Installation

(updated on November 18, 2020)

Bronze is a collection of **jupyter notebooks**.

We use **pyhton (3.6+)** as our programming language and **Qiskit library** to write our quantum programs.

The instructions here are for beginners!

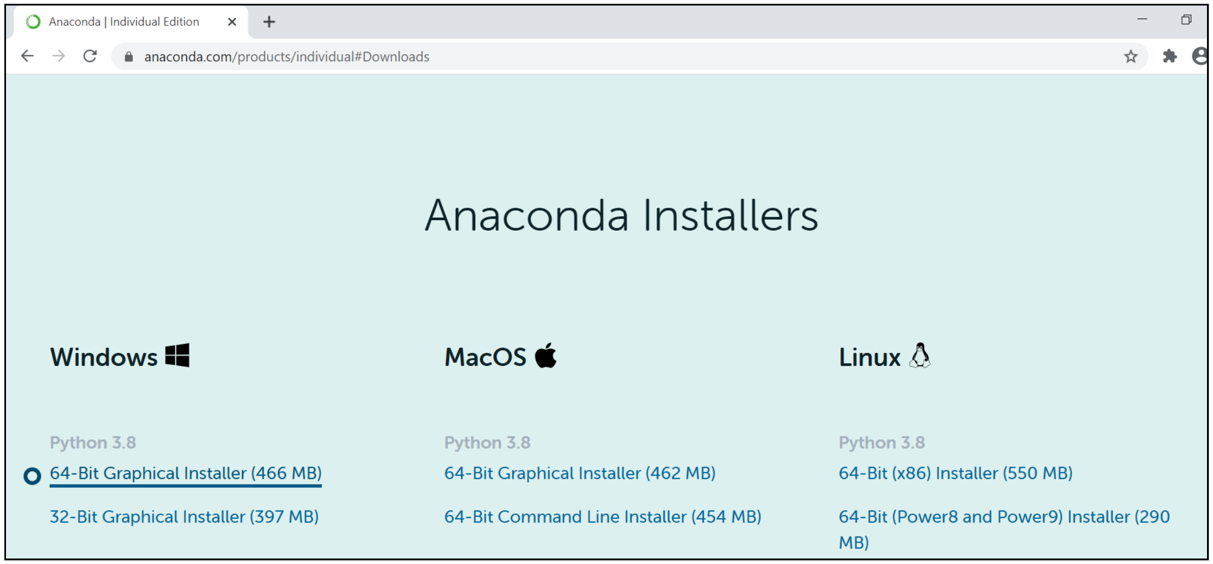
If you have qiskit installed, you may skip the instructions here.

If you have Jupyter notebooks installed, you may install Qiskit library by yourself or using the instructions here.

Install Anaconda

1. The easiest way to install jupyter notebooks and many python libraries is to install anaconda.

   Download anaconda


Anaconda | Individual Edition
anaconda.com/products/individual#Downloads

Anaconda Installers

Windows

Python 3.8

64-Bit Graphical Installer (466 MB)

32-Bit Graphical Installer (397 MB)

MacOS

Python 3.8

64-Bit Graphical Installer (462 MB)

64-Bit Command Line Installer (454 MB)

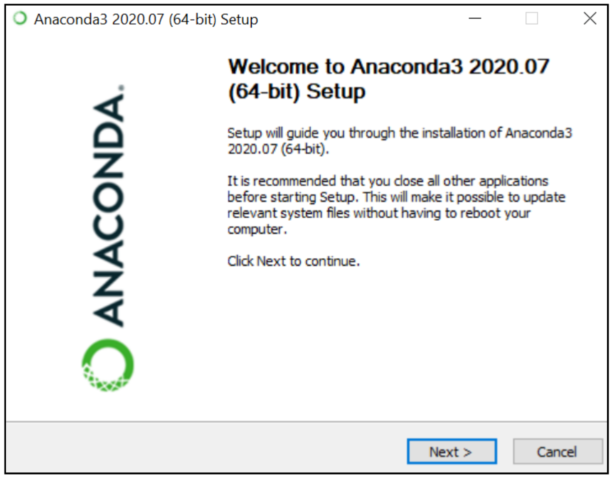
Linux

Python 3.8

64-Bit (x86) Installer (550 MB)

64-Bit (Power8 and Power9) Installer (290 MB)

2. We downloaded and installed the version for Windows (64-bit).

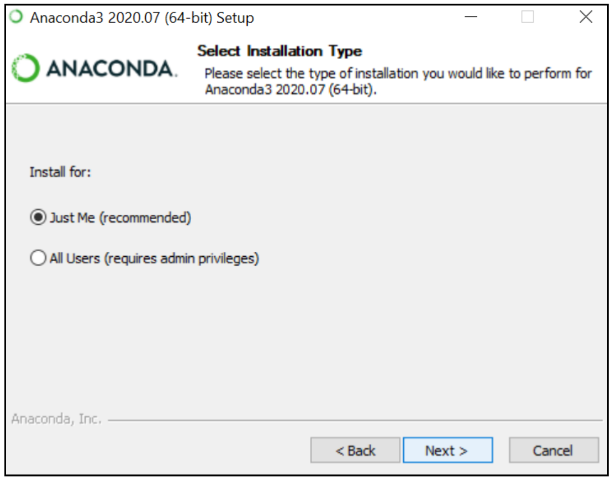


Welcome to Anaconda3 2020.07 (64-bit) Setup

Setup will guide you through the installation of Anaconda3 2020.07 (64-bit).

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.



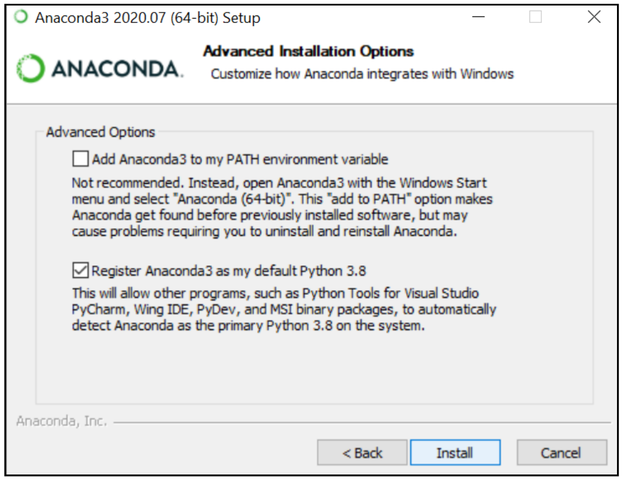
Select Installation Type

Please select the type of installation you would like to perform for Anaconda3 2020.07 (64-bit).

Install for:

● Just Me (recommended)

○ All Users (requires admin privileges)



Advanced Installation Options

Customize how Anaconda integrates with Windows

Advanced Options

□ Add Anaconda3 to my PATH environment variable

Not recommended. Instead, open Anaconda3 with the Windows Start menu and select "Anaconda (64-bit)". This "add to PATH" option makes Anaconda get found before previously installed software, but may cause problems requiring you to uninstall and reinstall Anaconda.

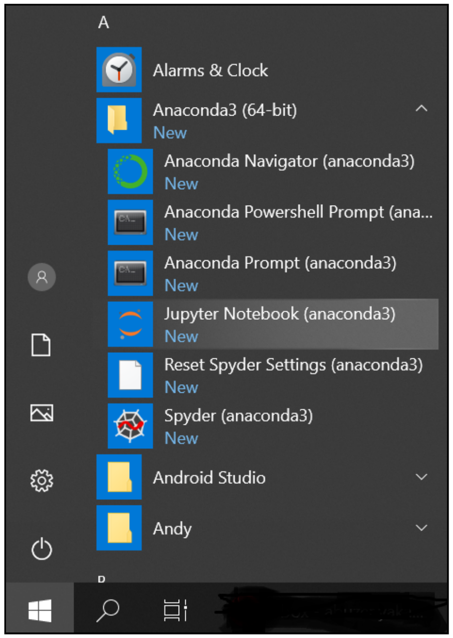
☑ Register Anaconda3 as my default Python 3.8

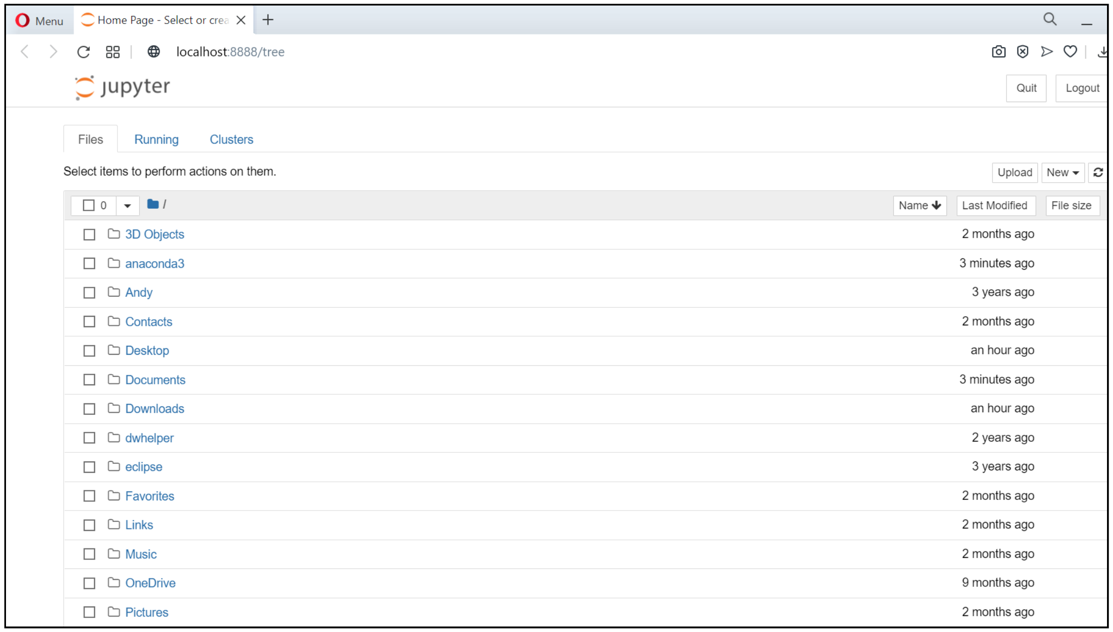
This will allow other programs, such as Python Tools for Visual Studio PyCharm, Wing IDE, PyDev, and MSI binary packages, to automatically detect Anaconda as the primary Python 3.8 on the system.

Jupyter Notebooks

1. After installing Anaconda, execute Jupyter Notebooks from start menu. Then, the dashboard of Jupyter notebooks should be opened on the browser.

   We suggest you to keep open the dashboard all the time!


A
Alarms & Clock
Anaconda3 (64-bit)
New
Anaconda Navigator (anaconda3)
New
Anaconda Powershell Prompt (ana...
New
Anaconda Prompt (anaconda3)
New
Jupyter Notebook (anaconda3)
New
Reset Spyder Settings (anaconda3)
New
Spyder (anaconda3)
New
Android Studio
Andy
[redacted]



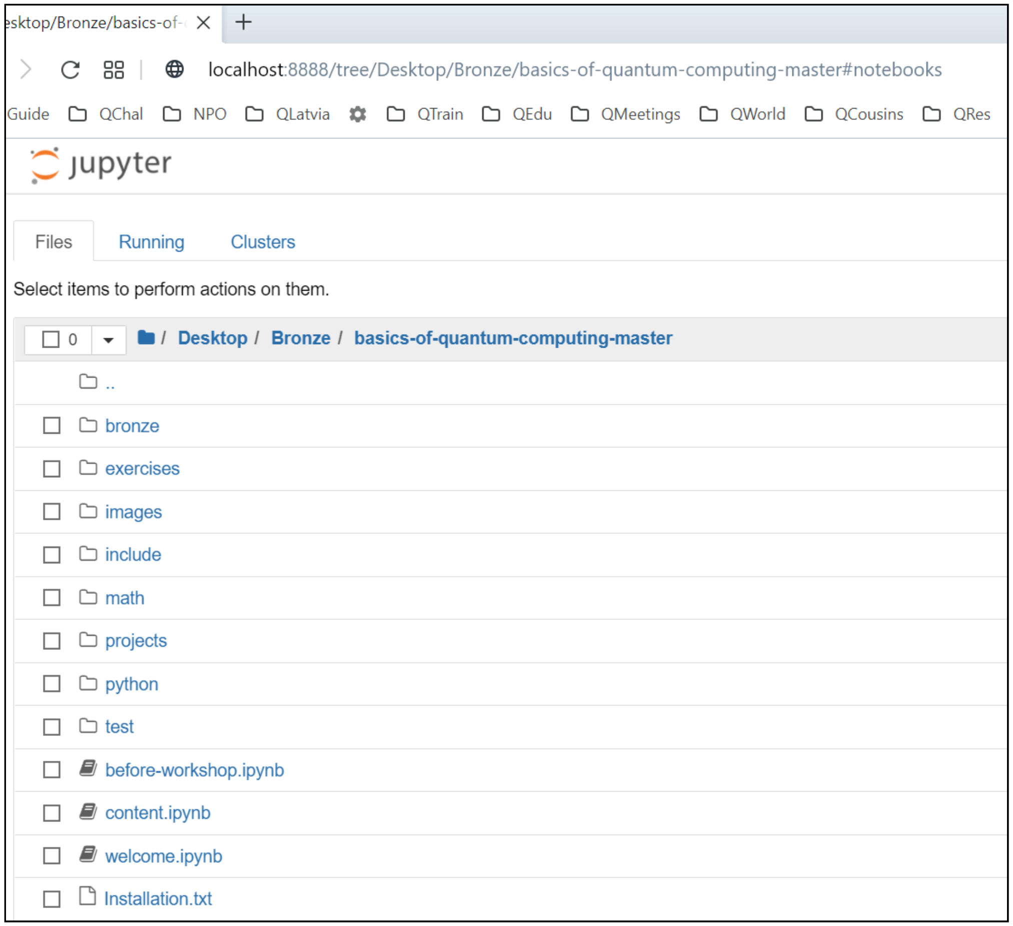
Select items to perform actions on them.

Name	Last Modified	File size
□ 3D Objects	2 months ago	
□ anaconda3	3 minutes ago	
□ Andy	3 years ago	
□ Contacts	2 months ago	
□ Desktop	an hour ago	
□ Documents	3 minutes ago	
□ Downloads	an hour ago	
□ dwhelper	2 years ago	
□ eclipse	3 years ago	
□ Favorites	2 months ago	
□ Links	2 months ago	
□ Music	2 months ago	
□ OneDrive	9 months ago	
□ Pictures	2 months ago	

2. The notebooks you will work with should be accesible from the dashboard, e.g., put them under a sub-directory of Desktop, Documents, Downloads, etc.

   In the following example, we downloaded our zip file under "Desktop/Bronze" and then extract the files there.

   Always extract the zip files before accessing from jupyter notebooks!



localhost:8888/tree/Desktop/Bronze/basics-of-quantum-computing-master#notebooks

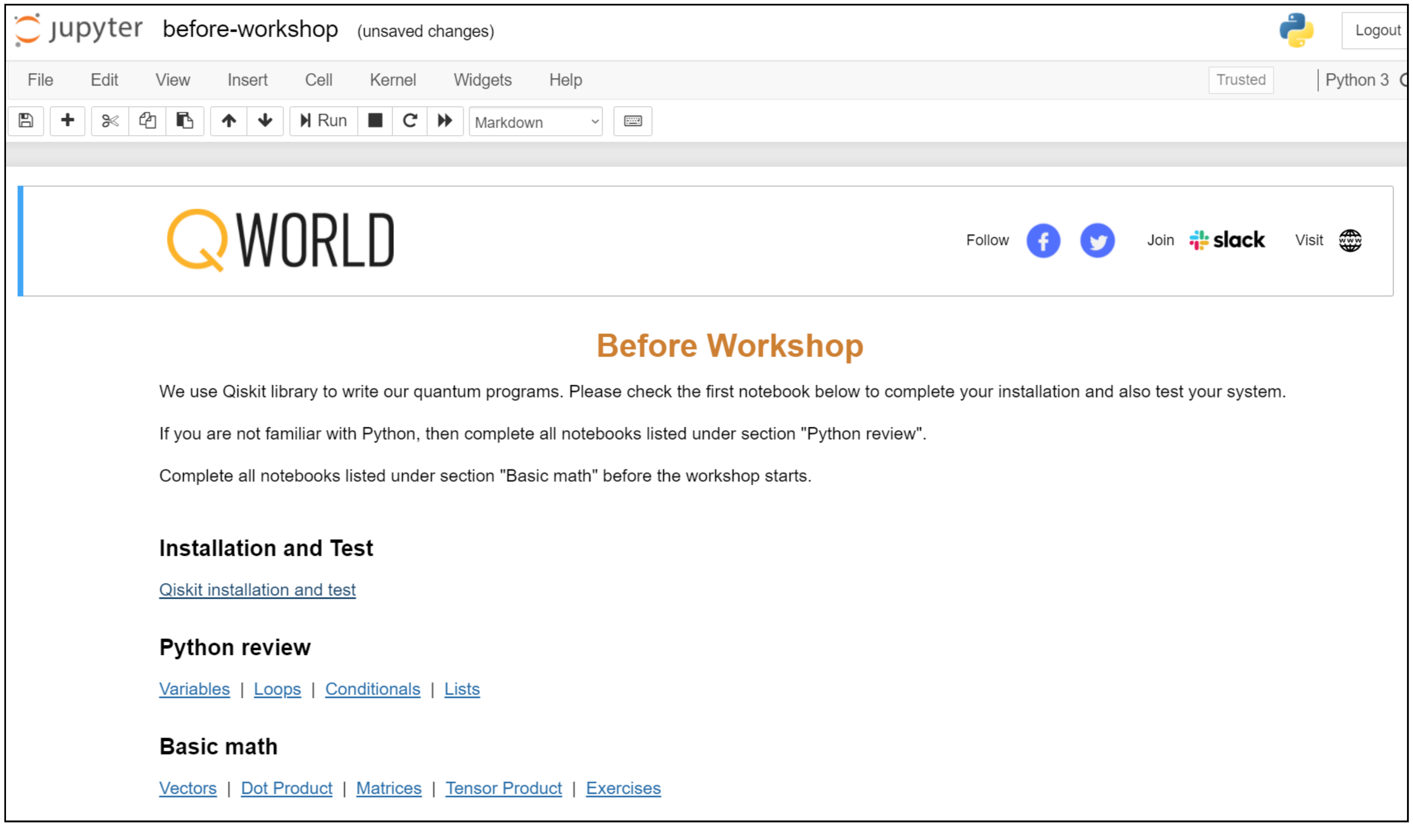
Select items to perform actions on them.

/ Desktop / Bronze / basics-of-quantum-computing-master

..
- □ bronze
- □ exercises
- □ images
- □ include
- □ math
- □ projects
- □ python
- □ test
- □ before-workshop.ipynb
- □ content.ipynb
- □ welcome.ipynb
- □ Installation.txt

Install Qiskit

1. Open the notebook "before-workshop.ipynb" from the dashboard.



Before Workshop

We use Qiskit library to write our quantum programs. Please check the first notebook below to complete your installation and also test your system.

If you are not familiar with Python, then complete all notebooks listed under section "Python review".

Complete all notebooks listed under section "Basic math" before the workshop starts.

Installation and Test

Qiskit installation and test

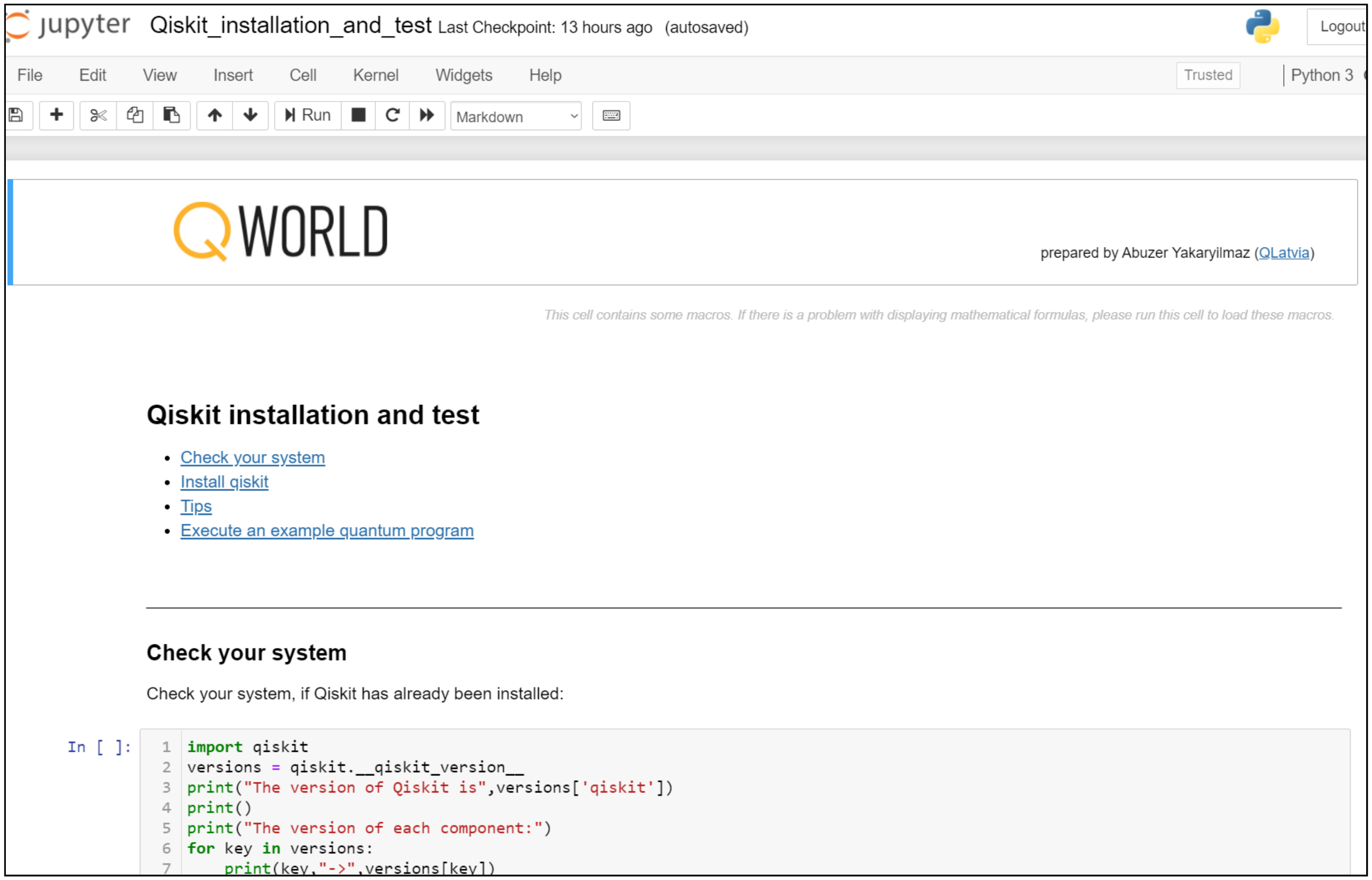
Python review

Variables | Loops | Conditionals | Lists

Basic math

Vectors | Dot Product | Matrices | Tensor Product | Exercises

2. Open "Qiskit installation and test".



prepared by Abuzer Yakaryilmaz (QLatvia)

This cell contains some macros. If there is a problem with displaying mathematical formulas, please run this cell to load these macros.

Qiskit installation and test

- Check your system
- Install qiskit
- Tips
- Execute an example quantum program

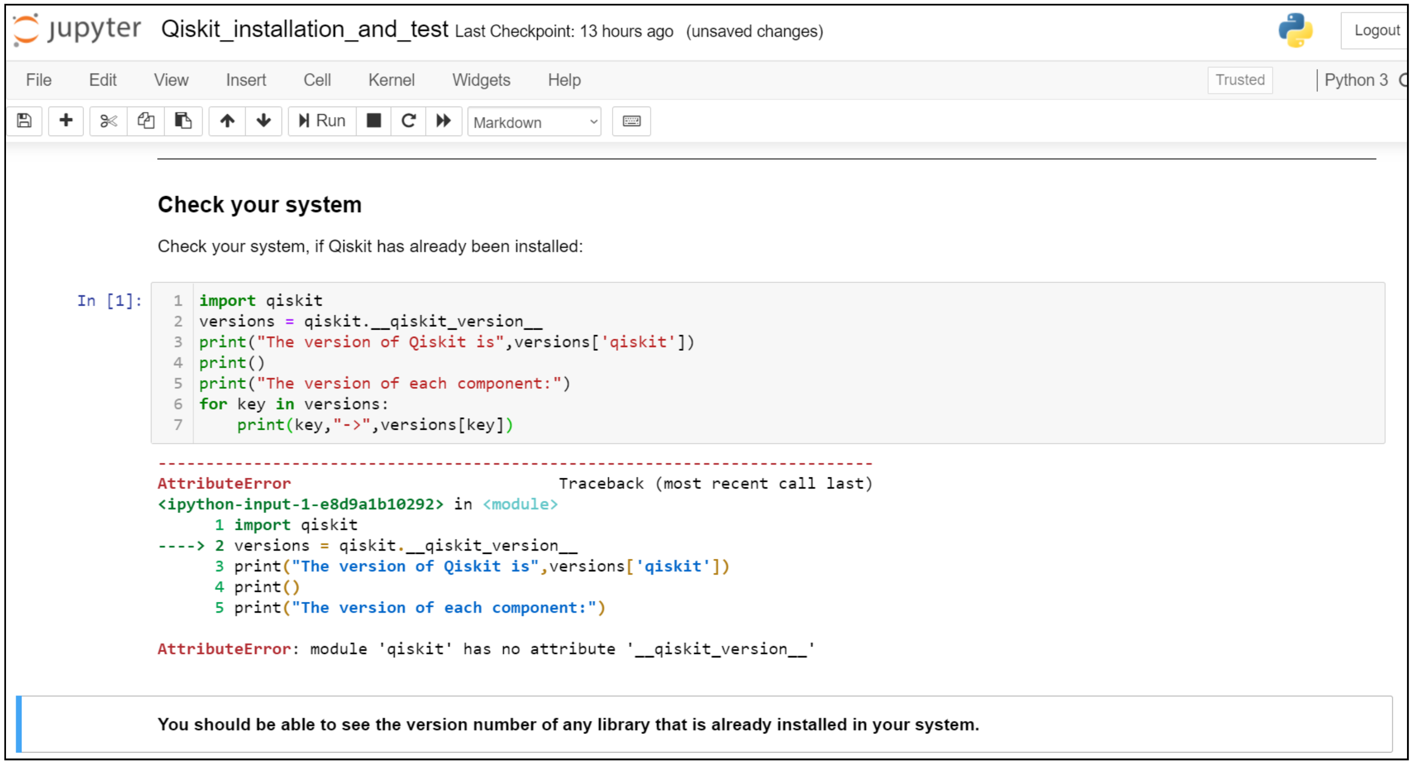
Check your system

Check your system, if Qiskit has already been installed:

In [ ]:

```
import qiskit
versions = qiskit.__qiskit_version__
print("The version of Qiskit is",versions['qiskit'])
print()
print("The version of each component:")
for key in versions:
    print(key,"->",versions[key])
```

3. When you execute the first cell, you should get an error if Qiskit is not installed on your system.


jupyter Qiskit_installation_and_test Last Checkpoint: 13 hours ago (unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Python 3
Run
Markdown

Check your system

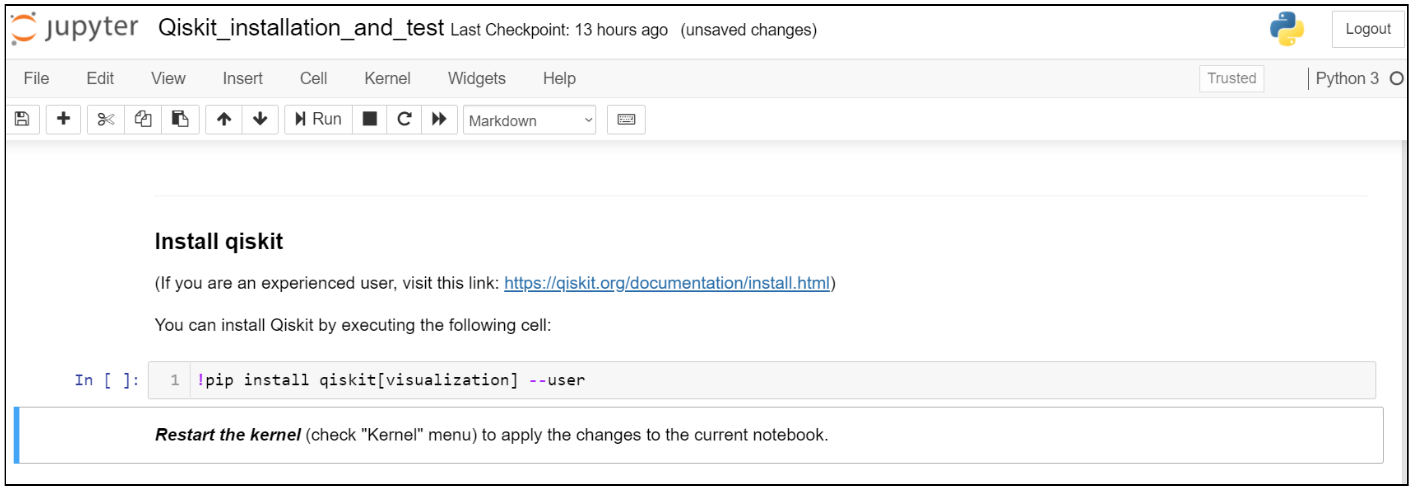
Check your system, if Qiskit has already been installed:

```
In [1]:
import qiskit
versions = qiskit.__qiskit_version__
print("The version of Qiskit is",versions['qiskit'])
print()
print("The version of each component:")
for key in versions:
    print(key,"->",versions[key])
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-1-e8d9a1b10292> in <module>
      1 import qiskit
----> 2 versions = qiskit.__qiskit_version__
      3 print("The version of Qiskit is",versions['qiskit'])
      4 print()
      5 print("The version of each component:")

AttributeError: module 'qiskit' has no attribute '__qiskit_version__'
```

You should be able to see the version number of any library that is already installed in your system.

4. To install Qiskit, run the cell shown below.


jupyter Qiskit_installation_and_test Last Checkpoint: 13 hours ago (unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Python 3
Run
Markdown

Install qiskit

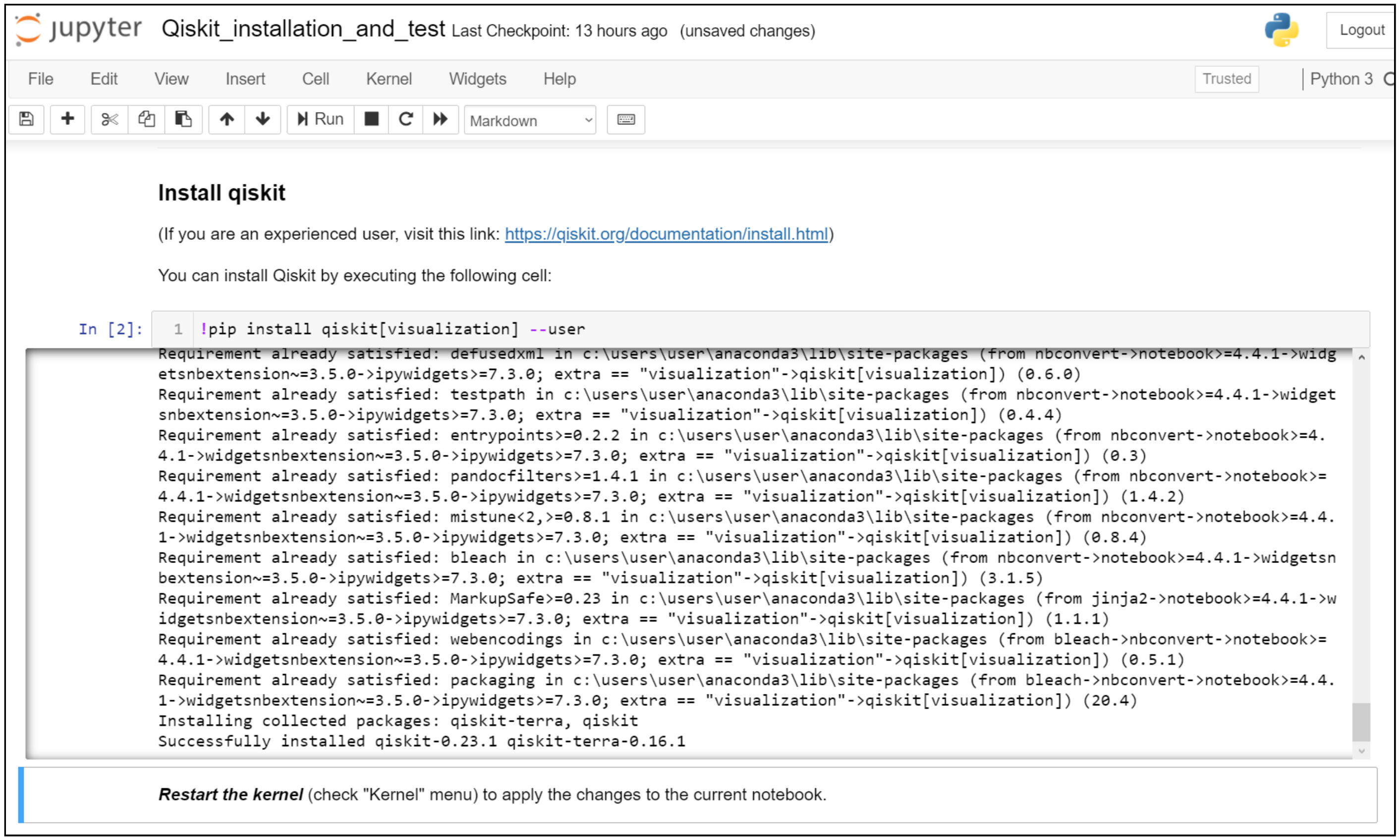
(If you are an experienced user, visit this link: https://qiskit.org/documentation/install.html)

You can install Qiskit by executing the following cell:

```
In [ ]:
!pip install qiskit[visualization] --user
```

Restart the kernel (check "Kernel" menu) to apply the changes to the current notebook.

5. We did not recieve any error during the installation.



Install qiskit

(If you are an experienced user, visit this link: https://qiskit.org/documentation/install.html)

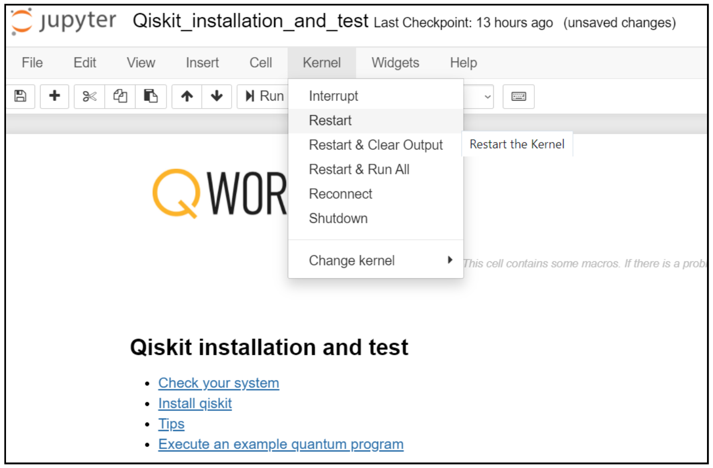
You can install Qiskit by executing the following cell:

```
In [2]:   !pip install qiskit[visualization] --user
```

```
Requirement already satisfied: defusedxml in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=4.4.1->widg
etsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (0.6.0)
Requirement already satisfied: testpath in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=4.4.1->widget
snbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (0.4.4)
Requirement already satisfied: entrypoints>=0.2.2 in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=4.
4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (0.3)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=
4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (1.4.2)
Requirement already satisfied: mistune<2,>=0.8.1 in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=4.4.
1->widgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (0.8.4)
Requirement already satisfied: bleach in c:\users\user\anaconda3\lib\site-packages (from nbconvert->notebook>=4.4.1->widgetsn
bextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (3.1.5)
Requirement already satisfied: MarkupSafe>=0.23 in c:\users\user\anaconda3\lib\site-packages (from jinja2->notebook>=4.4.1->w
idgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (1.1.1)
Requirement already satisfied: webencodings in c:\users\user\anaconda3\lib\site-packages (from bleach->nbconvert->notebook>=
4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (0.5.1)
Requirement already satisfied: packaging in c:\users\user\anaconda3\lib\site-packages (from bleach->nbconvert->notebook>=4.4.
1->widgetsnbextension~=3.5.0->ipywidgets>=7.3.0; extra == "visualization"->qiskit[visualization]) (20.4)
Installing collected packages: qiskit-terra, qiskit
Successfully installed qiskit-0.23.1 qiskit-terra-0.16.1
```

Restart the kernel (check "Kernel" menu) to apply the changes to the current notebook.

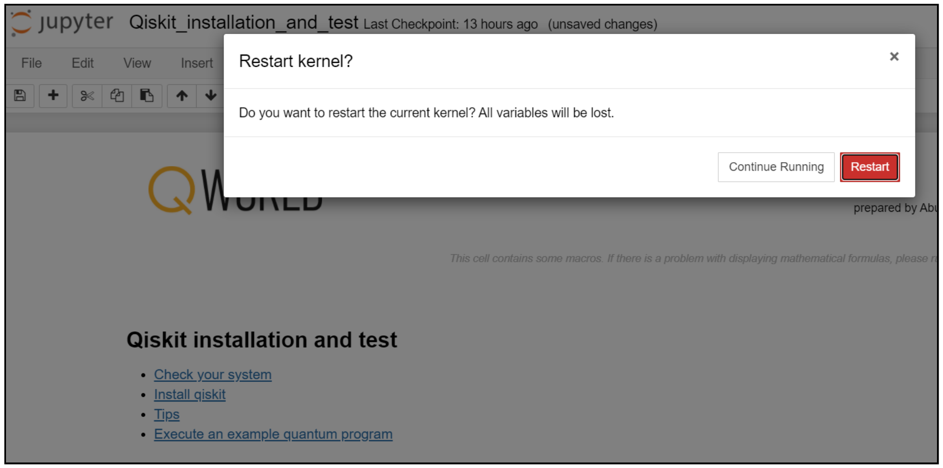
6. The next step is to restart to kernel. (Otherwise, the changes in the system will not be reflected immedeately.)



This cell contains some macros. If there is a prob

Qiskit installation and test

- Check your system
- Install qiskit
- Tips
- Execute an example quantum program


jupyter
Qiskit_installation_and_test Last Checkpoint: 13 hours ago (unsaved changes)
File
Edit
View
Insert
×
Continue Running
Restart
QWORLD
prepared by Abu

Restart kernel?

Do you want to restart the current kernel? All variables will be lost.

This cell contains some macros. If there is a problem with displaying mathematical formulas, please r

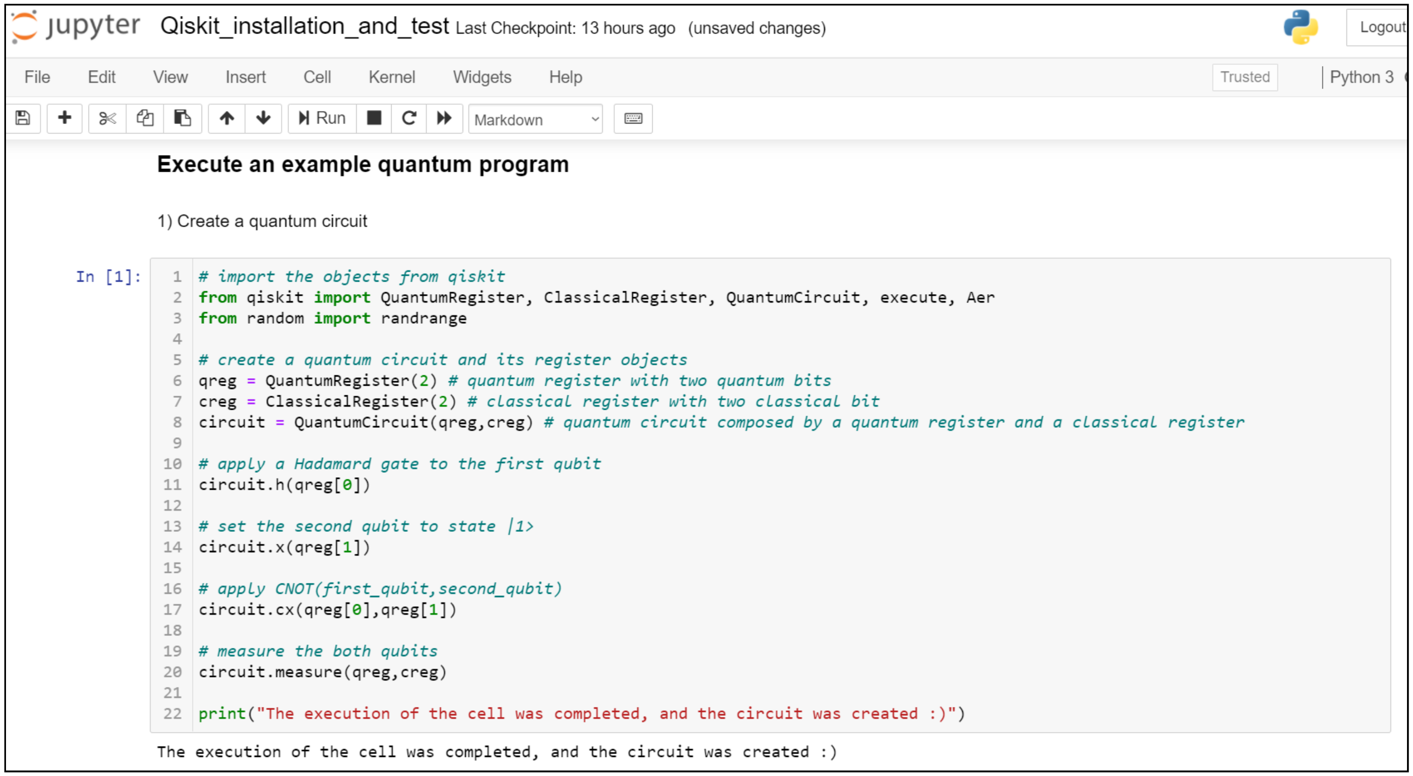
Qiskit installation and test

- Check your system
- Install qiskit
- Tips
- Execute an example quantum program

Test

It is time to test the system.

1. Run the cell shown below to create a quantum circuit with two entangled quantum bits.



Execute an example quantum program

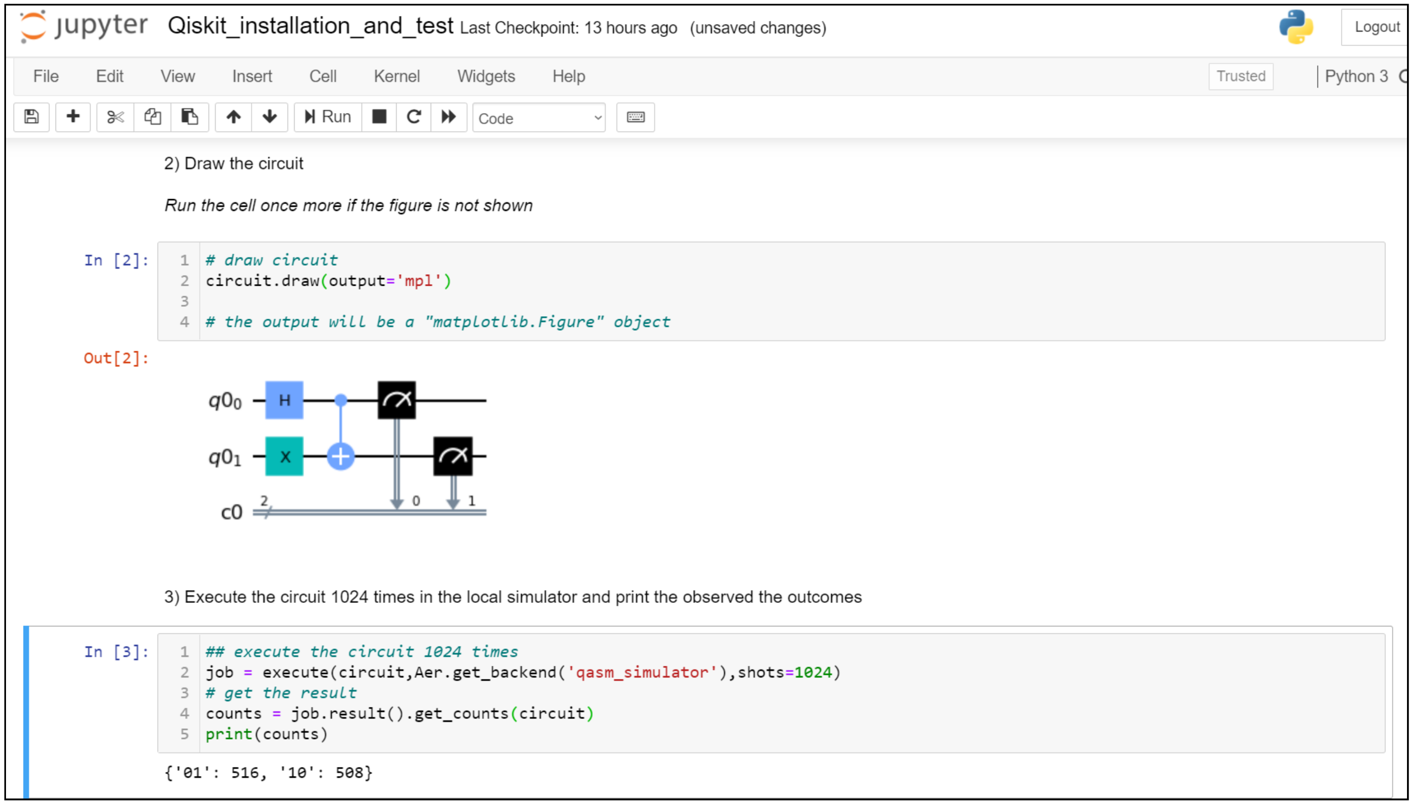
1) Create a quantum circuit

In [1]:

```
# import the objects from qiskit
from qiskit import QuantumRegister, ClassicalRegister, QuantumCircuit, execute, Aer
from random import randrange

# create a quantum circuit and its register objects
qreg = QuantumRegister(2) # quantum register with two quantum bits
creg = ClassicalRegister(2) # classical register with two classical bit
circuit = QuantumCircuit(qreg,creg) # quantum circuit composed by a quantum register and a classical register

# apply a Hadamard gate to the first qubit
circuit.h(qreg[0])

# set the second qubit to state |1>
circuit.x(qreg[1])

# apply CNOT(first_qubit,second_qubit)
circuit.cx(qreg[0],qreg[1])

# measure the both qubits
circuit.measure(qreg,creg)

print("The execution of the cell was completed, and the circuit was created :)")
```

```
The execution of the cell was completed, and the circuit was created :)
```

2. Run the next two cells to draw the circuit and to execute the circuit on local simulator 1024 times.



2) Draw the circuit

Run the cell once more if the figure is not shown

```
In [2]:
# draw circuit
circuit.draw(output='mpl')

# the output will be a "matplotlib.Figure" object
```

Out[2]:

3) Execute the circuit 1024 times in the local simulator and print the observed the outcomes

```
In [3]:
## execute the circuit 1024 times
job = execute(circuit,Aer.get_backend('qasm_simulator'),shots=1024)
# get the result
counts = job.result().get_counts(circuit)
print(counts)
```

```
{'01': 516, '10': 508}
```

The installation is completed. Enjoy Bronze :)