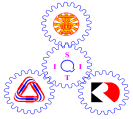# Sirindhorn International Institute of Technology
Thammasat University

Midterm Examination: Semester 2/2008

Course Title : ITS332 Information Technology II Laboratory

Instructor : Dr Steven Gordon

Date/Time : Friday 9 January 2009, 13:30 to 16:30

Instructions:

- This examination paper has 20 pages (including this page).

- Condition of Examination
    Closed book
    No dictionary
    Calculator is allowed

- Students are not allowed to be out of the exam room during examination. Going to the restroom may result in score deduction.

- Turn off all communication devices (mobile phone etc.) and leave them under your seat.

- Write your name, student ID, section, and seat number clearly on the answer sheet.

- The space on the back of each page can be used if necessary.

- If a question requires an IP address for an answer, then you may select any valid IP address that satisfies all conditions of the question.

- Assume 8 bits = 1 Byte; 1000 Bytes = 1KB; 1000KB = 1MB; 1000MB = 1GB; ...

Questions [84 marks]

Question 1 [14 marks]

The following shows interface configuration information for a computer (called *R*). Answer the questions based only on this output.

```
eth0      Link encap:Ethernet  HWaddr 00:17:31:5a:e5:89
          inet addr:10.10.1.110  Bcast:10.10.1.255  Mask:255.255.255.0
          inet6 addr: fe80::217:31ff:fe5a:e589/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:60312 errors:0 dropped:0 overruns:0 frame:0
          TX packets:36975 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:82269340 (78.4 MB)  TX bytes:2781062 (2.6 MB)

eth1      Link encap:Ethernet  HWaddr 00:17:31:5A:E7:E8
          inet addr:10.10.6.11  Bcast:10.10.6.255  Mask:255.255.255.0
          inet6 addr: fe80::217:31ff:fe5a:e7e8/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:75759 errors:0 dropped:0 overruns:0 frame:0
          TX packets:37816 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:12593354 (12.0 MB)  TX bytes:32730640 (31.2 MB)

eth4      Link encap:Ethernet  HWaddr 00:17:9a:36:f7:65
          inet addr:192.168.1.3  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::217:9aff:fe36:f765/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:308380 errors:0 dropped:0 overruns:0 frame:0
          TX packets:353949 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:33101632 (31.5 MB)  TX bytes:326555578 (311.4 MB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:1526 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1526 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:78780 (76.9 KB)  TX bytes:78780 (76.9 KB)
```

a) What program (command) was used to produce this output? [1 mark]

b) How many Ethernet cards does the computer have currently configured? [1 mark]

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c) Do you think all Ethernet cards are manufactured by the same company? Explain your answer. [1 mark]

d) Explain the `lo` interface and give an example of how it may be used. [1 mark]

e) What is the maximum size of a packet that can be sent on `eth1`? [1 mark]

f) What is the average size of a packet received on `eth4`? [1 mark]

g) Assume the computer R is a router, with two hosts connected, via a switch, to each interface of R. Draw a diagram that illustrates the network, showing the router, switches, hosts and the IP addresses of all interfaces. [4 marks]

h) In the network, which hosts receive the most traffic? Give their IP addresses and explain why [2 marks].

i) In the network, do you think router R generates any data (that is, R is the source of data)? Give a yes or no answer and explain why. (Apart from devices listed in part (g), assume no other devices are in the network) [2 marks].

Question 2 [8 marks]

The following shows output from a `ping` command on the computer *C*. Answer the questions based only on this output.

```
sgordon@basil:~$ ping -c 5 www.siit.tu.ac.th
PING www.siit.tu.ac.th (203.131.209.77) 56(84) bytes of data.
64 bytes from 203.131.209.77: icmp_seq=1 ttl=50 time=29.7 ms
64 bytes from 203.131.209.77: icmp_seq=2 ttl=50 time=27.3 ms
64 bytes from 203.131.209.77: icmp_seq=3 ttl=50 time=27.3 ms
64 bytes from 203.131.209.77: icmp_seq=4 ttl=50 time=29.6 ms
64 bytes from 203.131.209.77: icmp_seq=5 ttl=50 time=34.5 ms

--- www.siit.tu.ac.th ping statistics ---

_____ packets transmitted, _____ received, _____% packet loss, time 4008ms

rtt min/avg/max/mdev = _____/_____/_____/_____ ms
```

a) Fill in the seven spaces in the `ping` statistics. For times, give your answer to the nearest 0.1 ms (for example, "2.4ms"). [0.5 marks for each answer].

b) How many routers do you think are between the computer *C* and `www.siit.tu.ac.th`? Explain your answer. [3 marks]

Below are the results of another `ping` command on computer *C* to the same destination (`www.siit.tu.ac.th`). The summary statistics are hidden.

```
PING www.siit.tu.ac.th (203.131.209.77) 56(84) bytes of data.
64 bytes from 203.131.209.77: icmp_seq=1 ttl=50 time=34.4 ms
64 bytes from 203.131.209.77: icmp_seq=2 ttl=50 time=32.9 ms
64 bytes from 203.131.209.77: icmp_seq=3 ttl=50 time=29.1 ms
64 bytes from 203.131.209.77: icmp_seq=4 ttl=50 time=38.9 ms
64 bytes from 203.131.209.77: icmp_seq=5 ttl=50 time=37.8 ms

--- www.siit.tu.ac.th ping statistics ---
___ packets transmitted, ___ received, ___% packet loss, time 2004ms
rtt min/avg/max/mdev = ___/___/___/___ ms
```

The times reported are obviously different (e.g. 29.7ms versus 34.4ms).

c) When the user on computer *C* executed this second `ping` command, what did they do differently from the first `ping`? Explain your answer. [1.5 marks]

Question 3 [6 marks]

The following shows output from several commands on a computer *C*. Answer the questions based only on this output.

```
sgordon@ginger:~$ netstat -t -n
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address          Foreign Address         State
tcp        0      0 10.10.1.110:38331      63.150.131.190:80       ESTABLISHED
tcp        0      0 10.10.1.110:58685      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:58683      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:54299      125.25.226.110:22       ESTABLISHED
tcp        0      0 10.10.1.110:57025      10.10.6.11:22           ESTABLISHED
tcp        0      0 10.10.1.110:38333      63.150.131.190:80       ESTABLISHED
tcp        0      0 10.10.1.110:58682      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:39756      207.46.30.34:80         ESTABLISHED
tcp        0      0 10.10.1.110:58681      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:60955      209.85.143.83:80        ESTABLISHED
tcp        0      0 10.10.1.110:58680      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:58684      203.131.209.77:80       ESTABLISHED
tcp        0      0 10.10.1.110:38332      63.150.131.190:80       ESTABLISHED

sgordon@ginger:~$ nslookup www.siit.tu.ac.th
Server:         10.10.10.9
Address:  10.10.10.9#53

Name:     www.siit.tu.ac.th
Address: 203.131.209.77

sgordon@ginger:~$ nslookup mail.google.com
Server:         10.10.10.9
Address:  10.10.10.9#53

Non-authoritative answer:
mail.google.com    canonical name = googlemail.l.google.com.
Name:     googlemail.l.google.com
Address: 209.85.143.18
Name:     googlemail.l.google.com
Address: 209.85.143.19
Name:     googlemail.l.google.com
Address: 209.85.143.83
```

a) How many web sites do you think the user on computer *C* is visiting? Explain your answer. [1 mark]

b) In which of the following files would you find the abbreviated name of the server that computer *C* is connected to which isn't a web server? [Multiple choice, select only one answer, 1 mark]

    i. `/etc/hosts`

    ii. `/etc/services`

    iii. `/etc/resolv.conf`

    iv. `/var/www/index.html`

    v. `/proc/sys/net/ipv4/ip_forward`

    vi. `/etc/apache2/apache.conf`

c) What port number does a DNS server use? [1 mark]

d) What is computer *C*'s default DNS server? [1 mark]

e) What does the "Local Address" column of `netstat` output report? That is, explain *what* the two addresses identify. [2 marks]

Question 4 [18 marks]

The following pages show the text output from a packet capture in Wireshark. Answer the questions based only on this output.

a) What URL did the user first type into their browser? Explain how you know the answer. [2 marks]

b) How many TCP connections are captured? Explain your answer. (Hint: DNS does not use TCP) [2 marks]

c) Draw a diagram that illustrates all TCP segments in the connection setup and data transfer for the TCP connection used to transfer the first web page. Make sure you clearly label the message types (or other identifying information). (Hint: only draw the segments belonging to the one TCP connection) [6 marks]

The text output from Wireshark:

```
No. Time      Source        Destination    Prot. Info
 1  0.000000  10.10.1.110   10.10.10.9     DNS   Standard query A www.sandilands.info
 2  0.219620  10.10.10.9    10.10.1.110    DNS   Stand. query resp. CNAME sandilands.info A 125.25.226.110
 3  0.219861  10.10.1.110   125.25.226.110 TCP   49185 > 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460
 4  0.220618  125.25.226.110 10.10.1.110   TCP   80 > 49185 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460
 5  0.220646  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=1 Ack=1 Win=5888 Len=0
 6  0.220682  10.10.1.110   125.25.226.110 HTTP  GET /siit/index.html HTTP/1.1
 7  0.221617  125.25.226.110 10.10.1.110   TCP   80 > 49185 [ACK] Seq=1 Ack=403 Win=6912 Len=0
 8  0.483472  125.25.226.110 10.10.1.110   TCP   [TCP segment of a reassembled PDU]
 9  0.483494  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=403 Ack=1449 Win=8768 Len=0
10  0.483501  125.25.226.110 10.10.1.110   TCP   [TCP segment of a reassembled PDU]
11  0.483509  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=403 Ack=1526 Win=8768 Len=0
12  0.494431  10.10.1.110   125.25.226.110 TCP   49186 > 80 [SYN] Seq=0 Win=5840 Len=0 MSS=1460
13  0.495468  125.25.226.110 10.10.1.110   TCP   80 > 49186 [SYN, ACK] Seq=0 Ack=1 Win=5792 Len=0 MSS=1460
14  0.495486  10.10.1.110   125.25.226.110 TCP   49186 > 80 [ACK] Seq=1 Ack=1 Win=5888 Len=0
15  0.495525  10.10.1.110   125.25.226.110 HTTP  GET /siit/css/site.css HTTP/1.1
16  0.496470  125.25.226.110 10.10.1.110   TCP   80 > 49186 [ACK] Seq=1 Ack=413 Win=6912 Len=0
17  0.510461  125.25.226.110 10.10.1.110   TCP   [TCP segment of a reassembled PDU]
18  0.510477  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=403 Ack=2934 Win=11648 Len=0
19  0.543443  125.25.226.110 10.10.1.110   HTTP  HTTP/1.0 200 OK  (text/html)
20  0.543473  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=403 Ack=4196 Win=14528 Len=0
21  0.617404  125.25.226.110 10.10.1.110   HTTP  HTTP/1.0 200 OK  (text/css)
22  0.617435  10.10.1.110   125.25.226.110 TCP   49186 > 80 [ACK] Seq=413 Ack=1061 Win=8000 Len=0
24  3.636191  10.10.1.110   125.25.226.110 HTTP  GET /favicon.ico HTTP/1.1
25  3.636756  125.25.226.110 10.10.1.110   TCP   80 > 49185 [ACK] Seq=4196 Ack=893 Win=7936 Len=0
26  3.688722  125.25.226.110 10.10.1.110   HTTP  HTTP/1.0 304 Not Modified
27  3.688745  10.10.1.110   125.25.226.110 TCP   49185 > 80 [ACK] Seq=893 Ack=4585 Win=17472 Len=0
```

Details of selected packets:

```
Frame 6 (468 bytes on wire, 468 bytes captured)
Ethernet II, Src: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89), Dst: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45)
Internet Protocol, Src: 10.10.1.110 (10.10.1.110), Dst: 125.25.226.110 (125.25.226.110)
Transmission Control Protocol, Src Port: 49185 (49185), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 402
Hypertext Transfer Protocol

Frame 8 (1514 bytes on wire, 1514 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49185 (49185), Seq: 1, Ack: 403, Len: 1448

Frame 10 (143 bytes on wire, 143 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49185 (49185), Seq: 1449, Ack: 403, Len: 77

Frame 15 (478 bytes on wire, 478 bytes captured)
Ethernet II, Src: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89), Dst: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45)
Internet Protocol, Src: 10.10.1.110 (10.10.1.110), Dst: 125.25.226.110 (125.25.226.110)
Transmission Control Protocol, Src Port: 49186 (49186), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 412
Hypertext Transfer Protocol

Frame 17 (1474 bytes on wire, 1474 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49185 (49185), Seq: 1526, Ack: 403, Len: 1408

Frame 19 (1328 bytes on wire, 1328 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49185 (49185), Seq: 2934, Ack: 403, Len: 1262
[Reassembled TCP Segments (4195 bytes): #8(1448), #10(77), #17(1408), #19(1262)]
Hypertext Transfer Protocol
Line-based text data: text/html
```

```
Frame 21 (1126 bytes on wire, 1126 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49186 (49186), Seq: 1, Ack: 413, Len: 1060
Hypertext Transfer Protocol
Line-based text data: text/css

Frame 24 (556 bytes on wire, 556 bytes captured)
Ethernet II, Src: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89), Dst: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45)
Internet Protocol, Src: 10.10.1.110 (10.10.1.110), Dst: 125.25.226.110 (125.25.226.110)
Transmission Control Protocol, Src Port: 49185 (49185), Dst Port: 80 (80), Seq: 403, Ack: 4196, Len: 490
Hypertext Transfer Protocol

Frame 26 (455 bytes on wire, 455 bytes captured)
Ethernet II, Src: 00:50:ba:4c:6b:45 (00:50:ba:4c:6b:45), Dst: 00:17:31:5a:e5:89 (00:17:31:5a:e5:89)
Internet Protocol, Src: 125.25.226.110 (125.25.226.110), Dst: 10.10.1.110 (10.10.1.110)
Transmission Control Protocol, Src Port: 80 (80), Dst Port: 49185 (49185), Seq: 4196, Ack: 893, Len: 389
Hypertext Transfer Protocol
```

b) The MAC address 00:17:31:5a:e5:89 belongs to which device (or computer) in the network? (Give a description or name of the device, not the IP address). [1 mark]

c) The MAC address 00:50:ba:4c:6b:45 belongs to which device (or computer) in the network? (Give a description or name of the device, not the IP address). [1 mark]

d) List all URLs that have been requested using a HTTP GET request. [1.5 marks]

e) For each of the above requests sent by the source computer, explain the HTTP response received by the source computer (e.g. what type of response was received? why? What data (if any) is in the response?). [3 marks]

f) For each HTTP response indicate the size of the HTTP response (including any data). [1.5 marks]

Question 5 [10 marks]

The following shows the contents of the file `/var/lib/dhcp3/dhclient.leases` for a computer. Answer the questions based only on this output.

```
lease {
  interface "eth0";
  fixed-address 10.10.1.110;
  option subnet-mask 255.255.255.0;
  option routers 10.10.1.1;
  option dhcp-lease-time 86400;
  option dhcp-message-type 5;
  option domain-name-servers 10.10.6.34;
  option dhcp-server-identifier 10.10.1.1;
  option netbios-name-servers 192.168.1.6,10.10.1.5;
  renew 4 2008/11/6 16:12:00;
  rebind 5 2008/11/7 03:26:15;
  expire 5 2008/11/7 06:26:15;
}
```

a) What protocol is this information used by? [1 mark]

b) What is the purpose of the protocol? [1 mark]

c) Draw a diagram of a network that shows the devices involved in this protocol, and illustrate how the protocol works by drawing/labelling the messages on the diagram. For each device involved in the protocol, give its IP address. [5 marks]

d) What is the maximum time that the computer can use its IP address before contacting the server again? [1 mark]

e) During normal operation, at what time will the computer contact the server to continue using the IP address? Explain your answer. [1 mark]

f) What is the IP address of the server that the computer will contact to map `www.google.com` to an IP address? Explain your answer. [1 mark]

Question 6 [6 marks]

The following shows the text output from a packet capture in Wireshark. The details of two frames captured are shown. Answer the questions based only on this output.

```
Frame 1 (42 bytes on wire, 42 bytes captured)
Ethernet II, Src: 00:17:31:5a:e5:89, Dst: ff:ff:ff:ff:ff:ff
    Destination: ff:ff:ff:ff:ff:ff
        Address: ff:ff:ff:ff:ff:ff
        IG bit: Group address (multicast/broadcast)
        LG bit: Locally administered address (this is NOT the factory default)
    Source: 00:17:31:5a:e5:89
        Address: 00:17:31:5a:e5:89
        IG bit: Individual address (unicast)
        LG bit: Globally unique address (factory default)
    Type: ARP (0x0806)
Address Resolution Protocol (request)
    Hardware type: Ethernet (0x0001)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (0x0001)
    Sender MAC address: 00:17:31:5a:e5:89
    Sender IP address: 10.10.1.110
    Target MAC address: 00:00:00:00:00:00
    Target IP address: 10.10.1.33

Frame 2 (60 bytes on wire, 60 bytes captured)
Ethernet II, Src: 00:13:49:2b:7f:0b, Dst: 00:17:31:5a:e5:89
    Destination: 00:17:31:5a:e5:89
        Address: 00:17:31:5a:e5:89
        IG bit: Individual address (unicast)
        LG bit: Globally unique address (factory default)
    Source: 00:13:49:2b:7f:0b
        Address: 00:13:49:2b:7f:0b
        IG bit: Individual address (unicast)
        LG bit: Globally unique address (factory default)
    Type: ARP (0x0806)
    Trailer: 000000000000000000000000000000000000
Address Resolution Protocol (reply)
    Hardware type: Ethernet (0x0001)
    Protocol type: IP (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (0x0002)
    Sender MAC address: 00:13:49:2b:7f:0b
    Sender IP address: 10.10.1.33
    Target MAC address: 00:17:31:5a:e5:89
    Target IP address: 10.10.1.110
```

a) What protocol was in use that triggered the sending of these two frames? [1 mark]

b) What is the purpose of the protocol? [1 mark]

c) Draw both packets, indicating all layers down to at least layer 2. [2 marks]

d) For each frame, explain which node sent the frame, what the frame means (i.e. the purpose of the frame) and where they sent the frame to (i.e. destination)? Use an appropriate address to refer to nodes. [2 marks]

Question 7 [8 marks]

The following shows the output of a command on a computer *C*. Answer the questions based only on this output.

```
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
10.10.1.0       0.0.0.0          255.255.255.0    U     0      0        0 eth0
10.10.3.0       0.0.0.0          255.255.255.0    U     0      0        0 eth1
192.168.3.0     10.10.3.4        255.255.255.0    UG    0      0        0 eth1
72.16.0.0       10.10.3.4        255.255.0.0      UG    0      0        0 eth1
10.10.2.0       10.10.1.1        255.255.255.0    UG    0      0        0 eth0
0.0.0.0         10.10.1.1        0.0.0.0          UG    0      0        0 eth0
```

a) What command was used to produce this output? [1 mark]

b) How many LAN cards does this computer have? Explain your answer. [1 mark]

c) If computer *C* has an IP packet with one of the following destination addresses, then explain what is the next device that *C* sends the packet to, and what interface *C* uses to send the packet. Refer to devices using their IP address. In your explanation, refer to the row in the table that matches (e.g. rows 1 through to 6).

   i.   10.10.1.110 [1 mark]

   ii. 192.168.4.1 [1 mark]

   iii. 72.16.0.10 [1 mark]

   iv. 10.10.2.1 [1 mark]

d) If the following command was executed on computer *C*, would any of your answers to part (c) change? Explain your answer. [2 marks]

```
route del -net 10.10.2.0 netmask 255.255.255.0 gw 10.10.1.1 eth0
```

Question 8 [6 marks]

Assume you want to configure a peer-to-peer network between two computers at home. Assume computer A has an IP address of 192.168.1.34 and subnet mask 255.255.255.0.

a) For computer B, indicate if the following addresses are needed, and what they should be set to:

   i.   IP address [1 mark]

   ii. Subnet mask [1 mark]

   iii. Default gateway [1 mark]

b) What type of cable would you use to connect the two computers? [1 mark]

c) Which of the following commands (select zero or more) would you use to *configure* the computers so that the network worked? [1 mark]

   `ping`, `ifconfig`, `route`, `arp`, `tracepath`, `dhclient`, `wireshark`, `hosts`, `nslookup`

d) Which of the above set of commands (select zero or more) could you use to *test* that the network works by sending packets? [1 mark]

Question 9 [8 marks]

a) Draw the network topology if the SIIT ICT Networking Lab and its connections to other networks (up until `bridge.siit.tu.ac.th`) assuming the following [7 marks]:

○ The lab has 2 PCs per group (instead of 9), and 2 groups (instead of 4).

○ The cabinets in the Lab have Ethernet connections to a switch in the Computer Centre; the switch also connects to a Router in the Computer Centre via Ethernet.

○ Use the output from `tracepath` (performed from a computer within the Lab) to determine the devices/connectivity up until `bridge.siit.tu.ac.th`. You do not need to draw any networks beyond `bridge.siit.tu.ac.th`.

○ You should label each device as either a host, switch or router. Give IP addresses of the devices when they are available.

```
$ tracepath bridge.siit.tu.ac.th
 1:  10.10.6.11 (10.10.6.11)                          0.127ms pmtu 1500
 1:  10.10.6.1 (10.10.6.1)                            0.794ms
 2:  10.10.10.1 (10.10.10.1)                          1.919ms
 3:  192.168.72.3 (192.168.72.3)                      asymm  4   2.921ms
 4:  192.168.79.2 (192.168.79.2)                      asymm  5 209.821ms
 5:  192.168.73.1 (192.168.73.1)                      276.766ms
 6:  bridge.siit.tu.ac.th (192.168.10.1)              276.816ms reached
     Resume: pmtu 1500 hops 6 back 6
```

b) How many IP subnets are shown in your diagram? [1 mark]