Introduction to Web Science

Assignment 1

Prof. Dr. Steffen Staab
staab@uni-koblenz.de

René Pickhardt
rpickhardt@uni-koblenz.de

Korok Sengupta
koroksengupta@uni-koblenz.de

Institute of Web Science and Technologies
Department of Computer Science
University of Koblenz-Landau

Submission until: November 2, 2016, 10:00 a.m.
Tutorial on: November 4th, 2016, 12:00 p.m.

The main objective of this assignment is for you to use different tools with which you can understand the network that you are connected to or you are connecting to in a better sense. These tasks are not always specific to "Introduction to Web Science". For all the assignment questions that require you to write a code, make sure to include the code in the answer sheet, along with a separate python file. Where screen shots are required, please add them in the answers directly and not as separate files.

1 Ethernet Frame (5 Points)

Ethernet Frame is of the given structure:

Preamble	Destination MAC address	Source MAC address	Type/Length	User Data	Frame Check Sequence (FCS)
8	6	6	2	46 - 1500	4

Figure 1: Ethernet Frame Structure

Given below is an Ethernet frame without the Preamble and the Frame Check Sequence.

```
00 27 10 21 fa 48 00 13     10 e8 dd 52 08 06 00 01
08 00 06 04 00 01 00 13     10 e8 dd 52 c0 a8 02 01
00 00 00 00 00 00 c0 a8     02 67 00 00 00 00 00 00
00 00 00 00 00 00 00 00     00 00 00 00
```

Find:

1. Source MAC Address

   Answer : Source MAC Address is - `00 13 10 e8 dd 52`

2. Destination MAC Address

   Answer : Destination MAC Address is - `00 27 10 21 fa 48`

3. What protocol is inside the data payload?

   Answer : The protocol inside the data payload is Address Resolution Protocol (ARP)

4. Please mention what the last 2 fields hold in the above frame.

   Answer : The last 2 fields held in the above frame is Target protocol address (TPA)

2 Cable Issue (5 Points)

Let us consider we have two cables of 20 meters each. One of them is in a 100MBps network while the other is in a 10MBps network. If you had to transfer data through each of them, how much time it would take for the first bit to arrive in each setting? (For your calculation you can assume that the speed of light takes the same value as in the videos.) Please provide formulas and calculations along with your results.

Answer:

Assumption : Signal travels at speed of light

1st Case : 100 MBps

Given:
Cable Length = 20 m
Speed of light = 3 ×10^8 m/s

We Know
1 Clock cycle occurs in 1 / 1×10 ^ 8 s
i.e. 10^-8 s

Now,
In 1s : 1 bit travels : 3×10^8 meters
In 10^-8 s : 1 bit travels : 3×10^8 ×10^-8 meters
i.e. 3 meters

Therefore,
For 1 meter it takes 10^-8 / 3 s
For 20 meter it takes (10^-8 / 3)×20 s
Time it takes for the first bit to arrive is 66.667 nano seconds (3 decimal places)

2nd Case : 10 MBps

Given:
Cable Length = 20 m
Speed of light = 3 * 10^8 m/s

We Know
1 Clock cycle occurs in 1 / 1×10^7 s
i.e. 10^-7 s

Now,
In 1s : 1 bit travels : 3×10^8 meters
In 10^-7 s 1 bit travels 3*10^8 * 10^-7 meters
i.e. 30 meters

For 1 meter it takes 10^-7 / 30
For 20 meter it takes (10^-7 / 30)×20
Time it takes for the first bit to arrive is 66.667 nano seconds (3 decimal places)

3 Basic Network Tools (10 Points)

Listed below are some of the commands which you need to ”google” to understand what they stand for:

1. *ipconfig / ifconfig*
2. *ping*
3. *traceroute*
4. *arp*
5. *dig*

Consider a situation in which you need to check if `www.wikipedia.org` is reachable or not. Using the knowledge you gained above to find the following information:

1. The *% packet loss* if at all it happened after sending 100 packets.
2. *Size* of the packet sent to *Wikipedia* server
3. *IP address* of your machine and the *Wikipedia* server
4. *Query Time* for DNS query of the above url.
5. Number of *Hops* in between your machine and the server
6. MAC address of the device that is acting as your network gateway.

Do this once in the university and once in your home/dormitory network. With your answers, you must paste the screen shots to validate your find.

Answer 3.1

Destination : At Home

Result : When 100 packets were sent we received 96 packets and there were 4 lost packets, hence 4% packet loss as shown in Figure 5 screenshot below.

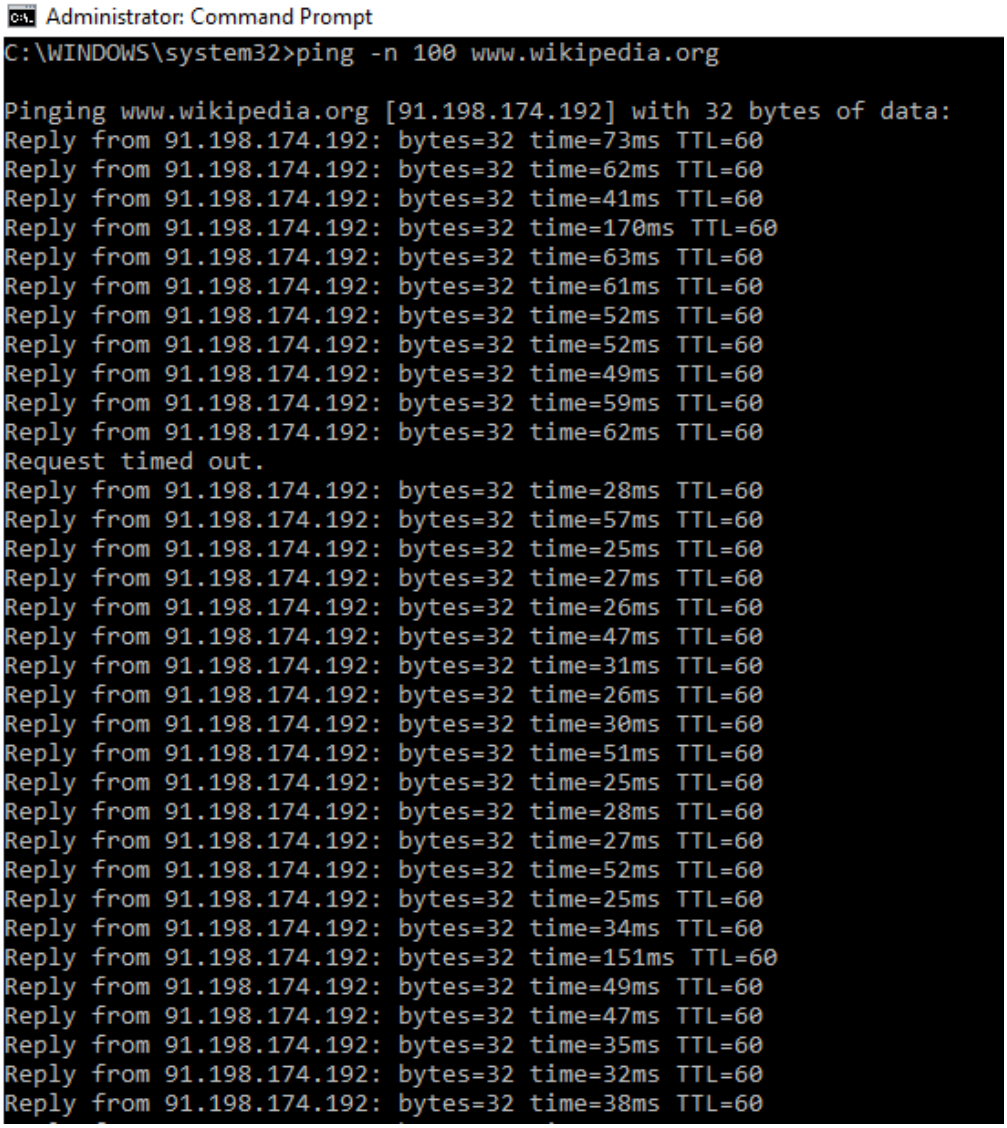

Figure 2: Packet loss percentage - At home Part 1

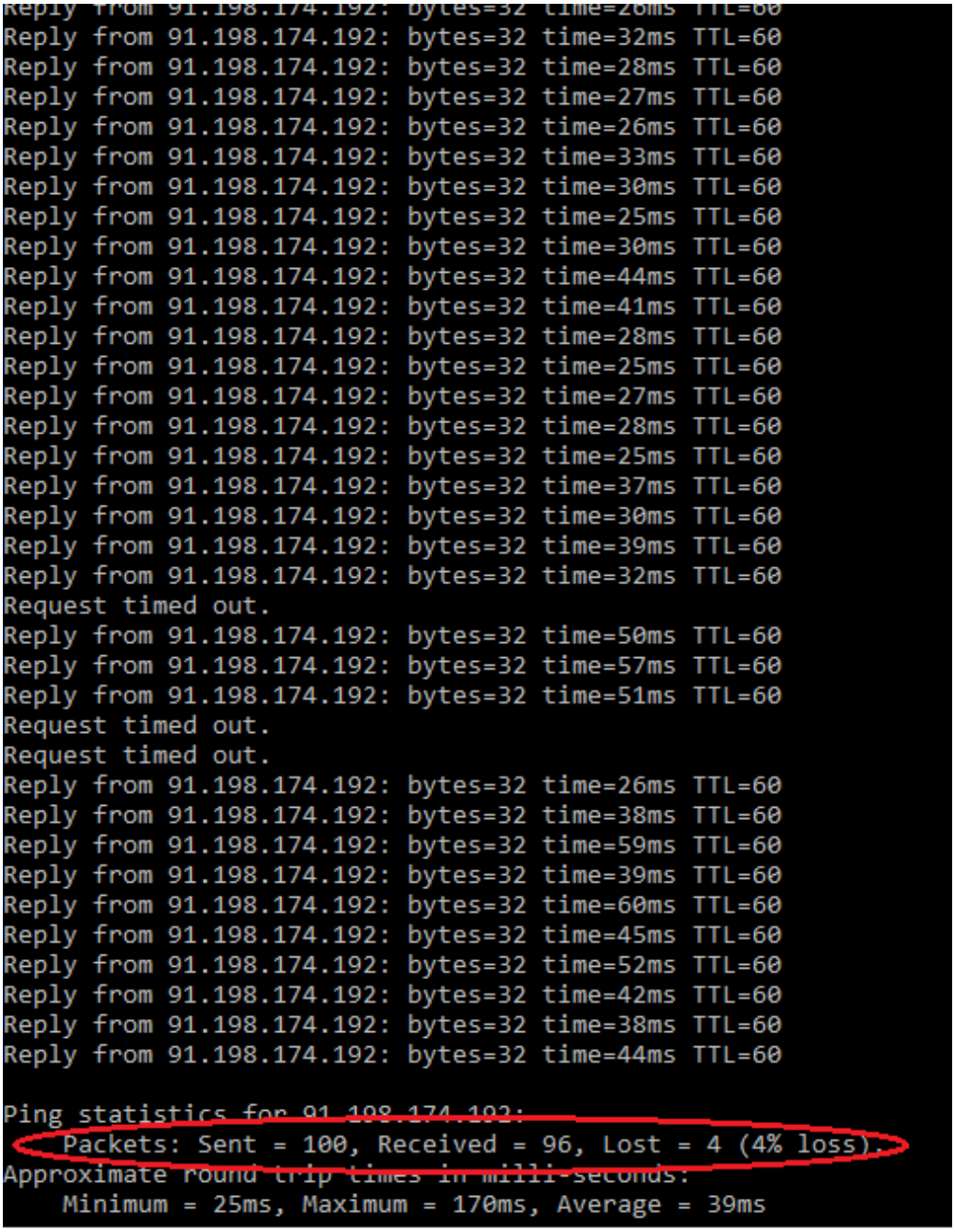

Figure 3: Packet loss percentage - At home Part 2

Destination : At University

Result : When 100 packets were sent we received 99 packets and there was 1 lost packet, hence 1% packet loss as shown in Figure 5 screenshot below.

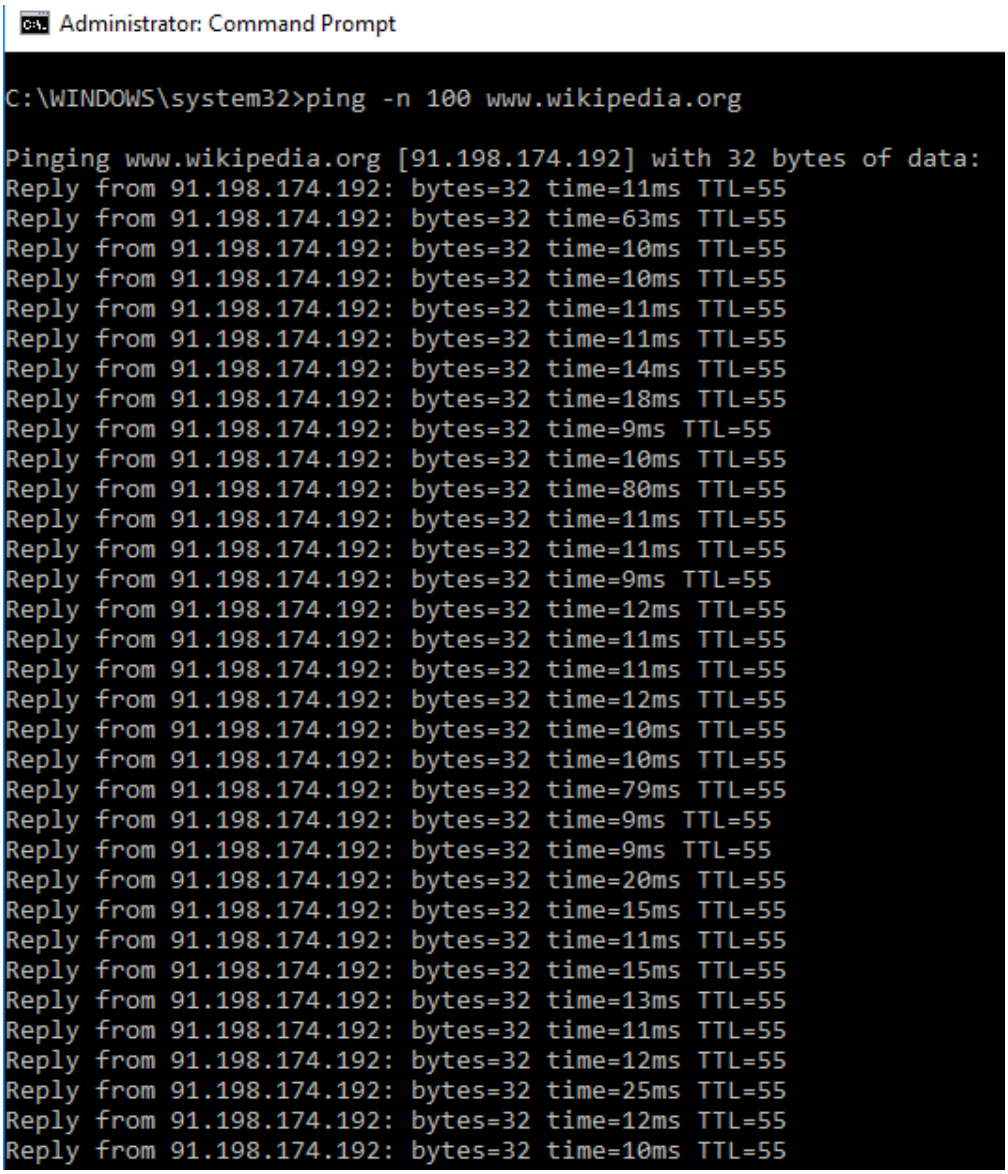

Figure 4: Packet loss percentage - At University Part 1

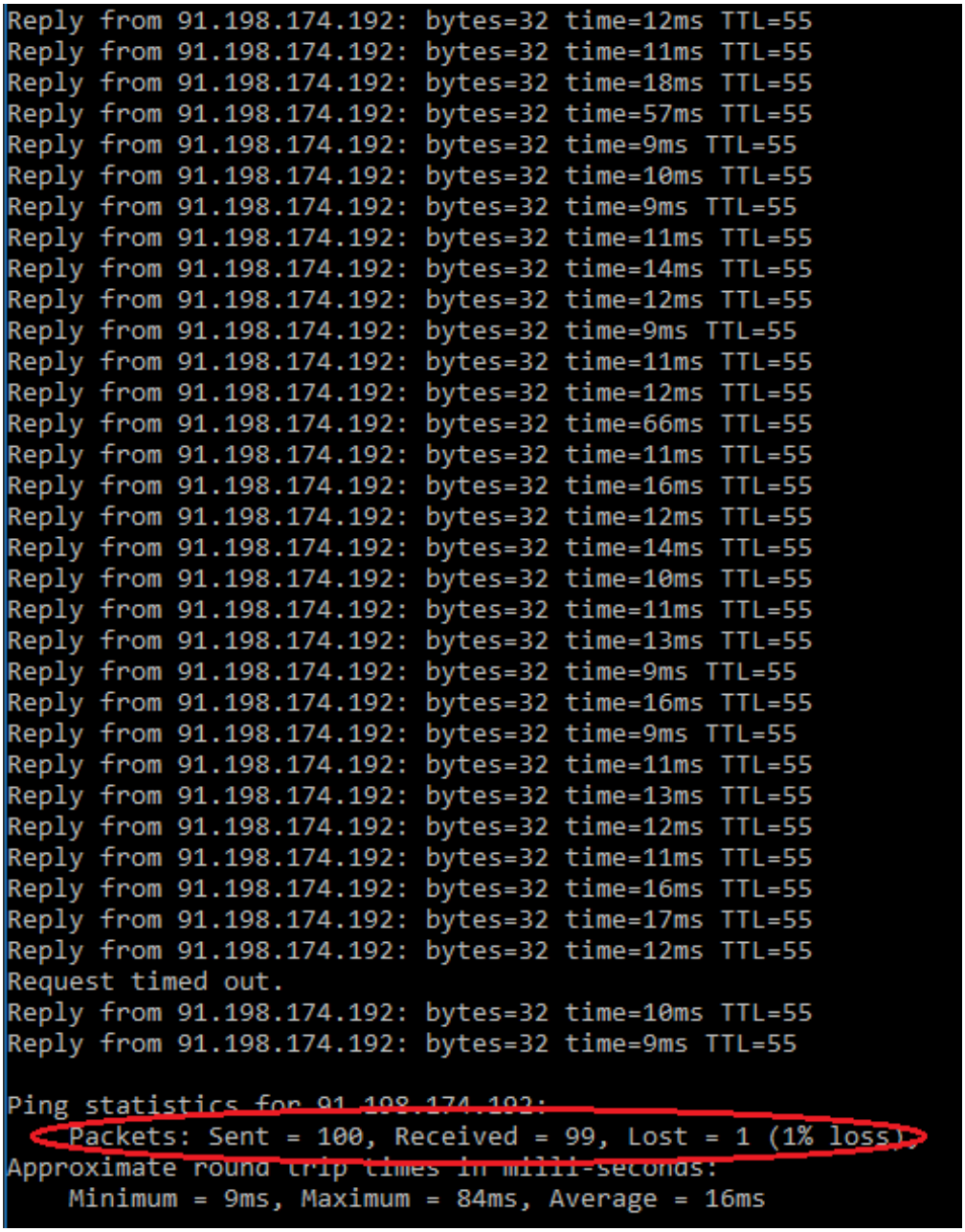

Figure 5: Packet loss percentage - At University Part 2

Answer 3.2

Destination : At Home

The size of the packet sent to Wikipedia server is 32 bytes.

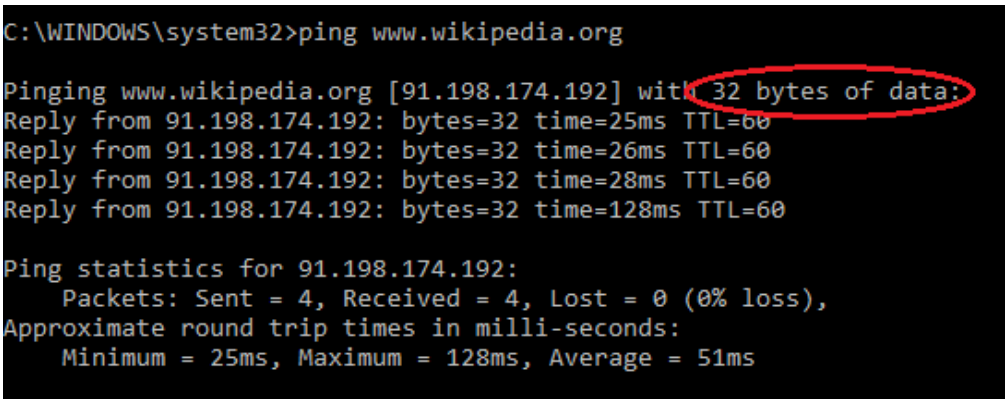

Figure 6: Packet sent to Wikipedia Server

Destination : At University

The size of the packet sent to Wikipedia server is 32 bytes.

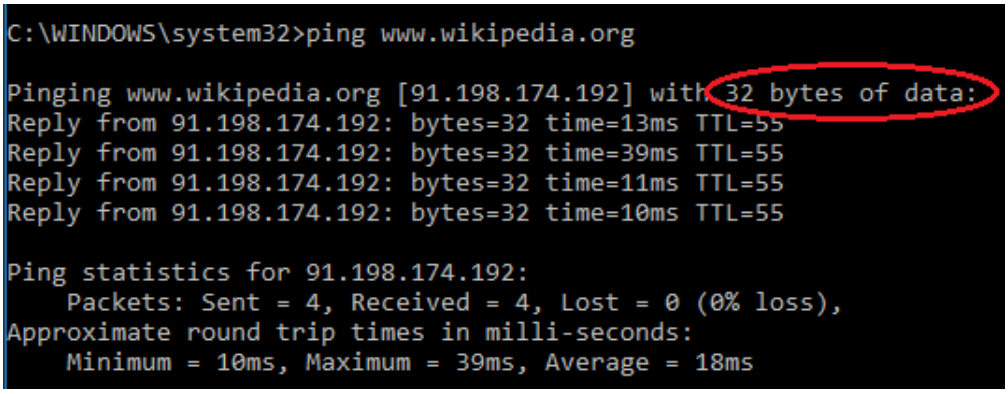

Figure 7: Packet sent to Wikipedia Server

Answer 3.3

Destination : At Home

IP address of the machine : 192.168.2.106

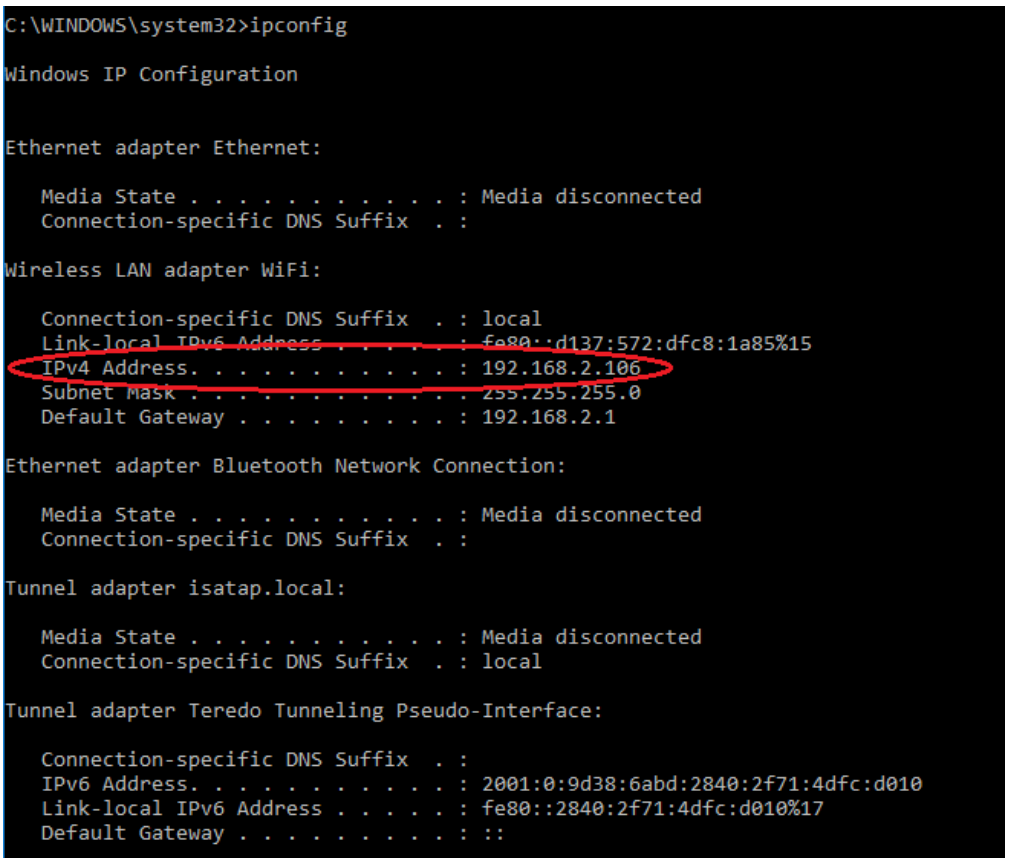

Figure 8: IP address of your machine

IP address of the Wikipedia server : 91.198.174.192

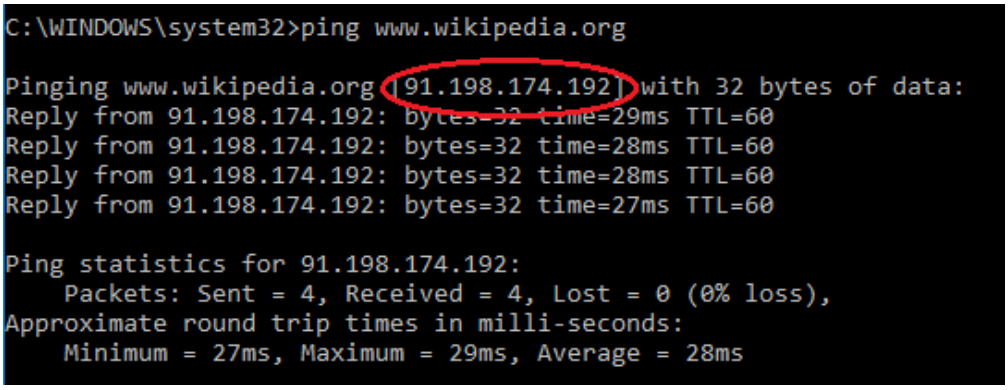

Figure 9: IP address of Wikipedia Server

Destination : At University

IP address of the machine : 141.26.186.78 as shown below in Figure 10

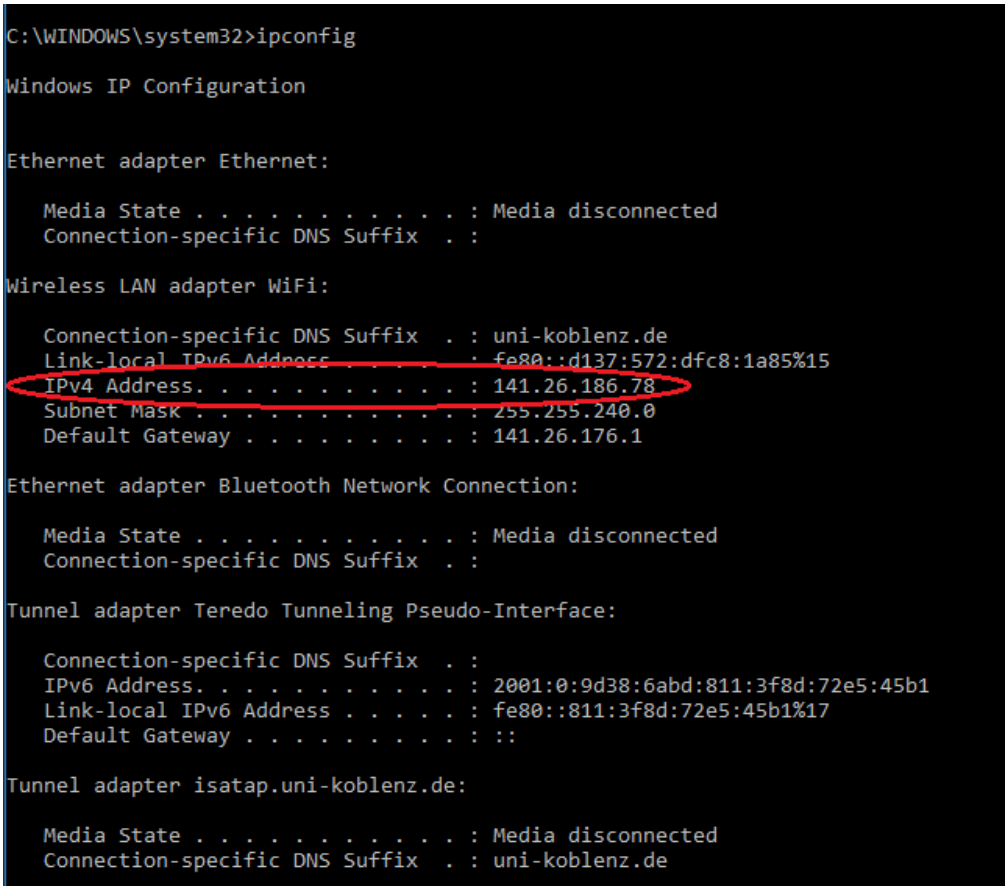

Figure 10: IP address of your machine

IP address of the Wikipedia server : 91.198.174.192

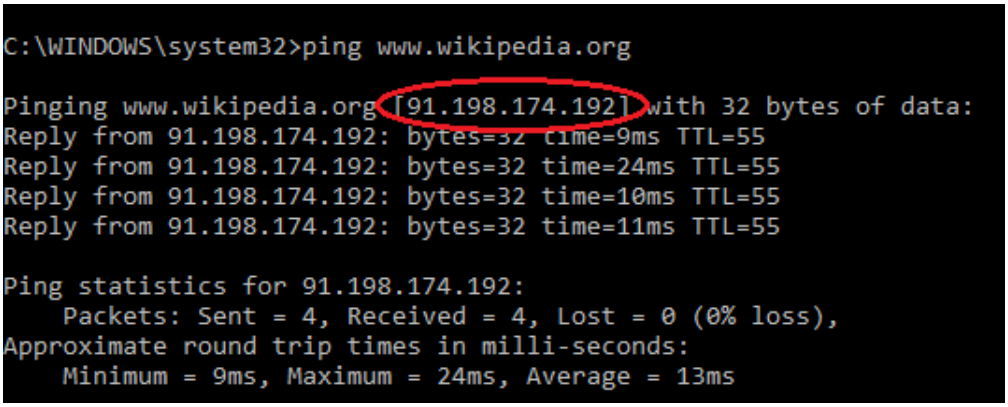

Figure 11: IP address of Wikipedia Server

Answer 3.4

Destination : At Home

Query Time for DNS query for www.wikipedia.org : 210 msec

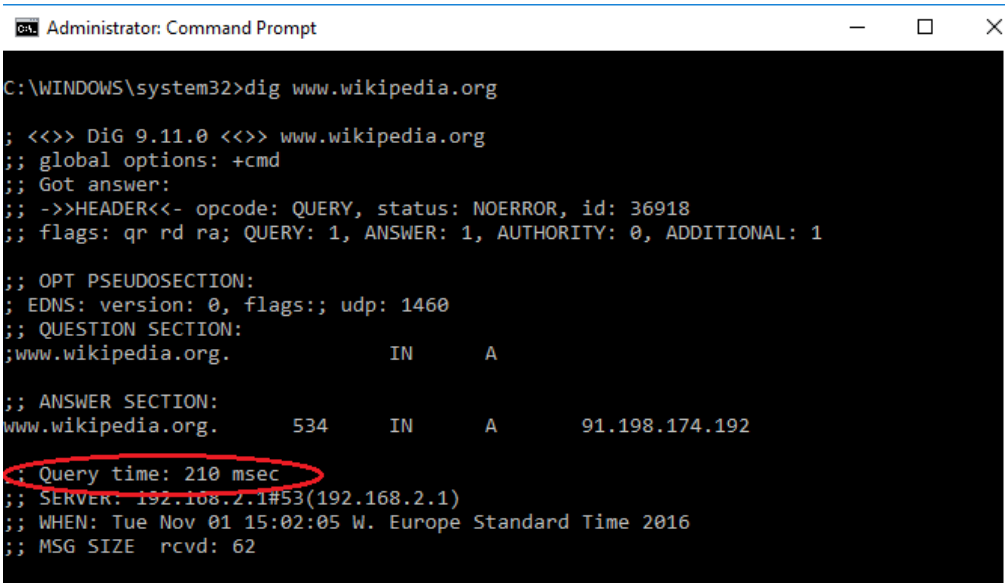

Figure 12: Query Time for DNS query for www.wikipedia.org

Destination : At University

Query Time for DNS query for www.wikipedia.org : 3 msec

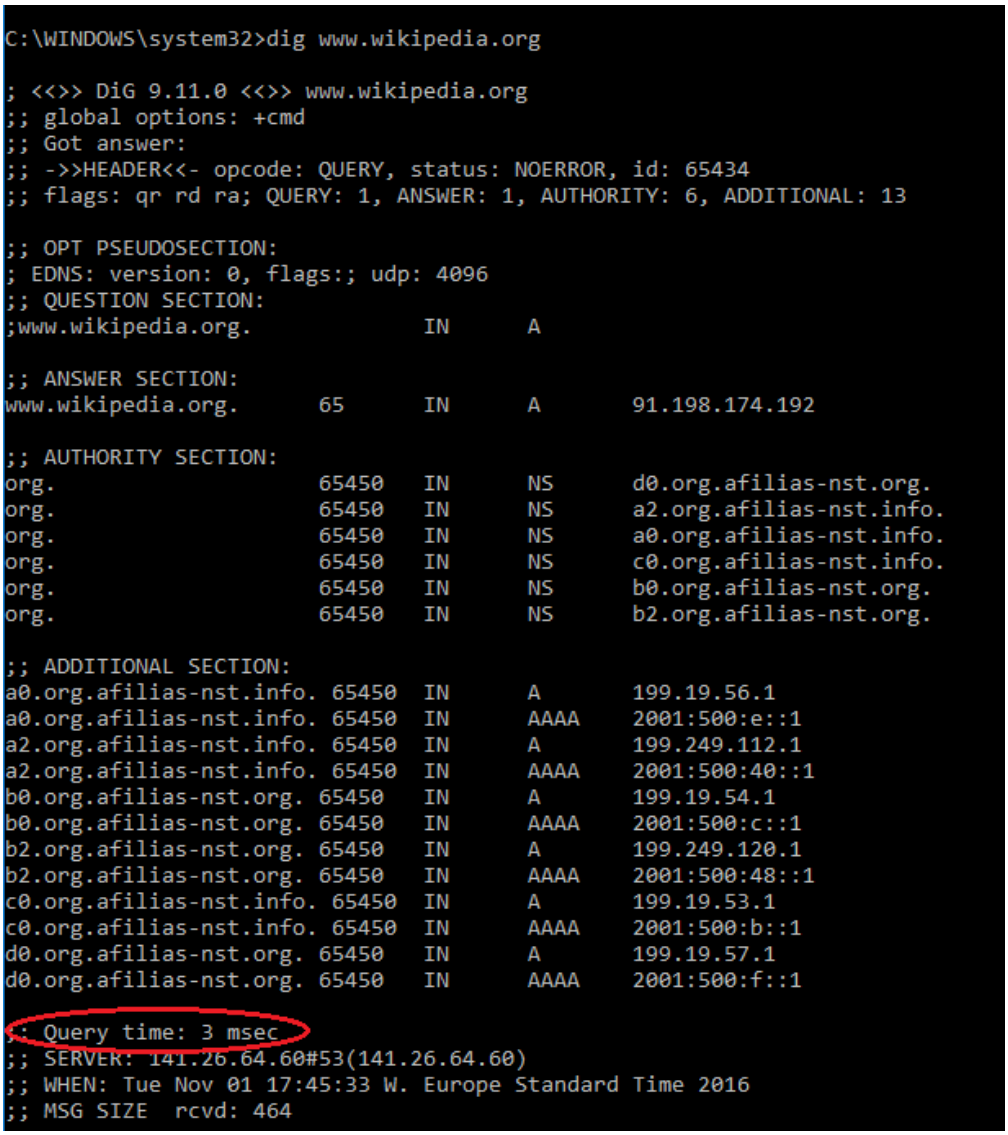

Figure 13: Query Time for DNS query for www.wikipedia.org

Answer 3.5

Destination : At Home

Number of Hops in between our machine and the server is : 8

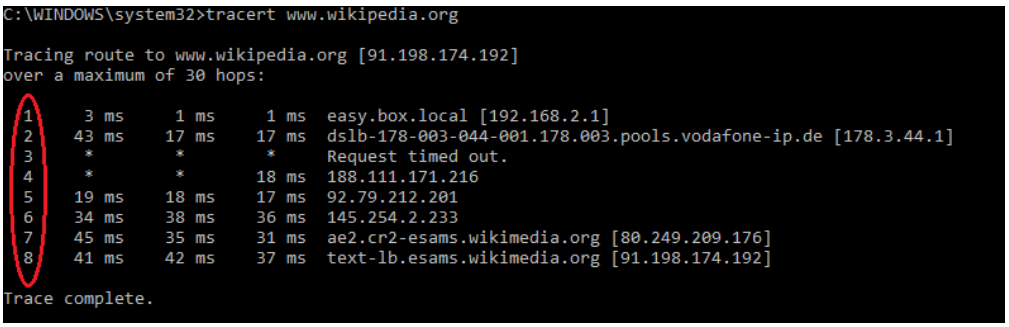

Figure 14: Number of Hops in between our machine and the server

Destination : At University

Number of Hops in between our machine and the server is : 11

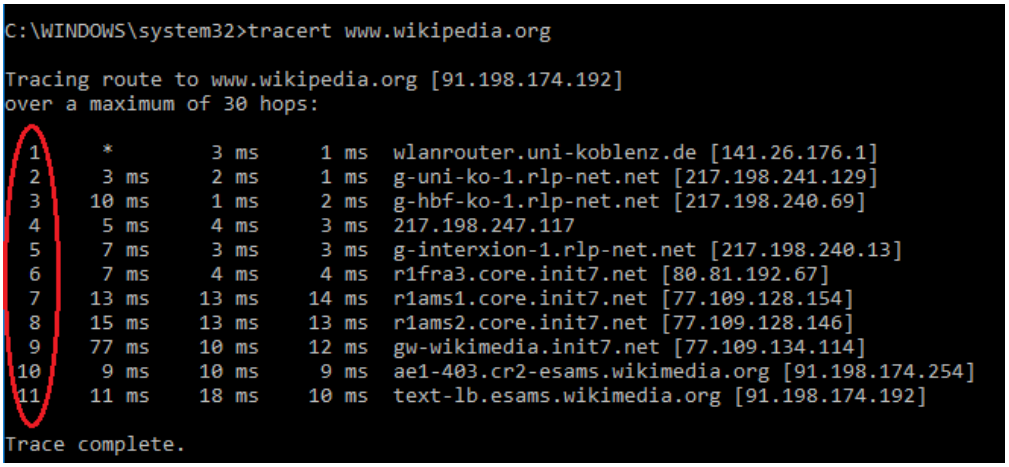

Figure 15: Number of Hops in between our machine and the server

Answer 3.6

Destination : At Home

Firstly the network gateway was obtained by using the command *ipconfig /all* which was 192.168.2.1 as shown in the screenshot below - Figure 16.

Thus with the command *arp -a* we were able to associate the default gateway - 192.168.2.1 to the MAC address of the device which was b4-a5-ef-2d-0d-40

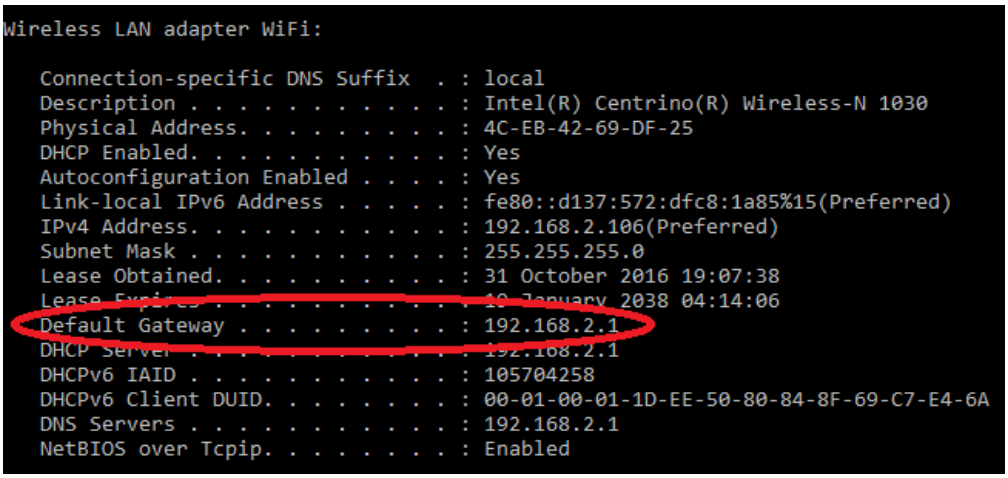

Figure 16: Default Gateway

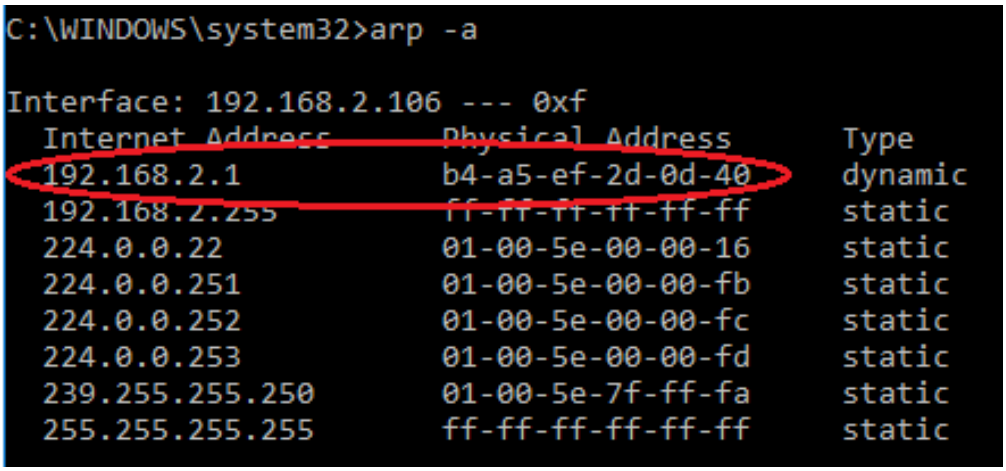

Figure 17: MAC Address of the device

Destination : At University

Similarly, the network gateway was obtained by using the command *ipconfig /all* which was 141.26.176.1 as shown in the screenshot below - Figure 18.

Thus with the command *arp -a* we were able to associate the default gateway - 141.26.186.78 to the MAC address of the device which was 14-18-77-45-b1-bd

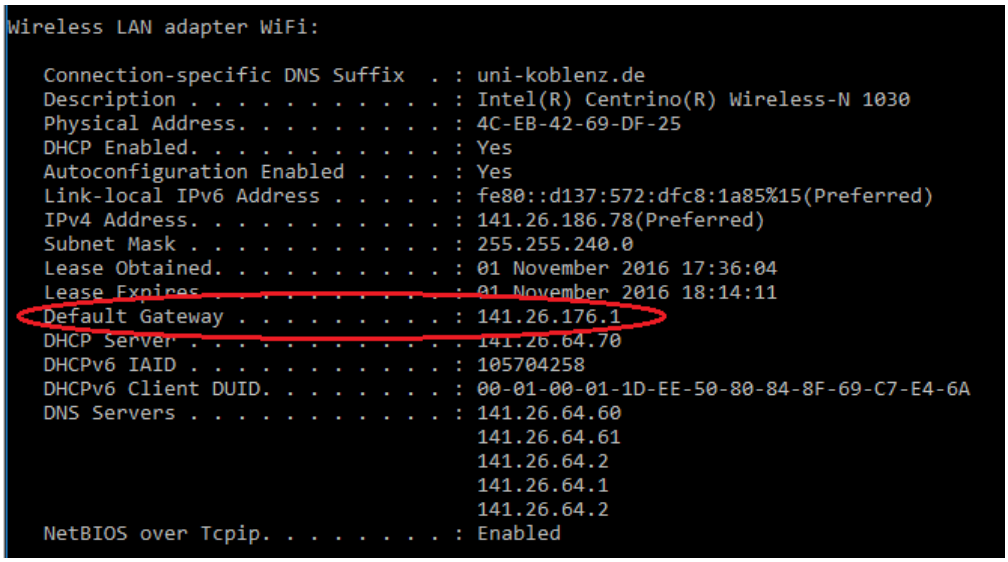

Figure 18: Default Gateway

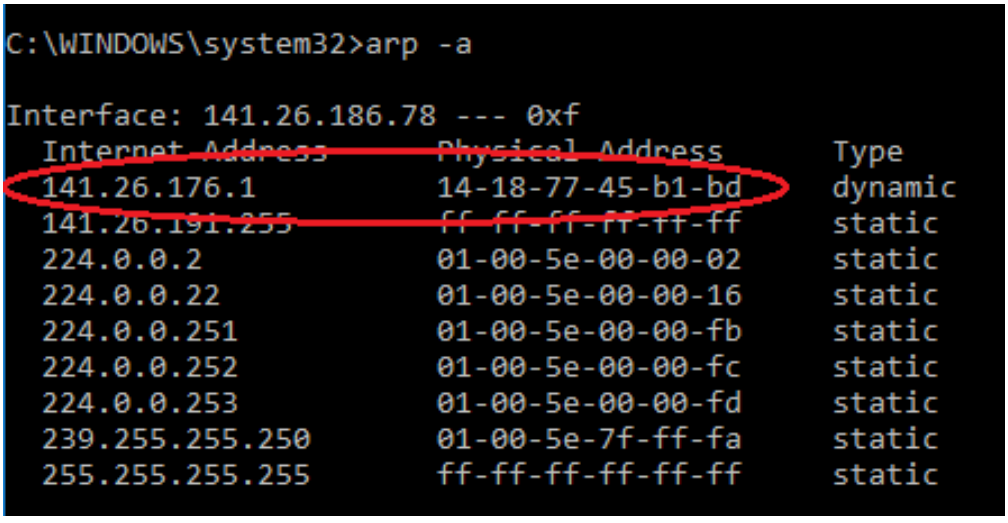

Figure 19: MAC Address of the device

4 Simple Python Programming (10 Points)

Write a simple python program that does the following:

1. Generate a random number sequence of 10 values between 0 to 90.
2. Perform `sine` and `cosine` operation on numbers generated.
3. Store the values in two different arrays named SIN & COSIN respectively.
4. Plot the values of SIN & COSIN in two different colors.
5. The plot should have labeled axes and legend.

Answer 4.1

```
1 #10 random number between 0 to 90
2 from random import randint
3 x = [randint(1,89) for p in range (0,10)]
4 print(x)
```

Answer 4.2

```
6 #performing sine and cosine on above generated random numbers
7 import numpy as np
8 print(np.cos(x))
9 print(np.sin(x))
```

Answer 4.3

```
11 #storing values of sine and cosine value on variable SIN and COSIN
12 import numpy as np
13 SIN = np.sin(x)
14 COSIN = np.cos(x)
```

Answer 4.4 and 4.5

```
#plotting value of SIN and COSIN in two different colors
from random import randint
import numpy as np
import matplotlib.pyplot as plt
x = [randint(0,90) for p in range (0,10)]
SIN = np.sin(x)
COSIN = np.cos(x)

plt.plot(SIN, color = "red", label = 'Sine')
plt.plot(COSIN, color = "black", label = 'Cosine')
plt.xlabel("Random number Index")
plt.ylabel("Values")
plt.legend(loc=(0,-0.4), ncol = 2)
plt.show()
```

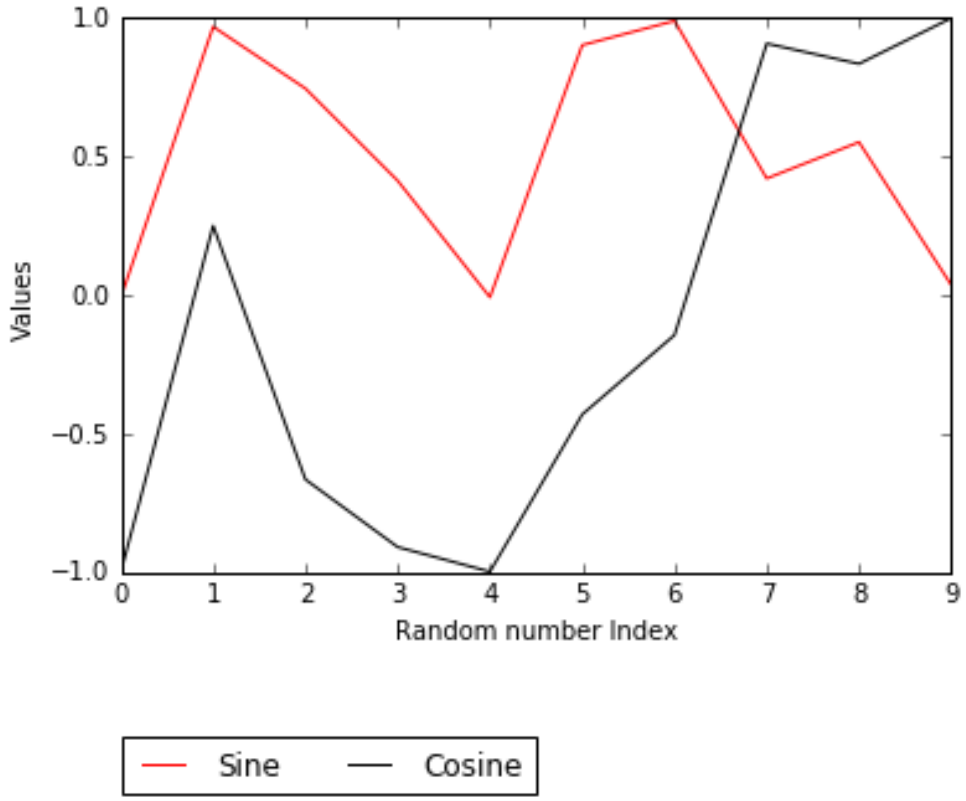

Figure 20: Plot for values of SIN and COSIN

Important Notes

Submission

- Solutions have to be checked into the github repository. Use the directory name `groupname/assignment1/` in your group's repository.
- The name of the group and the names of all participating students must be listed on each submission.
- Solution format: all solutions as *one* PDF document. Programming code has to be submitted as Python code to the github repository. Upload *all* `.py` files of your program! Use `UTF-8` as the file encoding. *Other encodings will not be taken into account!*
- Check that your code compiles without errors.
- Make sure your code is formatted to be easy to read.
  - Make sure you code has consistent indentation.
  - Make sure you comment and document your code adequately in English.
  - Choose consistent and intuitive names for your identifiers.
- Do *not* use any accents, spaces or special characters in your filenames.

Acknowledgment

This latex template was created by Lukas Schmelzeisen for the tutorials of "Web Information Retrieval".