Introduction to Web Science

Assignment 1

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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
```

Find:

1. Source MAC Address
2. Destination MAC Address
3. What protocol is inside the data payload?
4. Please mention what the last 2 fields hold in the above frame.

Answers:

1. Source Mac Address: 00 13 10 e8 dd 52
2. Destination Max Address: 00 27 10 21 fa 48
3. Protocol: 08 06 Address Resolution Protocol (ARP)
4. Last 2 fields hold: c0 a8 And 02 67 which is the Target Hardware Address(THA) And Target Protocol Address (TPA) respectively

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 calculatoins along with your results.

Answer:

- For the 100MBps Network Card it means that

  100,000,000 bits –> 1 sec
  so
  1 bit –> 10 nanosec

  And speed of light
  300,000,000 m –> 1 sec
  so
  3 m –> 10 nanosec
  Then
  20 m –> ?? nanosec
  ?? nanosec = (20 m * 10 nanosec)/3 m = $(20 * 10^{-}8)/3 \approx 66.6666667$ nanosec

- For the 10MBps Network Card it means that

  10,000,000 bits –> 1 sec
  so
  1 bit –> 100 nanosec
  And speed of light
  300,000,000 m –> 1 sec
  so
  30 m –> 100 nanosec
  Then
  20 m –> ?? nanosec
  ?? nanosec = (20 m * 100 nanosec)/30 m = $(20 * 10^{-}7)/30 \approx 66.6666667$ nanosec

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.

Answers For Dorm Network:

1. The *% packet loss* is *0%* as Shown in Fig.3
2. The packet size as shown in Fig.2 is 32 bytes.
3. a) Machine IP Address is ”172.16.5.47” as shown in Fig.4
   b) Wikipedia server IP Address is ”91.198.174.192” as shown in Fig.2
4. Query Time for DNS query is: 193 msec as shown in Fig.5
5. Number of Hops are: 12 as shown in Fig.6
6. MAC address for network gate way is: 04-18-d6-83-a9-83 as shown in Fig.7 and its the one in front of the Default Gateway IP Which is known from Fig.4

Answers For University Network:

1. The *% packet loss* is *0%* as Shown in Fig.9

2. The packet size as shown in Fig.8 is 32 bytes.
3. a) Machine IP Address is ”141.26.178.188” as shown in Fig.10

   b) Wikipedia server IP Address is ”91.198.174.192” as shown in Fig.8
4. Query Time for DNS query is: 1 msec as shown in Fig.11
5. Number of Hops are: 11 as shown in Fig.12
6. MAC address for network gate way is: 14-18-77-45-b1-bd as shown in Fig.13 and its the one in front of the Default Gateway IP Which is known from Fig.10

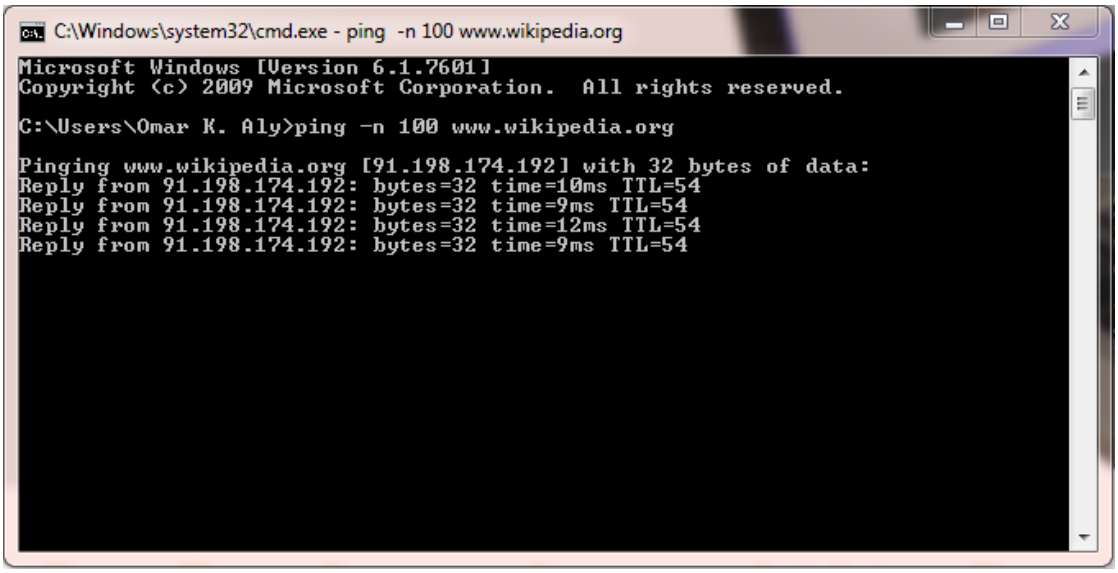

Figure 2: Ping Wikipedia with 100 Packets

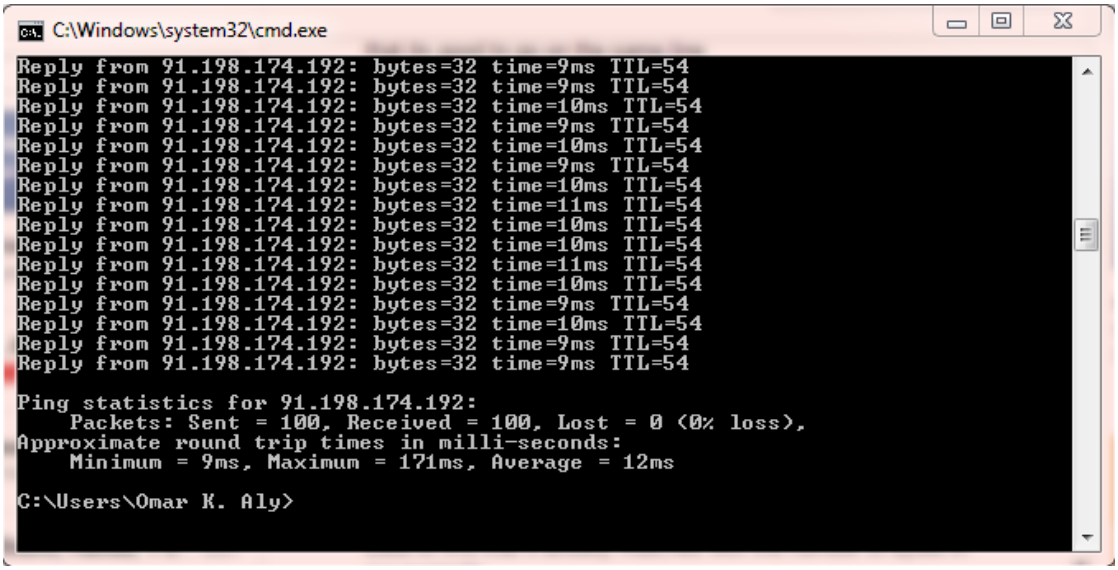

Figure 3: Ping Wikipedia with 100 Packets Result

```
Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::9cae:e873:313c:61fb%11
   IPv4 Address. . . . . . . . . . . : 172.16.5.47
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 172.16.1.1
```

Figure 4: ipconfig command

```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Omar K. Aly>dig www.wikiepedia.org

; <<>> DiG 9.11.0 <<>> www.wikiepedia.org
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 52757
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 6, ADDITIONAL: 13

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.wikiepedia.org.            IN      A

;; ANSWER SECTION:
www.wikiepedia.org.     3599    IN      A       103.224.182.239

;; AUTHORITY SECTION:
org.                    147735  IN      NS      c0.org.afilias-nst.info.
org.                    147735  IN      NS      a0.org.afilias-nst.info.
org.                    147735  IN      NS      b2.org.afilias-nst.org.
org.                    147735  IN      NS      d0.org.afilias-nst.org.
org.                    147735  IN      NS      a2.org.afilias-nst.info.
org.                    147735  IN      NS      b0.org.afilias-nst.org.

;; ADDITIONAL SECTION:
a0.org.afilias-nst.info. 147735 IN      A       199.19.56.1
a0.org.afilias-nst.info. 147735 IN      AAAA    2001:500:e::1
a2.org.afilias-nst.info. 147735 IN      A       199.249.112.1
a2.org.afilias-nst.info. 147735 IN      AAAA    2001:500:40::1
b0.org.afilias-nst.org. 147735  IN      A       199.19.54.1
b0.org.afilias-nst.org. 147735  IN      AAAA    2001:500:c::1
b2.org.afilias-nst.org. 147735  IN      A       199.249.120.1
b2.org.afilias-nst.org. 147735  IN      AAAA    2001:500:48::1
c0.org.afilias-nst.info. 147735 IN      A       199.19.53.1
c0.org.afilias-nst.info. 147735 IN      AAAA    2001:500:b::1
d0.org.afilias-nst.org. 147735  IN      A       199.19.57.1
d0.org.afilias-nst.org. 147735  IN      AAAA    2001:500:f::1

;; Query time: 193 msec
;; SERVER: 172.16.5.63#53(172.16.5.63)
;; WHEN: Mon Oct 31 18:54:28 W. Europe Standard Time 2016
;; MSG SIZE  rcvd: 465
```

Figure 5: Query Time For DNS query

Figure 6: Number Of Hops

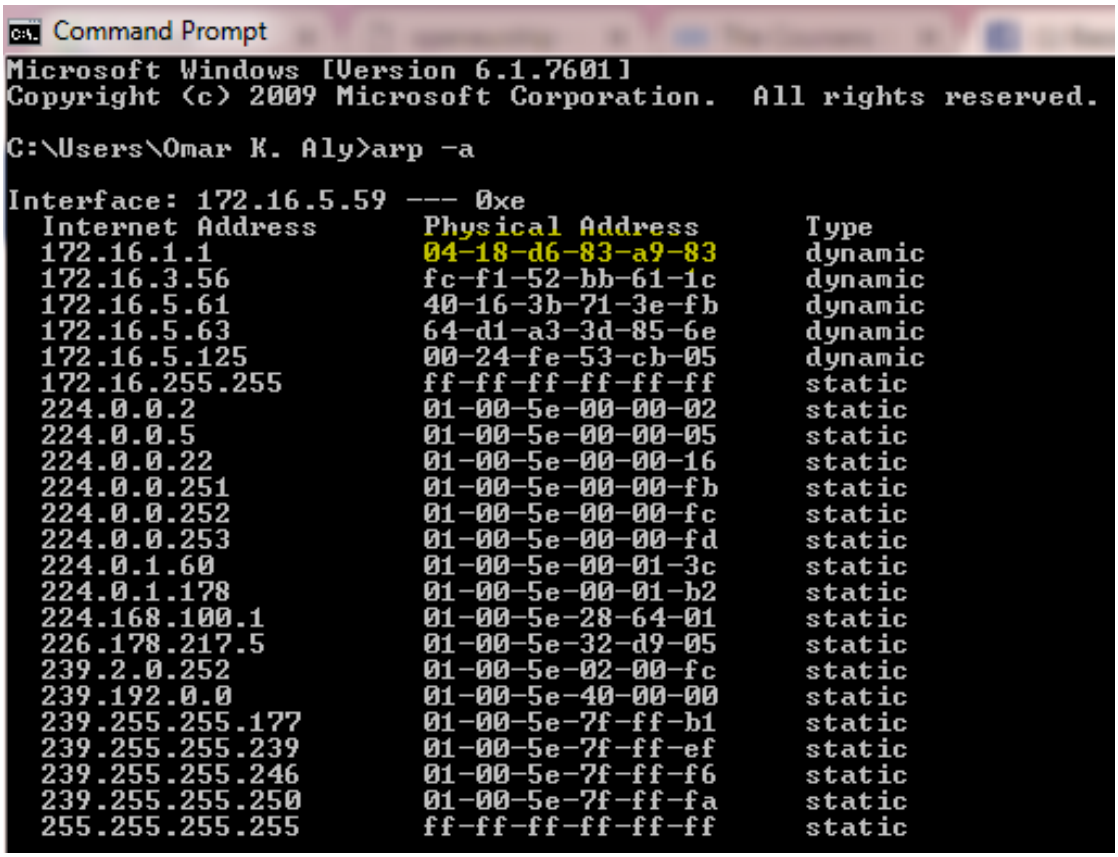

Figure 7: Gateway MAC

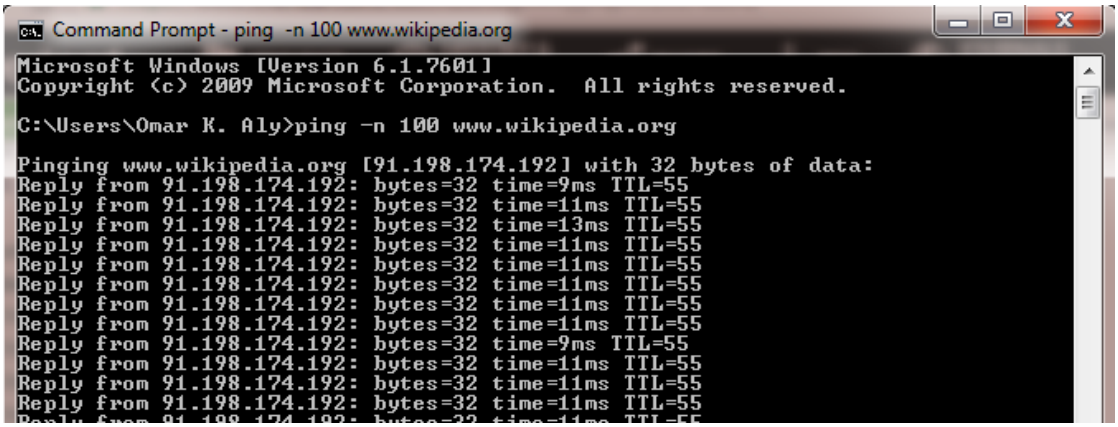

Figure 8: Ping Wikipedia with 100 Packets Uni

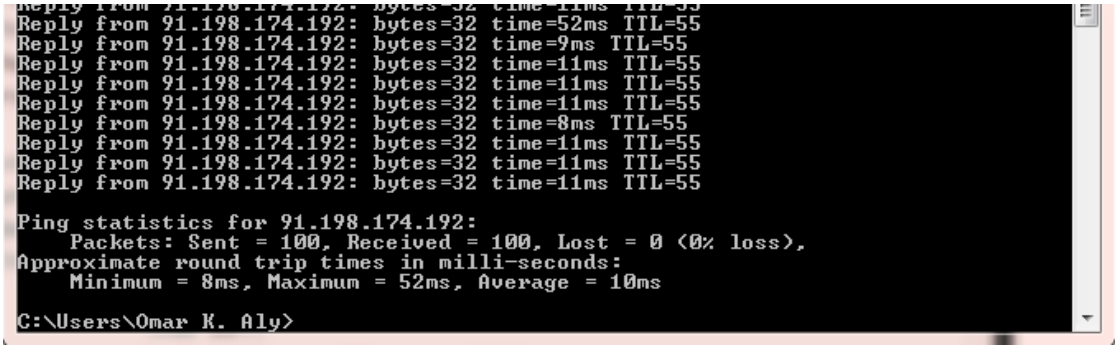

Figure 9: Ping Wikipedia with 100 Packets Result Uni

```
Wireless LAN adapter Wireless Network Connection:

   Connection-specific DNS Suffix  . : uni-koblenz.de
   Link-local IPv6 Address . . . . . : fe80::45f9:df7a:1fc4:61cf%14
   IPv4 Address. . . . . . . . . . . : 141.26.178.188
   Subnet Mask . . . . . . . . . . . : 255.255.240.0
   Default Gateway . . . . . . . . . : 141.26.176.1
```

Figure 10: ipconfig command Uni

```
Command Prompt
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Omar K. Aly>dig www.wikipedia.org

; <<>> DiG 9.11.0 <<>> www.wikipedia.org
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6880
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 6, ADDITIONAL: 13

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.wikipedia.org.             IN      A

;; ANSWER SECTION:
www.wikipedia.org.      143     IN      A       91.198.174.192

;; AUTHORITY SECTION:
org.                    138792  IN      NS      a2.org.afilias-nst.info.
org.                    138792  IN      NS      b0.org.afilias-nst.org.
org.                    138792  IN      NS      d0.org.afilias-nst.org.
org.                    138792  IN      NS      b2.org.afilias-nst.org.
org.                    138792  IN      NS      a0.org.afilias-nst.info.
org.                    138792  IN      NS      c0.org.afilias-nst.info.

;; ADDITIONAL SECTION:
a0.org.afilias-nst.info. 138792 IN      A       199.19.56.1
a0.org.afilias-nst.info. 138792 IN      AAAA    2001:500:e::1
a2.org.afilias-nst.info. 138792 IN      A       199.249.112.1
a2.org.afilias-nst.info. 138792 IN      AAAA    2001:500:40::1
b0.org.afilias-nst.org. 138792  IN      A       199.19.54.1
b0.org.afilias-nst.org. 138792  IN      AAAA    2001:500:c::1
b2.org.afilias-nst.org. 138792  IN      A       199.249.120.1
b2.org.afilias-nst.org. 138792  IN      AAAA    2001:500:48::1
c0.org.afilias-nst.info. 138792 IN      A       199.19.53.1
c0.org.afilias-nst.info. 138792 IN      AAAA    2001:500:b::1
d0.org.afilias-nst.org. 138792  IN      A       199.19.57.1
d0.org.afilias-nst.org. 138792  IN      AAAA    2001:500:f::1

;; Query time: 1 msec
;; SERVER: 141.26.64.60#53(141.26.64.60)
;; WHEN: Mon Oct 31 21:23:31 W. Europe Standard Time 2016
;; MSG SIZE  rcvd: 464
```

Figure 11: Query Time For DNS query Uni

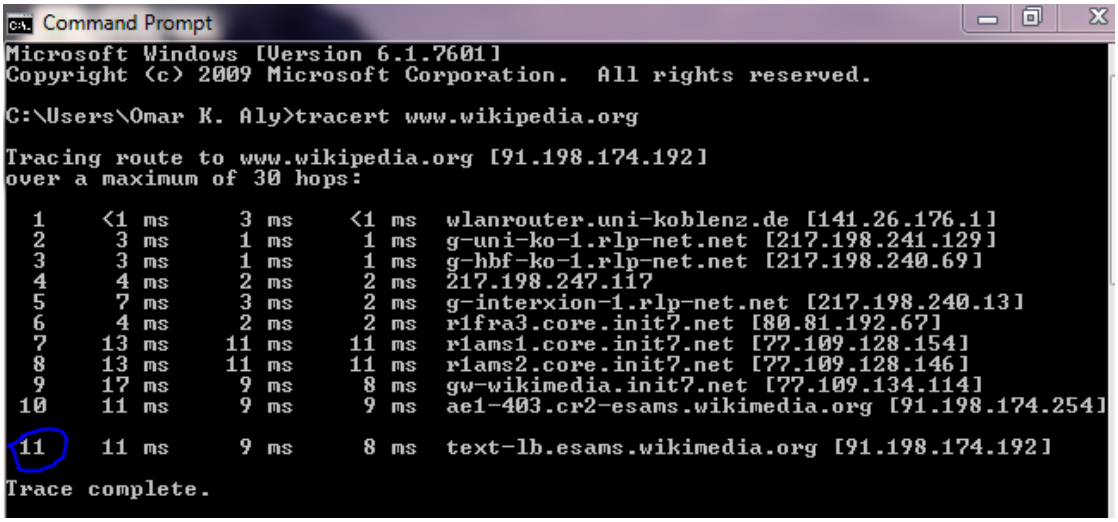

Figure 12: Number Of Hops Uni

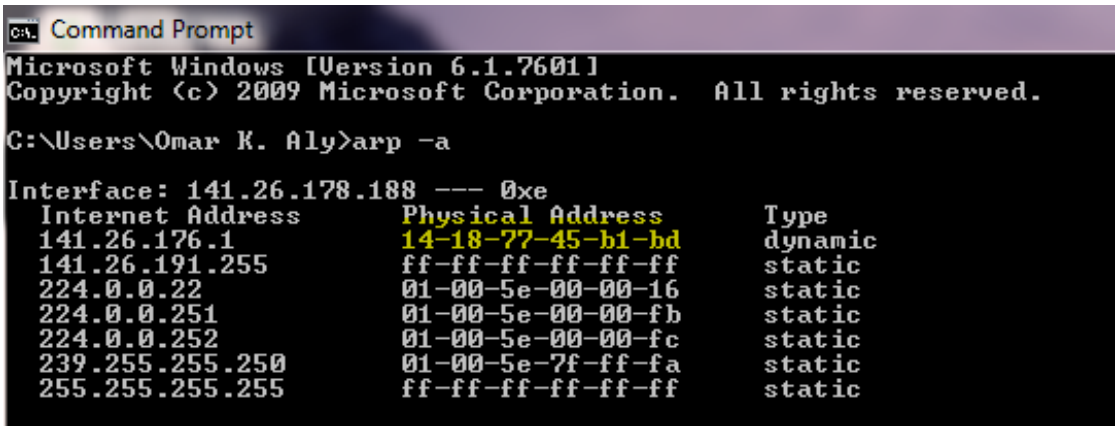

Figure 13: Gateway MAC Uni

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:

```
1: # -*- coding: utf-8 -*-
2: """
3: Spyder Editor
4:
5: This is a temporary script file.
6: """
7: import random
8: import math
9: import matplotlib.pyplot as plt
10:
11: #1
12: #first we generate 10 random numbers between 0 and 90
13: randNumbers = random.sample(range(0, 90), 10)
14:
15: #2
16: #then we print the sin and cos for each number
17: for i in randNumbers:
18:     print (math.sin(i))
19:     print (math.cos(i))
20:
21: #3
22: #we create empty lists to append sin and cos values to them
23: #and we use for loop to do so
24: #then we pring the two lists
25: SIN = []
26: COSIN = []
27:
28: for i in randNumbers:
29:     SIN.append(math.sin(i))
30:     COSIN.append(math.cos(i))
31:
32: print(SIN)
33: print(COSIN)
34:
```

```
35: #4
36: #we plot results on scatter plot random numbers as x-axis
37: #and sin/cos values as y-axis with blue and green colors respectively
38: plt.scatter(randNumbers,SIN,  color="blue")
39: plt.scatter(randNumbers,COSIN, color="green")
40:
41: #5
42: #we then label each axis and draw our legend
43: plt.xlabel('Random Generated Numbers')
44: plt.ylabel('SIN / COS Values')
45: plt.legend(["SIN", "COS"])
```

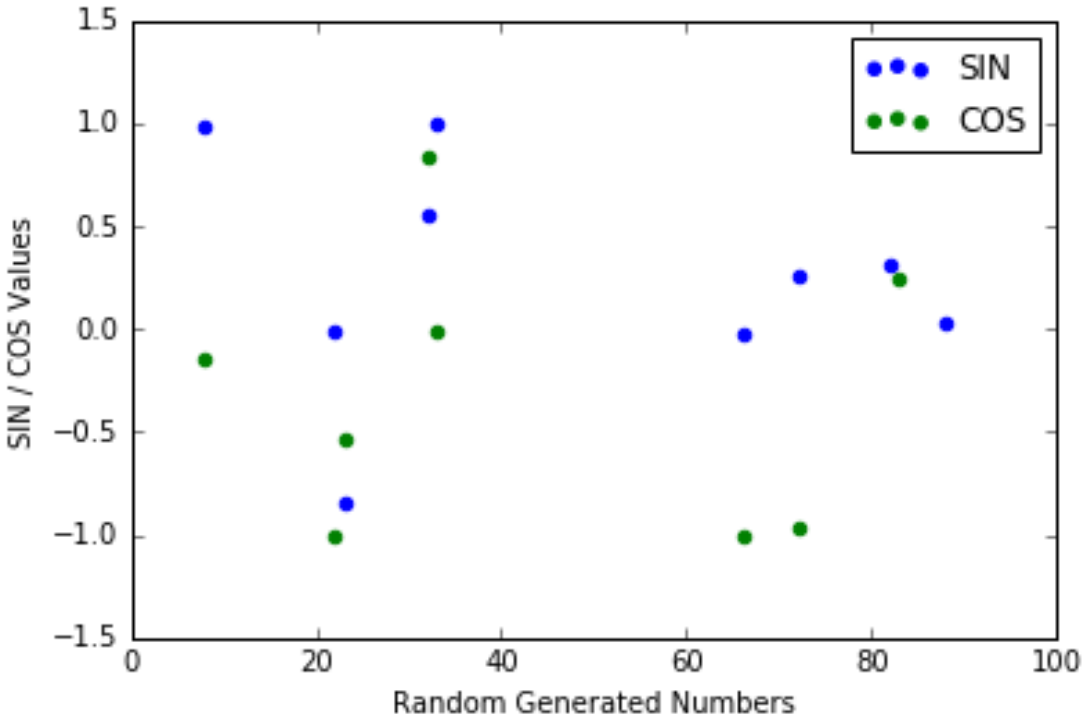

Figure 14: SIN And COS values Plot for Generated Random Numbers

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".