET or http://wq.apnic.net/apnic-bin/whois.pl
Comment:
Comment:           ** IMPORTANT NOTE: APNIC is the Regional Internet Registry
Comment:           for the Asia Pacific region.  APNIC does not operate networks
Comment:           using this IP address range and is not able to investigate
Comment:           spam or abuse reports relating to these addresses.  For more
Comment:           help, refer to http://www.apnic.net/apnic-info/whois_search2/abuse-and
-spamming
Ref:               https://rdap.arin.net/registry/ip/138.44.0.0

ResourceLink:      http://wq.apnic.net/whois-search/static/search.html
ResourceLink:      whois.apnic.net


OrgName:           Asia Pacific Network Information Centre
OrgId:             APNIC
Address:           PO Box 3646
```

```
City:              South Brisbane
StateProv:         QLD
PostalCode:        4101
Country:           AU
RegDate:
Updated:           2012-01-24
Ref:               https://rdap.arin.net/registry/entity/APNIC

ReferralServer:  whois://whois.apnic.net
ResourceLink:    http://wq.apnic.net/whois-search/static/search.html

OrgAbuseHandle: AWC12-ARIN
OrgAbuseName:    APNIC Whois Contact
OrgAbusePhone:   +61 7 3858 3188
OrgAbuseEmail:   search-apnic-not-arin@apnic.net
OrgAbuseRef:     https://rdap.arin.net/registry/entity/AWC12-ARIN

OrgTechHandle: AWC12-ARIN
OrgTechName:    APNIC Whois Contact
OrgTechPhone:   +61 7 3858 3188
OrgTechEmail:   search-apnic-not-arin@apnic.net
OrgTechRef:     https://rdap.arin.net/registry/entity/AWC12-ARIN


#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/whois_tou.html
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/whois_reporting/index.html
#
# Copyright 1997-2018, American Registry for Internet Numbers, Ltd.
#



Found a referral to whois.apnic.net.

% [whois.apnic.net]
% Whois data copyright terms    http://www.apnic.net/db/dbcopyright.html

% Information related to '138.44.0.0 - 138.44.255.255'

% Abuse contact for '138.44.0.0 - 138.44.255.255' is 'abuse@aarnet.edu.au'

inetnum:           138.44.0.0 - 138.44.255.255
netname:           AARNET
```

```
descr:               Australian Academic and Research Network
descr:               Building 9
descr:               Banks Street
country:             AU
org:                 ORG-AAAR1-AP
admin-c:             SM6-AP
tech-c:              ANOC-AP
notify:              irrcontact@aarnet.edu.au
mnt-by:              APNIC-HM
mnt-lower:           MAINT-AARNET-AP
mnt-routes:          MAINT-AARNET-AP
mnt-irt:             IRT-AARNET-AU
status:              ALLOCATED PORTABLE
remarks:             -+-+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
remarks:             This object can only be updated by APNIC hostmasters.
remarks:             To update this object, please contact APNIC
remarks:             hostmasters and include your organisation's account
remarks:             name in the subject line.
remarks:             -+-+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
last-modified:       2017-10-09T13:02:43Z
source:              APNIC

irt:                 IRT-AARNET-AU
address:             AARNet Pty Ltd
address:             26 Dick Perry Avenue
address:             Kensington, Western Australia
address:             Australia
e-mail:              abuse@aarnet.edu.au
abuse-mailbox:       abuse@aarnet.edu.au
admin-c:             SM6-AP
tech-c:              ANOC-AP
auth:                # Filtered
mnt-by:              MAINT-AARNET-AP
last-modified:       2010-11-08T08:02:43Z
source:              APNIC

organisation:        ORG-AAAR1-AP
org-name:            Australian Academic and Research Network
country:             AU
address:             Building 9
address:             Banks Street
phone:               +61-2-6222-3530
fax-no:              +61-2-6222-3535
```

```
e-mail:         irrcontact@aarnet.edu.au
mnt-ref:        APNIC-HM
mnt-by:         APNIC-HM
last-modified:  2017-10-09T12:56:36Z
source:         APNIC

role:           AARNet Network Operations Centre
remarks:
address:        AARNet Pty Ltd
address:        GPO Box 1559
address:        Canberra
address:        ACT  2601
country:        AU
phone:          +61 1300 275 662
phone:          +61 2 6222 3555
remarks:
e-mail:         noc@aarnet.edu.au
remarks:
remarks:        Send abuse reports to abuse@aarnet.edu.au
remarks:        Please include timestamps and offset to UTC in logs
remarks:        Peering requests to peering@aarnet.edu.au
remarks:
admin-c:        SM6-AP
tech-c:         BM-AP
nic-hdl:        ANOC-AP
mnt-by:         MAINT-AARNET-AP
last-modified:  2010-06-30T13:16:48Z
source:         APNIC

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

% This query was served by the APNIC Whois Service version 1.88.15-46 (WHOIS-NODE2)
```

I do not think the number of hops on each path is proportional to the physical distance; because to UK, there are 26 hops, to USA, there are 14, to japan there are 19. If it is proportional, the USA should have more hops then that to japan

3.

Traceroute From http://www.speedtest.com.sg/tr.php to my machine:

IP address: 202.150.221.170

```
traceroute to 129.94.242.51 (129.94.242.51), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.205 ms  0.224 ms  0.233 ms
 2  10.11.33.38 (10.11.33.38)  32.876 ms  32.915 ms  32.942 ms
 3  hutchcity3-10g.hkix.net (123.255.90.140)  40.171 ms  40.128 ms  40.181 ms
 4  218.189.5.42 (218.189.5.42)  34.446 ms d1-42-238-143-118-on-nets.com (118.143.238.42)  73.657 ms  76.215 ms
 5  d1-6-224-143-118-on-nets.com (118.143.224.6)  222.691 ms d1-26-224-143-118-on-nets.com (118.143.224.26)  230.996 ms d1-18-224-143
 6  aarnet.as7575.any2ix.coresite.com (206.72.210.64)  218.393 ms  179.880 ms  211.120 ms
 7  xe-0-0-3.pe1.tkpa.akl.aarnet.net.au (202.158.194.172)  338.404 ms  337.542 ms  297.679 ms
 8  et-0-1-0.200.pe1.wnpa.akl.aarnet.net.au (113.197.15.68)  347.599 ms  387.559 ms  346.058 ms
 9  xe-1-2-1.pe1.msct.nsw.aarnet.net.au (113.197.15.66)  359.596 ms xe-0-2-2-204.pe1.alxd.nsw.aarnet.net.au (113.197.15.182)  367.980
10  et-8-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.152)  334.744 ms  369.359 ms  375.205 ms
11  138.44.5.1 (138.44.5.1)  361.895 ms  353.691 ms  321.542 ms
12  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.186)  354.137 ms  364.505 ms  329.881 ms
13  ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  332.809 ms  374.658 ms  366.991 ms
14  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  372.725 ms  347.002 ms  332.164 ms
15  129.94.39.23 (129.94.39.23)  330.168 ms  365.408 ms  329.889 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Reverse:

```
wagner % traceroute www.speedtest.com.sg
traceroute to www.speedtest.com.sg (202.150.221.170), 30 hops max, 60 byte packets
 1   cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.129 ms  0.114 ms  0.133 ms
 2   129.94.39.17 (129.94.39.17)  1.122 ms  1.060 ms  1.072 ms
 3   libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.778 ms  1.701 ms  1.982 ms
 4   ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.359 ms libcr1-po-5.gw.unsw.edu.au
(149.171.255.165)  1.249 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.263 ms
 5   unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.346 ms  1.291 ms unswbr1-te-2-1
3.gw.unsw.edu.au (149.171.255.105)  1.339 ms
 6   138.44.5.0 (138.44.5.0)  1.404 ms  1.417 ms  1.392 ms
 7   et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  4.013 ms  3.361 ms  2.542 ms
 8   xe-0-0-3.pe1.wnpa.akl.aarnet.net.au (113.197.15.67)  24.381 ms  24.279 ms  24.276
ms
 9   et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69)  24.634 ms  24.631 ms  24.
649 ms
10   xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  148.017 ms  147.986 ms  148.0
53 ms
11   singtel.as7473.any2ix.coresite.com (206.72.210.63)  330.508 ms  330.387 ms  330.49
4 ms
12   203.208.154.45 (203.208.154.45)  361.155 ms 203.208.172.173 (203.208.172.173)  330
.971 ms 203.208.154.45 (203.208.154.45)  361.196 ms
13   203.208.173.73 (203.208.173.73)  362.120 ms 203.208.182.77 (203.208.182.77)  373.2
80 ms 203.208.177.110 (203.208.177.110)  361.686 ms
14   202-150-221-170.rev.ne.com.sg (202.150.221.170)  357.033 ms 203.208.182.45 (203.20
8.182.45)  348.709 ms  350.253 ms
```

Traceroute from https://www.telstra.net/cgi-bin/trace to my machine is

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.305 ms  0.222 ms  0.245 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  2.619 ms  1.487 ms  2.369 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  12.864 ms  12.107 ms  12.613 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  13.363 ms  12.107 ms  11.864 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.612 ms  11.607 ms  11.612 ms
 6  ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17)  11.739 ms  11.855 ms  11.739 ms
 7  ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56)  11.989 ms  12.106 ms  11.989 ms
 8  et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  12.363 ms  12.356 ms  12.364 ms
 9  138.44.5.1 (138.44.5.1)  12.613 ms  12.608 ms  12.613 ms
10  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  12.614 ms  12.606 ms  12.612 ms
11  libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  12.989 ms
12  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  13.113 ms  13.105 ms  13.238 ms
13  129.94.39.23 (129.94.39.23)  13.364 ms  13.358 ms  13.363 ms
```
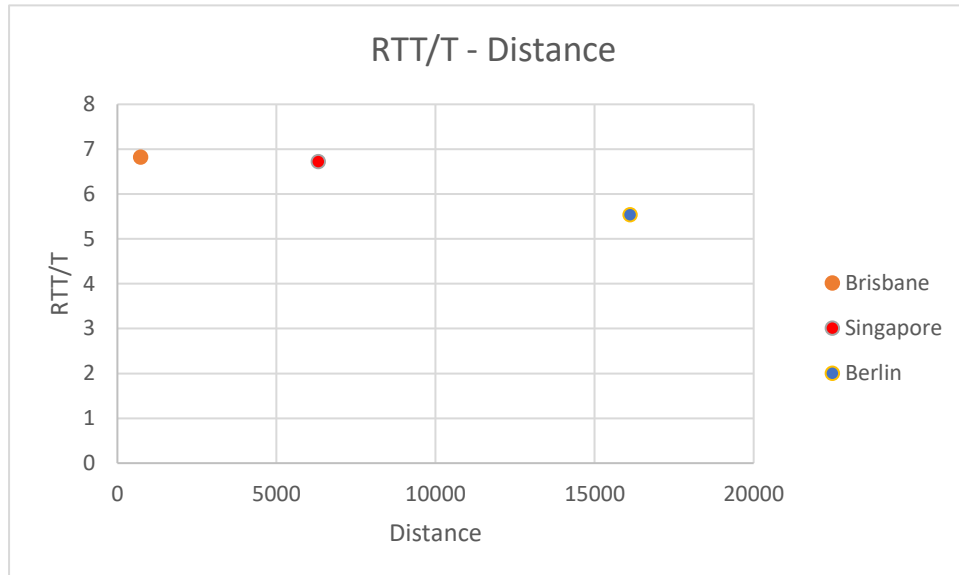
Reverse:

```
wagner % traceroute www.telstra.net
traceroute to www.telstra.net (203.50.5.178), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.117 ms  0.148 ms  0.127 ms
 2  129.94.39.17 (129.94.39.17)  1.060 ms  1.077 ms  1.049 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.361 ms libudnex1-vl-3154.gw.u
nsw.edu.au (149.171.253.34)  1.463 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35
)  1.930 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.228 ms libcr1-po-5.gw.unsw.edu.au
(149.171.255.165)  1.179 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.237 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.320 ms  1.268 ms  1.321 ms
 6  138.44.5.0 (138.44.5.0)  1.519 ms  1.449 ms  1.542 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.884 ms  1.718 ms  1.719 ms
 8  ae9.bb1.a.syd.aarnet.net.au (113.197.15.57)  2.093 ms  2.108 ms  2.129 ms
 9  gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18)  2.239 ms  2.235 ms  2
.270 ms
10  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  2.814 ms  3.095 ms  3
.093 ms
11  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  3.718 ms  4.342 ms  3
.697 ms
12  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  15.895 ms  15.981
 ms  15.704 ms
13  gigabitethernet5-0.exi-service2.melbourne.telstra.net (203.50.80.132)  14.017 ms
14.197 ms  14.065 ms
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

From the above observation, the reverse path does not go through the same routers as the forwarding path. The reason for that is there are many other routes can go from one end to its destination.

EXERCISE 4

1. UNSW to UQ: 731kms; T = 2.43ms;   ratio: 16.58/2.43 = 6.82

    UNSW to NUS: 6317.5kms; T = 21.1ms;   ratio: $142.016/21.1 = 6.72$

    UNSW to TU-BERLIN: 16114.5kms; T = 53.7ms;   ratio: $297.526/53.7= 5.54$

    RTT/T - Distance

    (scatter plot with x-axis "Distance" from 0 to 20000, y-axis "RTT/T" from 0 to 8. Points: Brisbane (orange) ~700, ~6.8; Singapore (red) ~6300, ~6.7; Berlin (blue) ~16000, ~5.5. Legend: Brisbane, Singapore, Berlin)

    Reasons why y-axis values that I plot are greater than 2:

    ● Because for one forwarding trip, RRT includes some other delay existing, like processing delay or queueing delay or transmission delay. The shortest possible time T is only the propagation delay

    ● The shortest possible time T is measured by the direct distance, there might be some detour for the real physical wires.

2. No, the delay to the destination is not constant. From the delay graph, we can see that over different times, the delay time is different. The reason for is that this delay is mostly due to the variability of processing and queueing delays. The degree of variability is related to the quality of the connection.

3. The propagation delay is NOT dependent on the packet size since it only depend on the link.

    The transmission delay is highly dependent on the packet size since it equals packet size/bandwidth

    The processing delay is dependent on the packet size because it needs to check the error of the packet.

    The queueing delay is NOT dependent on the packet size because it depends on the congestion of the network.