

## Networks and Protocols (Preparation Material)

### Question 1

Answer the following questions with **yes**, **no**, or **maybe**.

1. The website `google.dz` is hosted in Algeria
2. The website `google.dz` can be hosted outside Algeria
3. The website `google.dz` can be hosted inside and outside Algeria

### Question 2

1. We run the following command `dig example.edu` from a terminal. Fill in the gaps (represented by ...) in the following output and answer subsequent questions:

```
;; QUESTION SECTION:
; ...                IN      A

;; ANSWER SECTION:
...                86400    IN      A      93.184.216.119

;; AUTHORITY SECTION:
...                172800   IN      NS      b.iana-servers.net.
...                172800   IN      NS      ...

;; ADDITIONAL SECTION:
a.iana-servers.net. 22728   IN      A      199.43.132.53
...                22728   IN      AAAA   2001:500:8c::53
...                22728   IN      A      199.43.133.53
...                22728   IN      AAAA   2001:500:8d::53
```

2. Does the host `b.iana-servers.net` have an IPv6 address? If so give it, if not justify.
3. What does 93.184.216.119 represent?
4. What are the name(s) of the domain name servers that have authority over the domain `example.edu`?

### Question 3

Consider the following output resulting from running the command `traceroute example-ensia.dz`.

```
traceroute to example-ensia.dz (193.194.69.98), 30 hops max, 60 byte packets
1  192.168.1.1 (192.168.1.1)  25.556 ms  26.045 ms  26.727 ms
2  41.99.0.1 (41.99.0.1)  40.235 ms  41.089 ms  41.720 ms
3  172.18.0.58 (172.18.0.58)  30.068 ms  32.542 ms  35.773 ms
```

```

4 ae-1-12.bar1.Vienna1.Level3.net (4.69.153.145) 170.189 ms * 149.298 ms
5 212.73.203.102 (212.73.203.102) 149.951 ms 148.335 ms 148.869 ms
6 ae0.mx1.mil2.it.geant.net (62.40.98.39) 172.626 ms 170.135 ms *
7 so-1-3-0.rtl.cat.it.geant.net (62.40.112.55) 536.250 ms 535.646 ms 540.370 ms
8 arn-gw.rtl.cat.it.geant.net (62.40.124.66) 168.936 ms 170.285 ms 172.263 ms
9 10.16.250.9 (10.16.250.9) 110.594 ms 106.447 ms 109.794 ms
10 * 172.16.100.17 (172.16.100.17) 117.839 ms 117.146 ms
11 172.16.100.30 (172.16.100.30) 130.207 ms 121.987 ms 122.015 ms
12 10.19.101.1 (10.19.101.1) 108.965 ms 106.397 ms 105.869 ms
13 10.19.101.2 (10.19.101.2) 156.436 ms 165.216 ms 160.924 ms
14 193.194.69.98 (193.194.69.98) 162.734 ms * *

```

1. Can the IP address of `example-ensia.dz` be known from the obtained output? If yes, what is it?
2. Can the IP address of our machine be known from the obtained output? If yes, what is it?
3. What do the following numbers represent 192.168.1.1, 193.194.69.98?
4. How many routers are there between our machine and `example-ensia.dz`?
5. What would be the response of pinging the following machines 192.168.1.1, 41.99.0.1, 172.16.100.30, and 10.19.101.2 (include an approximate value of mean round trip time in your response)?

## Question 4

Consider the following routing table:

```

192.168.0.128/25    If1
192.168.0.0/17     If2
192.168.0.0/25     If1
192.168.16.0/23    If3
192.168.16.0/21    If4

```

1. List the range of IP addresses that belong to each one of these five networks.
2. To which interface each of the following IP addresses should be forwarded: 192.168.2.1, 192.168.22.1, 192.168.17.128, 192.168.255.0, 192.168.32.0.
3. Perform routing table aggregation on the routing table.

## Question 5

Consider the following output resulting from running the command `ifconfig`.

```

user@machine:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr f1:dc:fa:8e:f5:35
UP BROADCAST MULTICAST  MTU:1500  Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0

```

```

collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:20 Memory:f2500000-f2520000

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:65536 Metric:1
RX packets:2492 errors:0 dropped:0 overruns:0 frame:0
TX packets:2492 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:259361 (259.3 KB) TX bytes:259361 (259.3 KB)

wlan0       Link encap:Ethernet HWaddr c1:de:fa:82:da:0b
inet addr:192.168.1.2 Bcast:192.168.1.255 Mask:255.255.255.0
inet6 addr: fe80::d2df:9aff:fe72:d49b/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:20042 errors:0 dropped:0 overruns:0 frame:0
TX packets:20567 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:14064923 (14.0 MB) TX bytes:2889508 (2.8 MB)

```

1. What do the following represent?
  - f1:dc:fa:8e:f5:35,
  - c1:de:fa:82:da:0b,
  - 192.168.1.2,
  - 192.168.1.255
2. What is the network address to which the interface `wlan0` is connected?
3. Is this machine connected to the Internet through wireless or wired interface? Justify.

## Question 6

Consider the following routing table:

1. Can 192.168.0.1/24 ping 192.168.0.2/24?
2. Can 192.168.1.1/24 ping 192.168.0.2/24?
3. Can 192.168.1.1/16 ping 192.168.0.2/16?

## Question 7

1. What are the main differences between UDP and TCP protocols? Consider the following elements: packet retransmission, error detection, and congestion control.
2. Do the following applications use TCP or UDP?

- Live video streaming
- File transfer
- Mail
- Web browsing

## Question 8

1. What is the name of the server hosting the URL `http://en.wikipedia.org/wiki/Main_Page?`
2. Can the HTTP version used be deduced from the URL?
3. What is the command line that gives the MAC address of your local machine?
4. What is the command line that allows checking if a given server (e.g 183.192.16.5) is listening on port 5780?

## Question 9

Answer the following questions with True or False.

1. Every domain name has an IP address.
2. Every IP address has a domain name.
3. A domain name can have multiple IP addresses.
4. An IP address can have multiple domain names.
5. A DNS zone may consist of one or several domain names
6. A DNS domain and a zone can refer to the same thing.
7. A DNS server is responsible for a DNS zone
8. A DNS server is responsible for a DNS domain
9. A DNS server helps a machine find a route to another machine.
10. The command `ping` measures the RTT between a source machine a destination machine.
11. A web server usually listens to connections on port number 80.

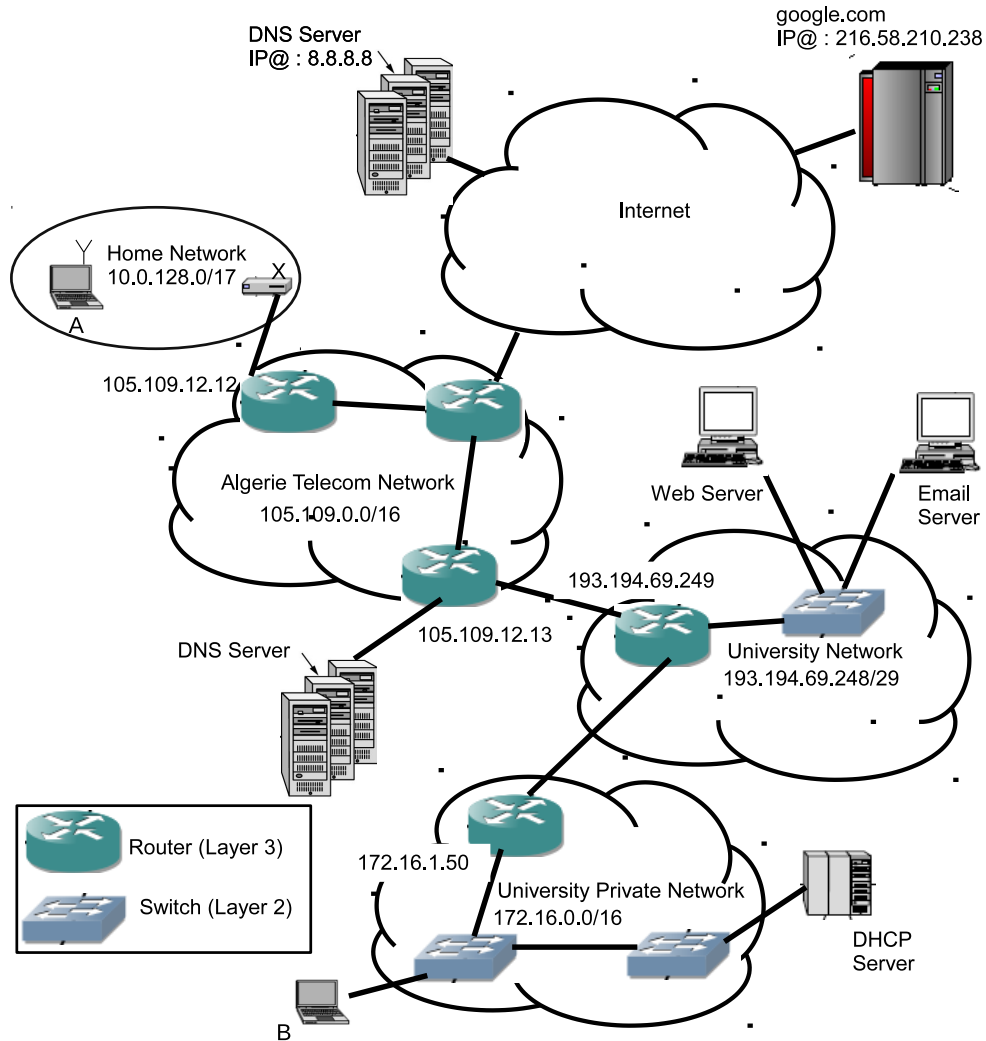
## Question 10

Answer the following questions briefly.

1. What is the command line that allows you to know if `ensia.edu.dz` is running a Mail Server?
2. What is the command line that gives the name of the email server to which the email `contact@ensia.edu.dz` should be sent.
3. What is the main difference between POP3 and SMTP.
4. Describe the DNS spoofing attack and the Denial of Service Attack.
5. Assume that you do not trust your DNS server anymore, will you be able to continue to browse the Internet safely? Which sites continue to be trusted. Explain.

6. Explain why it is important for TCP to estimate the Round Trip Time accurately.
7. What does DHCP provide to hosts connected to the network. (
8. What is the difference between unicast, multicast, and broadcast.

## Question 11



Consider the configuration depicted in the figure above and answer the following questions.

1. Provide an IP configuration for the following hosts: (1) home machine A, (2) home router X, (3) Algeria Telecom DNS server, (4) university machine B, (5) university DHCP server, (6) university Web server, (7) university Email server.
2. How many machines can we connect to University Network? (0.25 mark)
3. Answer the following questions with Yes or No and justify your answer.
  - (a) Machine A can ping Machine B.
  - (b) Machine B can ping Machine A

- (c) Machine A can ping google.com.
- (d) google.com can ping Machine A.
- (e) Machine B can ping DHCP server.
- (f) Machine A can ping Email server.

## Question 12

Answer the following questions with True or False.

1. 0.0.0.0 should always be used as a destination address.
2. A machine that does not know its own address should use 0.0.0.0.
3. IP addresses are not necessarily unique worldwide.
4. 192.168.128.127/25 is a host address.
5. DHCP uses TCP for long message exchange.
6. A communication flow is uniquely identified by the IP address of the source and the IP of the destination, as well as the source and destination port numbers.
7. TCP detects congestion by analyzing the jitter observed between the source and the destination.
8. Congestion can be detected by the source node.
9. The version of UDP run on the routers should be the same as the one run on the terminals.
10. TCP needs to have a good estimate of the round trip time to perform congestion control.
11. Over wireless links, longer round trip delays indicate congestion.
12. DHCP performs address translation from IP to MAC addresses.
13. ARP Requests are broadcast in the local network and outside the local network.
14. It is not possible to have more than one ARP server in the same network.
15. Transmission errors can not be detected by the source node if the transport protocol used is UDP.
16. Congestion can be detected by the destination node.
17. The transmission delay between two hosts only depends on the bandwidth and the distance between them.
18. All hosts in the Internet should run the same variant of TCP.
19. UDP needs to have a good estimate of the jitter to perform congestion control.
20. UDP is only used for realtime streaming applications.

## Question 13

Answer the following questions briefly.

1. Why is it necessary for a router to recalculate the IP checksum of a packet before it forwards it to the next hop?
2. Why is it required that NAT recalculates TCP checksum before packet forwarding to the next hop?

3. Cite two major advantages of NAT.
4. What would happen if all IP addresses of hosts were fixed (same as hardware addresses)?
5. Why does DHCP use UDP but not TCP?
6. What is the purpose of the TTL field in the IP header of packets?
7. What is the difference between the delay and the jitter?
8. Explain why the round trip time would be effective in detecting congestions in wired networks but not as effective in wireless networks.