

# qsharp-example

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## 1 Jupyter Notebook with Q# Kernel

An example of a Jupyter Notebook with a Q# Kernel.

### 1.1 Setup

The following steps are required to setup the Jupyter Notebook with a Q# Kernel.

1. Select the Q# kernel in the Jupyter Notebook menu `Kernel → Jupyter Kernel → Q#`.
2. Run the Jupyter Notebook.

### 1.2 Q# Example - Apply Hadamard Gates and Simulate Measurement

A Q# operation that applies a Hadamard gate to `n` qubits initialized at  $|0\rangle$ , measured, and returned as an array of integers.

#### 1.2.1 Create a Q# Operation

Create a Q# operation called `ApplyHadamardGate`. Setup the number of qubits `n` and the array of integers `result` to store the measurement results. Apply a Hadamard gate to each qubit and measure the qubits. Return the measurement results.

```
[ ]: operation ApplyHadamardGate() : Int [] {
    let n = 3; // number of qubits
    mutable result = [0, size=n]; // result of measurement
    use q = Qubit[n]; // array of qubits

    ResetAll(q); // reset all qubits

    H(q[0]); // apply Hadamard gate to the first qubit
    H(q[1]); // apply Hadamard gate to the second qubit
    H(q[2]); // apply Hadamard gate to the third qubit

    // measure all qubits
    for i in 0..n-1 {
        set result w/= i <- M(q[i]) == One ? 1 | 0;
    }

    ResetAll(q); // reset all qubits
}
```

```
    return result;  
}
```

```
[ ]: ApplyHadamardGate
```

### 1.2.2 Simulate the Q# Operation

Simulate the Q# operation `ApplyHadamard` with `n = 3` qubits.

```
[ ]: %simulate ApplyHadamardGate
```

```
[ ]: 1, 0, 0
```

## 1.3 Resources

- [Q# and the Quantum Development Kit](#)
- [Q# Language](#)