MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY

DEPARTMENT OF ICT

Lab Report No : 06

Course Code	: ICT-3208
Course Title	: Network Planning and Designing Lab
Lab Report name	: Programming with Python

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Session : 2016-2017
Year : 3rd Semester : 2nd

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Date of Submission : 13 September 2020

Programming with Python

Objectives:

- Understand how python function works
- Understand the use of global and local variables
- Understand how python modules works
- Learning the basis of networking programing with python

1.What is Local variable and Global variable ?

Ans: Local variable : Variables declared inside a function definition are not related in any way to other variables with the same names used outside the function (variable names are local to the function). This is called the scope of the variable. All variables have the scope of the block they are declared in starting from the point of definition of the name.

Global variable : Variables defined at the top level of the program are intended global. Global variables are intended to be used in any functions or classes). Global statement allows defining global variables inside functions as well.

2.Describe networking backgrounds for sockets?

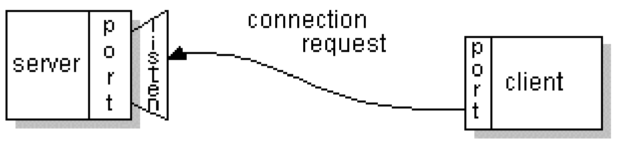
Ans: A socket is one endpoint of a two-way communication link between two programs running on the network or PC. A socket is bound to a port number so that the TCP layer can identify the application that data is destined to be sent to.

Endpoint: An endpoint is a combination of an IP address and a port number.

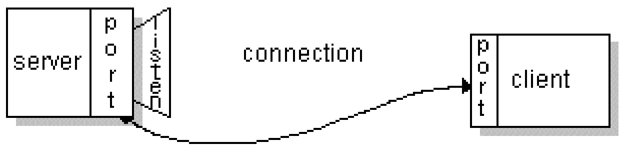
Server and Client: Normally, a server runs on a specific computer and has a socket that is bound to a specific port number.

- On the server-side: The server just waits, listening to the socket for a client to make a connection request.
- On the client-side: The client knows the hostname of the machine on which the server is running and the port number on which the server is listening. To make a connection request, the client tries to rendezvous with the server on the server's machine and port. The client also needs

to identify itself to the server so it binds to a local port number that it will use during this connection. This is usually assigned by the system.



If everything goes well, the server accepts the connection. Upon acceptance, the server gets a new socket bound to the same local port and also has its remote endpoint set to the address and port of the client. It needs a new socket so that it can continue to listen to the original socket for connection requests while tending to the needs of the connected client.



On the client side, if the connection is accepted, a socket is successfully created and the client can use the socket to communicate with the server. The client and server can now communicate by writing to or reading from their sockets.

3.Define TCP and UDP ?

<u>TCP :</u> TCP stands for transmission control protocol. It is implemented in the transport layer of the IP/TCP model and is used to establish reliable connections. TCP is one of the protocols that encapsulate data into packets. It then transfers these to the remote end of the connection using the methods available on the lower layers. On the other end, it can check for errors, request certain pieces to be resent, and reassemble the information into one logical piece to send to the application layer.

The protocol builds up a connection prior to data transfer using a system called a three-way handshake. This is a way for the two ends of the communication to acknowledge the request and agree upon a method of ensuring data reliability. After the data has been sent, the connection is torn down using a similar four-way handshake.

TCP is the protocol of choice for many of the most popular uses for the internet, including WWW, FTP, SSH, and email. It is safe to say that the internet we know today would not be here without TCP.

UDP : UDP stands for user datagram protocol. It is a popular companion protocol to TCP and is also implemented in the transport layer.

The fundamental difference between UDP and TCP is that UDP offers unreliable data transfer. It does not verify that data has been received on the other end of the connection. This might sound like a bad thing, and for many purposes, it is. However, it is also extremely important for some functions.

Because it is not required to wait for confirmation that the data was received and forced to resend data, UDP is much faster than TCP. It does not establish a connection with the remote host, it simply fires off the data to that host and doesn't care if it is accepted or not. Because it is a simple transaction, it is useful for simple communications like querying for network resources. It also doesn't maintain a state, which makes it great for transmitting data from one machine to many real-time clients. This makes it ideal for VOIP, games, and other applications that cannot afford delays.

4.Describe python functions, local and global variables and modules ?

Ans: Defining functions: Functions are defined using the def keyword. After this keyword comes an identifier name for the function, followed by a pair of parentheses which may enclose some names of variables, and by the final colon that ends the line.

```
def XX_YY(variable1, varible2):
    # block belonging to the function
```

Defining local and global variables: Local and global variables can be defined using:

```
x = 50 #Local
global x
```

Defining modules: There are various methods of writing modules, but the simplest way is to create a file with a .py extension that contains functions and variables.

```
def xx_yy():
```

Using modules: A module can be imported by another program to make use of its functionality. This is how we can use the Python standard library as well.

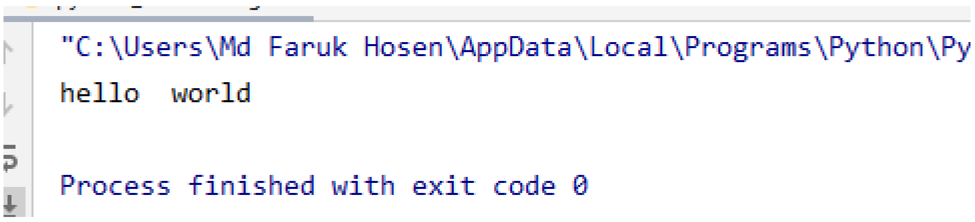
```
import xx_yy
```

5. Create python program using the syntax provided below ?

Source code :

```
def  say_hello():
  print('hello  world')

if __name__=='__main__':
    say_hello()    #  call  the  function
```

Output:



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Py
hello  world

Process finished with exit code 0
```

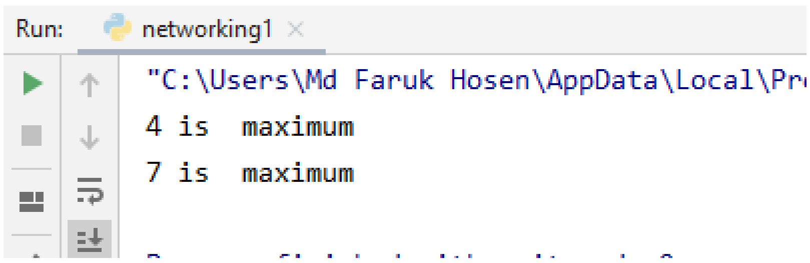
6. Create python script using the syntax provided below ?

Source code :

```
def  print_max(a,  b):
    if  a  >  b:
        print(a,  'is  maximum')
    elif  a  ==  b:
        print(a,  'is  equal  to',  b)
    else:
        print(b, 'is  maximum')

if __name__=='__main__':
    print_max(3, 4)
x = 5
```

```
y = 7
print_max(x,  y)
```

Output:



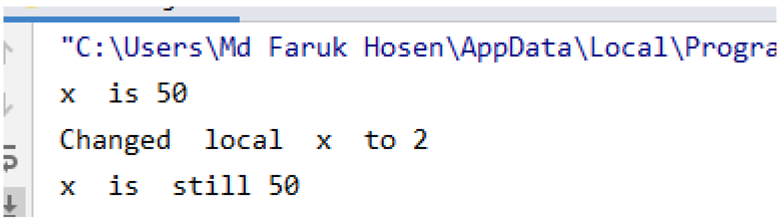
```
"C:\Users\Md Faruk Hosen\AppData\Local\Pr
4 is  maximum
7 is  maximum
```

7. Create python script using the syntax provided below ? Which is the final value of variable x?

Source code :

```
x = 50
def func(x):
    print('x  is',  x)
    x = 2
    print('Changed  local  x  to',  x)

if __name__=='__main__':
    func(x)
    print('x  is  still',  x)
```

Output:



```
"C:\Users\Md Faruk Hosen\AppData\Local\Progra
x  is 50
Changed  local  x  to 2
x  is  still 50
```

8. Python modules:

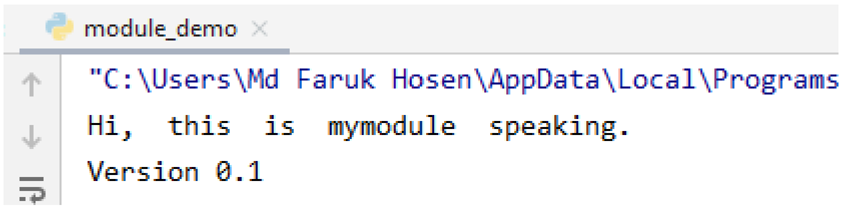
Create python script using the syntax provided below (save as mymodule.py).

```
def  say_hi():
    print('Hi,  this  is  mymodule  speaking.')
__version__= '0.1'
```

Create python script using the syntax provided below (save as module_demo.py).

```
import  mymodule

if __name__=='__main__':
    mymodule.say_hi()
    print('Version',  mymodule.__version__   )
```

Output:



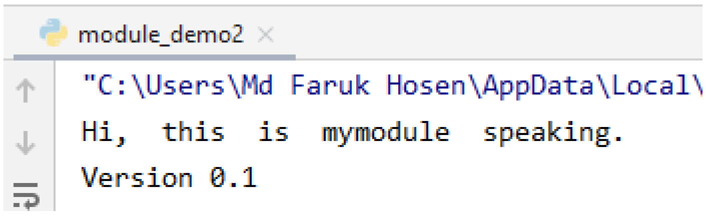
```
module_demo
"C:\Users\Md Faruk Hosen\AppData\Local\Programs
Hi,  this  is  mymodule  speaking.
Version 0.1
```

Run the script, which is the role of import?

Create python scrip using the syntax provided below (save as module_demo2.py).

```
from  mymodule  import  say_hi,__version__

if __name__=='__main__':
    say_hi()
    print('Version',__version__)
```

Output:



```
module_demo2
"C:\Users\Md Faruk Hosen\AppData\Local\
Hi,  this  is  mymodule  speaking.
Version 0.1
```

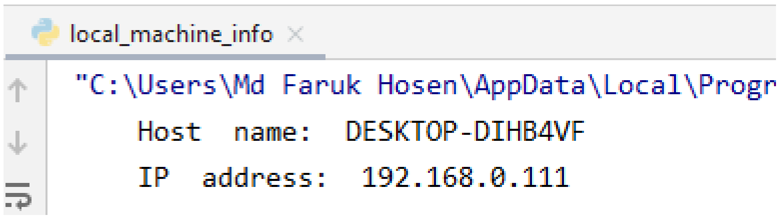
Run the script, which is the role of from, import?

9. Sockets, IPv4, and Simple Client/Server Programming:

Ex-1: Printing your machine's name and IPv4 address ?

```
import  socket

def  print_machine_info():
    host_name  =  socket.gethostname()
    ip_address  =  socket.gethostbyname(host_name)
    print  ("  Host  name:  %s"  %  host_name)
    print (" IP address: %s" % ip_address)
if __name__=='__main__':
    print_machine_info()
```

Output:

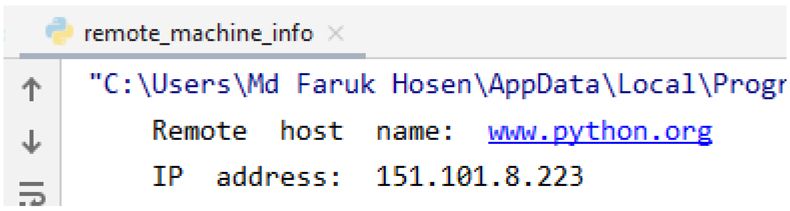


```
local_machine_info ×
"C:\Users\Md Faruk Hosen\AppData\Local\Progr
    Host name: DESKTOP-DIHB4VF
    IP address: 192.168.0.111
```

Ex-2 : Retrieving a remote machine's IP address

```
import socket

def get_remote_machine_info():
    remote_host = 'www.python.org'
    try:
        print (" Remote host name: %s" % remote_host)
        print (" IP address: %s"
%socket.gethostbyname(remote_host))
    except socket.error as err_msg:
        print ("Error accesing %s: error number and detail
%s"%(remote_host, err_msg))

if __name__=='__main__':
    get_remote_machine_info()
```

Output :

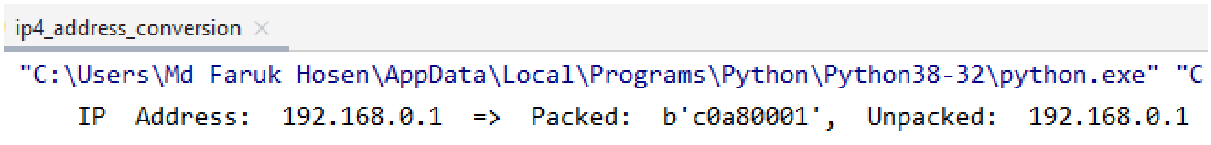


```
remote_machine_info ×
"C:\Users\Md Faruk Hosen\AppData\Local\Progr
    Remote host name: www.python.org
    IP address: 151.101.8.223
```

Ex-3 : Converting an IPv4 address to different formats

```
import socket
from binascii import hexlify

def convert_ip4_address():
    for ip_addr in ['127.0.0.1', '192.168.0.1']:
        packed_ip_addr = socket.inet_aton(ip_addr)
        unpacked_ip_addr  =  socket.inet_ntoa(packed_ip_addr)
    print  ("  IP  Address:  %s  =>  Packed:  %s,  Unpacked:
%s"%(ip_addr, hexlify(packed_ip_addr), unpacked_ip_addr))

if __name__=='__main__':
    convert_ip4_address()
```

Output:

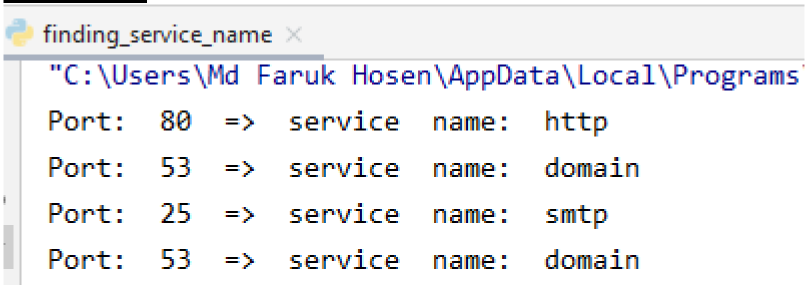


```
ip4_address_conversion
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python38-32\python.exe" "C
    IP  Address:  192.168.0.1  =>  Packed:  b'c0a80001',  Unpacked:  192.168.0.1
```

Ex-4 : Finding a service name, given the port and protocol ?

```
import  socket
def  find_service_name():
    protocolname  =  'tcp'
    for  port  in  [80,  25]:
        print  ("Port:  %s  =>  service  name:  %s"  %(port,
socket.getservbyport(port, protocolname)))
        print  ("Port:  %s  =>  service  name:  %s"  %(53,
socket.getservbyport(53,  'udp')))

if __name__=='__main__':
    find_service_name()
```

Output:

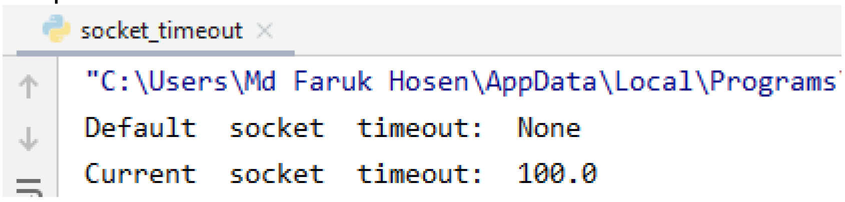


```
finding_service_name
"C:\Users\Md Faruk Hosen\AppData\Local\Programs
Port:  80  =>  service  name:  http
Port:  53  =>  service  name:  domain
Port:  25  =>  service  name:  smtp
Port:  53  =>  service  name:  domain
```

Ex-5 : Setting and getting the default socket timeout

```
import  socket

def  test_socket_timeout():
    s  =  socket.socket(socket.AF_INET,  socket.SOCK_STREAM)
    print  ("Default  socket  timeout:  %s"  %s.gettimeout())
    s.settimeout(100)
    print  ("Current  socket  timeout:  %s"  %s.gettimeout())

if __name__=='__main__':
    test_socket_timeout()
```

Output :



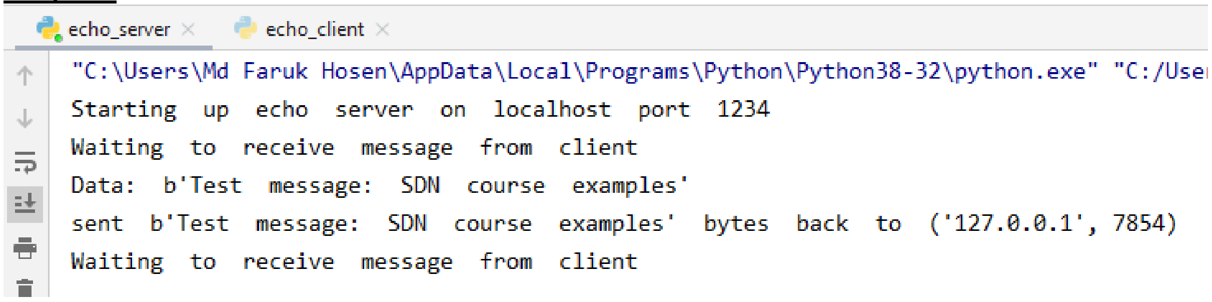
```
socket_timeout
"C:\Users\Md Faruk Hosen\AppData\Local\Programs
Default  socket  timeout:  None
Current  socket  timeout:  100.0
```

Ex-6 : Writing a simple echo client/server application?

Create python scrip using the syntax below (save as **echo server.py**):

```
import  socket
import sys
import argparse
import codecs

from  codecs  import  encode,  decode
host  =  'localhost'
data_payload = 4096
backlog = 5


def  echo_server(port):
    sock  =  socket.socket(socket.AF_INET,  socket.SOCK_STREAM) #
Enable  reuse  address/port
    sock.setsockopt(socket.SOL_SOCKET,  socket.SO_REUSEADDR,  1) #
Bind  the  socket  to  the  port
    server_address  =  (host,port)
    print  ("Starting  up  echo  server  on  %s  port  %s"
%server_address)
    sock.bind(server_address)
    #  Listen  to  clients,  backlog  argument  specifies  the  max
no.  of  queued connections
    sock.listen(backlog)

    while  True:
        print  ("Waiting  to  receive  message  from  client")
        client,  address  =  sock.accept()
        data  =  client.recv(data_payload)
        if  data:
            print  ("Data:  %s"  %data)
            client.send(data)
            print  ("sent  %s  bytes  back  to  %s"  %  (data,
address)) #  end  connection
        client.close()


if __name__=='__main__':
    parser  =  argparse.ArgumentParser(description='Socket  Server
Example')
    parser.add_argument('--port',  action="store",  dest="port",
type=int,required=False)
    given_args  =  parser.parse_args()
    port  =  given_args.port
    echo_server(1234)
```

Output:

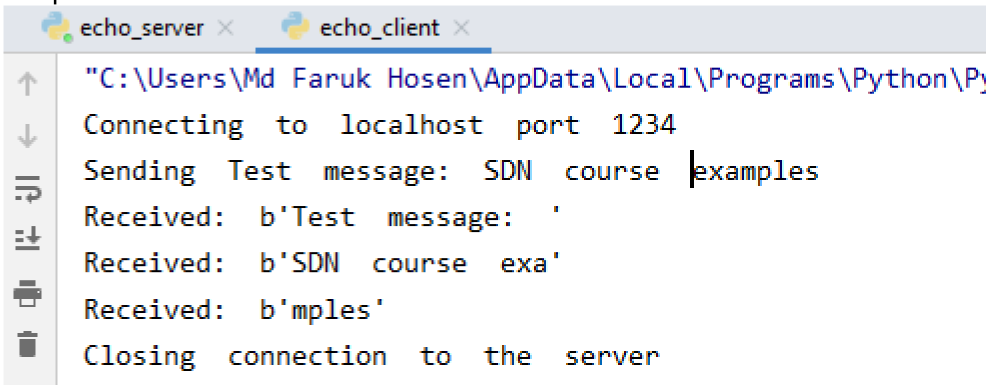


```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python38-32\python.exe" "C:/Use
Starting  up  echo  server  on  localhost  port  1234
Waiting  to  receive  message  from  client
Data:  b'Test  message:  SDN  course  examples'
sent  b'Test  message:  SDN  course  examples'  bytes  back  to  ('127.0.0.1', 7854)
Waiting  to  receive  message  from  client
```

Create python scrip using the syntax below (save as **echo_client.py**):

```
import  socket
import sys
import argparse
import codecs

from  codecs  import  encode,  decode
host  =  'localhost'
def  echo_client(port):
    sock  =  socket.socket(socket.AF_INET,  socket.SOCK_STREAM) #
Connect  the  socket  to  the  server
    server_address  =  (host,  port)
    print  ("Connecting  to  %s  port  %s"  %  server_address)
    sock.connect(server_address)
    try:
        message  =  "Test  message:  SDN  course  examples"
        print  ("Sending  %s"  %  message)
        sock.sendall(message.encode('utf_8'))
        #  Look  for  the  response
        amount_received = 0
        amount_expected = len(message)
        while amount_received < amount_expected:
            data = sock.recv(16)
            amount_received += len(data)
            print("Received:  %s" % data)
    except  socket.errno  as  e:
            print("Socket error: %s" % str(e))
        except Exception as e:
            print("Other exception: %s" % str(e))
        finally:
            print("Closing connection to the server")
            sock.close()

if __name__=='__main__':
    parser = argparse.ArgumentParser(description='Socket Server
Example')
    parser.add_argument('--port', action="store", dest="port",
type=int,required=False)
    given_args = parser.parse_args()
    port = given_args.port
    echo_client(1234)
```

Output :



echo_server echo_client

```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Py
Connecting to localhost port 1234
Sending Test message: SDN course examples
Received: b'Test message: '
Received: b'SDN course exa'
Received: b'mples'
Closing connection to the server
```

Conclusion :

From this lab, I learn how python function works and how python module works. I also learn the basis of networking programming.I face some problems when I do the echo_server and echo_client code. But I solve these problem with the help of my Course teacher(Nazrul Islam Sir).