Homework 6: Cirq I

Description

In this homework assignment, you will recognize the basics of Cirq and how to work with Quantum Circuit Objects.

Homework Structure

Part 1: Introduction to Lists

Part 2: Introduction to Cirq

Part 3: Working with Qubit Representations

Learning Objectives

By the end of this assignment, you will:

- Recognize the landscape of quantum programming options.
- Recognize the basics of lists in python.
- Recognize the basics of Cirq.
- Recognize how to represent qubits and their states in Cirq.

Resources

Before starting, run the code below to import all necessary functions and libraries.

Show code

```
Libraries imported successfully!
```

Part 1: Introduction to Lists

In this part, you will practice using lists in python.

Problem #1.1

Create a list with the entries 1, 1, 2, and 3. Output the list.

```
my_list = # COMPLETE THIS CODE
```

Problem #1.2

Output the second element of `my_list`.

```
# COMPLETE THIS CODE
```

Problem #1.3

Add `my_other_list` to `my_list`. Output the length of this new list.

```
my_other_list = [5, 8, 13, 21, 34]
# COMPLETE THIS CODE
```

Problem #1.4

Add the elements 55 and 89 to `my_list`.

```
# COMPLETE THIS CODE
```

Problem #1.5

Output the fourth to last element of `my_list`.

```
# COMPLETE THIS CODE
```

Part 2: Introduction to Cirq

In this part, you will practice the basics of Cirq, including creating single qubits, creating multiple qubits, creating circuits, editing circuits, and simulating circuits.

Problem #2.1

Create and output a qubit.

```
my_qubit = #COMPLETE THIS CODE
```

Problem #2.2

Create a circuit.

```
my_circuit = # COMPLETE THIS CODE
```

Problem #2.3

Append your circuit so that we can measure `my_qubit`. Output your circuit.

```
# COMPLETE THIS CODE
```

Problem #2.4

Create a list of five qubits. Create a circuit and append a measurement for each of your qubits. Simulate the results of your circuit.

```
my_qubits = # COMPLETE THIS CODE
my_circuit = # COMPLETE THIS CODE
```

Part 3: Working with Qubit Representations

In this part, you will represent qubit states using vectors, ket notation, and the Bloch Sphere.

Problem #3.1

Produce a ket representation and a Bloch Sphere representation for the below vector.

```
vec = [1/np.sqrt(2), -1/np.sqrt(2)]
# COMPLETE THIS CODE
```

Problem #3.2

Simulate the circuit below. Then represent the result of the circuit using all three qubit representations.

```
my_qubit = cirq.NamedQubit("q0")
my_circuit = cirq.Circuit()
my_circuit.append(cirq.measure(my_qubit))
# COMPLETE THIS CODE
```

```
vec = # COMPLETE THIS CODE
```

```
# COMPLETE THIS CODE
```

```
# COMPLETE THIS CODE
```

Problem #3.3

Create a vector that has a 1/3 chance of being measured in the 0 state and a 2/3 chance of being measured in the 1 state. Represent that state using ket notation and the Bloch Sphere.

```
vec = # COMPLETE THIS CODE
```

```
# COMPLETE THIS CODE
```

```
# COMPLETE THIS CODE
```

End of notebook
