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

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

1.2 Q# Example - Apply Hadamard Gates

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`.

[ ]:
```
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
```

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