In [1]:
```
%matplotlib inline
from qiskit import QuantumCircuit, execute, Aer, QuantumRegister, ClassicalRegister, BasicAer
from qiskit.compiler import transpile, assemble
from qiskit.tools.jupyter import *
from qiskit.visualization import *
from qiskit_ibm_provider import IBMProvider

provider = IBMProvider()
```

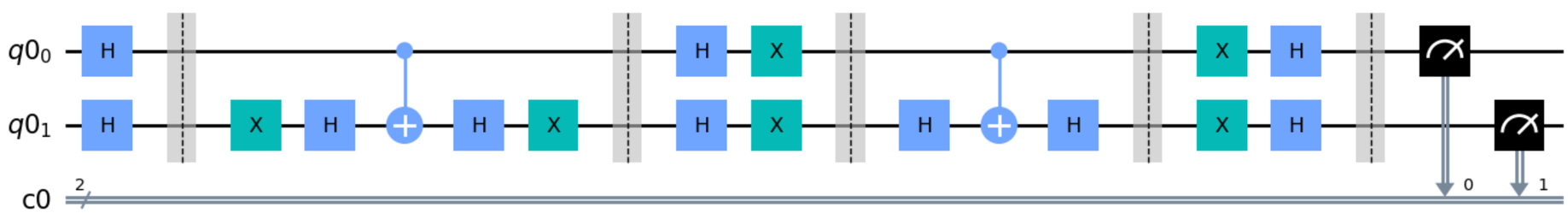
In [2]:
```
def controlled_Z(circuit, control, target):
    circuit.h(target)
    circuit.cnot(control, target)
    circuit.h(target)
```

In [3]:
```
def phase_oracle(circuit, registers):
    circuit.x(registers[1])
    controlled_Z(circuit, registers[0], registers[1])
    circuit.x(registers[1])
```

In [4]:
```
def grover_diffusion ( circuit , registers ):
    # Apply Hadamard and X gates on all qubits
    circuit .h( registers )
    circuit .x( registers )

    # Create a barrier that isolates different sections of the circuit
    circuit.barrier()

    # Apply CZ gate with target as qubit 1
    controlled_Z ( circuit , registers [0] , registers [1])

    circuit.barrier()
    circuit.x(registers)
    circuit.h(registers)
```

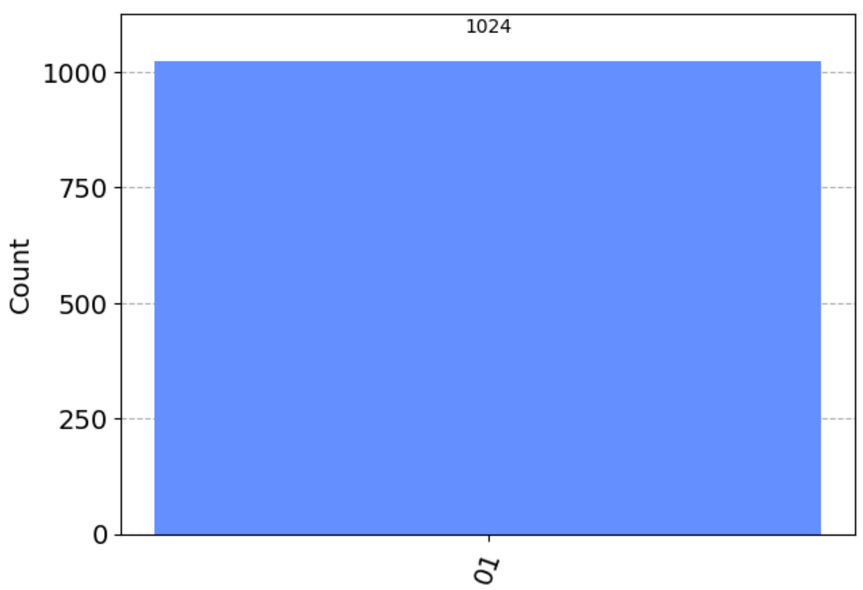
In [5]:
```
# Define circuit constants
Qubits = 2
tests = 1

# Define register objects
qr = QuantumRegister (Qubits )
cr = ClassicalRegister (Qubits )
groverCircuit = QuantumCircuit (qr, cr)

# Initialize circuit with Hadamard gates
groverCircuit.h(qr)

# Run phase oracle and diffusion operators .
# Can be run multiple times depending on the variable , tests .
for test in range (0, tests):
    groverCircuit.barrier()
    phase_oracle(groverCircuit, qr)
    groverCircuit.barrier()
    grover_diffusion(groverCircuit, qr)

# Measure quantum registers
groverCircuit.barrier ()
groverCircuit.measure (qr ,cr)

# Draw Circuit
groverCircuit.draw (output="mpl")
```

Out[5]:



In [6]:
```
# Define backend that will simulate quantum circuit
backend = BasicAer.get_backend('qasm_simulator')
# Number of times the circuit is run
shots = 1024
# Execute circuit and plot results on histogram
results = execute (groverCircuit, backend=backend, shots=shots).result()
answer = results.get_counts()
plot_histogram(answer)
```

Out[6]:



In [ ]: