



## Practical 6 - Deutsch Jozsa Alogrithm

```
In [1]: !pip install qiskit
!pip install qiskit_aer
!pip install qiskit[visualization]
```

Requirement already satisfied: qiskit in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (2.1.1)

Requirement already satisfied: rustworkx>=0.15.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (0.16.0)

Requirement already satisfied: numpy<3,>=1.17 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (2.3.2)

Requirement already satisfied: scipy>=1.5 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (1.16.1)

Requirement already satisfied: dill>=0.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (0.4.0)

Requirement already satisfied: stevedore>=3.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (5.4.1)

Requirement already satisfied: typing-extensions in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit) (4.14.1)

Requirement already satisfied: pbr>=2.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from stevedore>=3.0.0->qiskit) (6.1.1)

Requirement already satisfied: setuptools in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from pbr>=2.0.0->stevedore>=3.0.0->qiskit) (80.9.0)

Requirement already satisfied: qiskit\_aer in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (0.17.2)

Requirement already satisfied: qiskit>=1.1.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit\_aer) (2.1.1)

Requirement already satisfied: numpy>=1.16.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit\_aer) (2.3.2)

Requirement already satisfied: scipy>=1.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit\_aer) (1.16.1)

Requirement already satisfied: psutil>=5 in c:\users\vinay\appdata\roaming\python\python312\site-packages (from qiskit\_aer) (6.1.1)

Requirement already satisfied: python-dateutil>=2.8.0 in c:\users\vinay\appdata\roaming\python\python312\site-packages (from qiskit\_aer) (2.9.0.post0)

Requirement already satisfied: six>=1.5 in c:\users\vinay\appdata\roaming\python\python312\site-packages (from python-dateutil>=2.8.0->qiskit\_aer) (1.17.0)

Requirement already satisfied: rustworkx>=0.15.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit>=1.1.0->qiskit\_aer) (0.16.0)

Requirement already satisfied: dill>=0.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit>=1.1.0->qiskit\_aer) (0.4.0)

Requirement already satisfied: stevedore>=3.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit>=1.1.0->qiskit\_aer) (5.4.1)

Requirement already satisfied: typing-extensions in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit>=1.1.0->qiskit\_aer) (4.14.1)

Requirement already satisfied: pbr>=2.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from stevedore>=3.0.0->qiskit>=1.1.0->qiskit\_aer) (6.1.1)

Requirement already satisfied: setuptools in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from pbr>=2.0.0->stevedore>=3.0.0->qiskit>=1.1.0->qiskit\_aer) (80.9.0)

Requirement already satisfied: qiskit[visualization] in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (2.1.1)

Requirement already satisfied: rustworkx>=0.15.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (0.1

6.0)

Requirement already satisfied: numpy<3,>=1.17 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (2.3.2)

Requirement already satisfied: scipy>=1.5 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (1.16.1)

Requirement already satisfied: dill>=0.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (0.4.0)

Requirement already satisfied: stevedore>=3.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (5.4.1)

Requirement already satisfied: typing-extensions in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (4.14.1)

Requirement already satisfied: matplotlib>=3.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (3.10.5)

Requirement already satisfied: pydot in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (4.0.1)

Requirement already satisfied: Pillow>=4.2.1 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (11.3.0)

Requirement already satisfied: pylatexenc>=1.4 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (2.10)

Requirement already satisfied: seaborn>=0.9.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (0.13.2)

Requirement already satisfied: sympy>=1.3 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from qiskit[visualization]) (1.14.0)

Requirement already satisfied: contourpy>=1.0.1 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (1.3.3)

Requirement already satisfied: cycler>=0.10 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (0.12.1)

Requirement already satisfied: fonttools>=4.22.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (4.59.0)

Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (1.4.8)

Requirement already satisfied: packaging>=20.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (23.2)

Requirement already satisfied: pyparsing>=2.3.1 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from matplotlib>=3.3->qiskit[visualization]) (3.2.3)

Requirement already satisfied: python-dateutil>=2.7 in c:\users\vinay\appdata\roaming\python\python312\site-packages (from matplotlib>=3.3->qiskit[visualization]) (2.9.0.post0)

Requirement already satisfied: six>=1.5 in c:\users\vinay\appdata\roaming\python\python312\site-packages (from python-dateutil>=2.7->matplotlib>=3.3->qiskit[visualization]) (1.17.0)

Requirement already satisfied: pandas>=1.2 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from seaborn>=0.9.0->qiskit[visualization]) (2.3.1)

Requirement already satisfied: pytz>=2020.1 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from pandas>=1.2->seaborn>=0.9.0->qiskit[visualization]) (2025.2)

Requirement already satisfied: tzdata>=2022.7 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from pandas>=1.2->seaborn>=0.9.0->qiskit[visualization]) (2025.2)

Requirement already satisfied: pbr>=2.0.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from stevedore>=3.0.0->qiskit[visualization]) (6.1.1)

Requirement already satisfied: setuptools in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from pbr>=2.0.0->stevedore>=3.0.0->qiskit[visualization]) (80.9.0)

Requirement already satisfied: mpmath<1.4,>=1.1.0 in c:\users\vinay\appdata\local\programs\python\python312\lib\site-packages (from sympy>=1.3->qiskit[visualization]) (1.3.0)

```
In [2]: from qiskit import QuantumCircuit
        from qiskit_aer import AerSimulator
        from qiskit.visualization import plot_histogram
```

```
In [3]: def dj_oracle( n, balanced = True ):
        oracle = QuantumCircuit ( n + 1 )
        if balanced:
            for qubit in range( n ):
                oracle.cx( qubit, n )
        else:
            pass
        return oracle
```

```
In [4]: def deutsch_jozsa( n, oracle ):
        circuit = QuantumCircuit( n+1, n )
        circuit.x( n )
        circuit.h( n )
        circuit.h( range( n ) )
        circuit.compose( oracle, inplace = True )
        circuit.h( range( n ) )
        circuit.measure( range( n ), range( n ) )
        return circuit
```

```
In [5]: n = 3
        oracle = dj_oracle( n, balanced = True )
        dj_circuit = deutsch_jozsa( n, oracle )

        # Use AerSimulator from qiskit_aer
        simulator = AerSimulator()

        job = simulator.run( dj_circuit, shots = 1024 )
        result = job.result()
        counts = result.get_counts()

        print( "Measurement results:", counts )

        if '0'*n in counts:
```

```
    print( "Function is constant." )  
else:  
    print( "Function is balanced." )  
  
dj_circuit.draw( "mpl" )  
result = job.result()  
  
dj_circuit.draw( "mpl" )  
plot_histogram( counts )
```

Measurement results: {'111': 1024}  
Function is balanced.

Out[5]:

