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CSCI 4140U

Laboratory Five

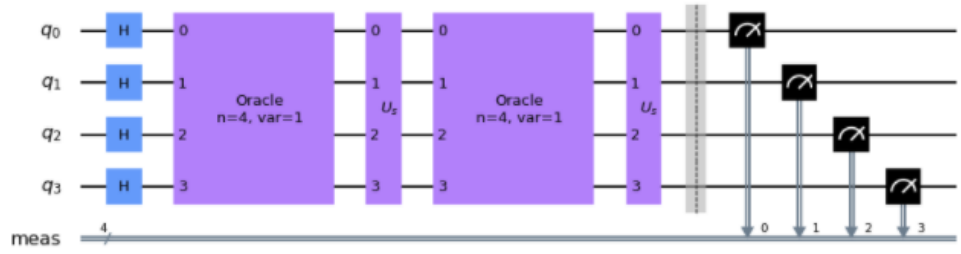
Laboratory Activity

The first activity is to use variant=0. You will see that this variant has 1 solution so you will need to use 2 iterations of the algorithm. Cut and Paste the circuit and your plot and add them to your report.

In [43]:
```
n = 4
oracle = grover_problem_oracle(n, variant=1, print_solutions = True)
qc = QuantumCircuit(n)
qc = initialize_s(qc, [0,1,2, 3])
qc.append(oracle, [0,1,2,3])
qc.append(diffuser(n), [0,1,2, 3])
qc.append(oracle, [0,1,2,3])
qc.append(diffuser(n), [0,1,2,3])
qc.measure_all()
qc.draw('mpl')
```

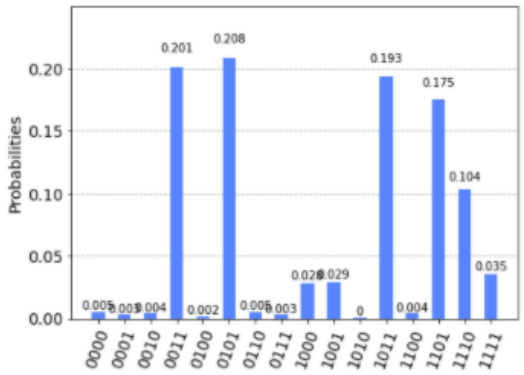
```
Solutions:
|0111>
|1001>
```

Out[43]:



In [44]:
```
backend = Aer.get_backend('qasm_simulator')
results = execute(qc, backend=backend, shots=1024).result()
answer = results.get_counts()
plot_histogram(answer)
```

Out[44]:

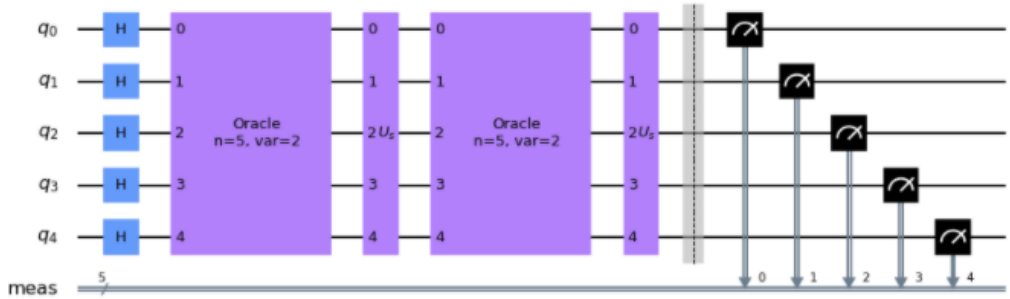


For the second activity create an oracle with 5 qubits and variant 2. This oracle has one solution with 5 qubits. We have √5≈2.24, so 2 iterations probably won't work. Give this oracle a try with 2 iterations to see if that is enough. If not, go to 3 iterations. Again, cut and paste the circuit and plot into your report.

In [51]:
```
#two iterations
n = 5
oracle = grover_problem_oracle(n, variant=2, print_solutions = True)
qc = QuantumCircuit(n)
qc = initialize_s(qc, [0,1,2,3,4])
qc.append(oracle, [0,1,2,3,4])
qc.append(diffuser(n), [0,1,2, 3,4])
qc.append(oracle, [0,1,2,3,4])
qc.append(diffuser(n), [0,1,2,3,4])
qc.measure_all()
qc.draw('mpl')
```

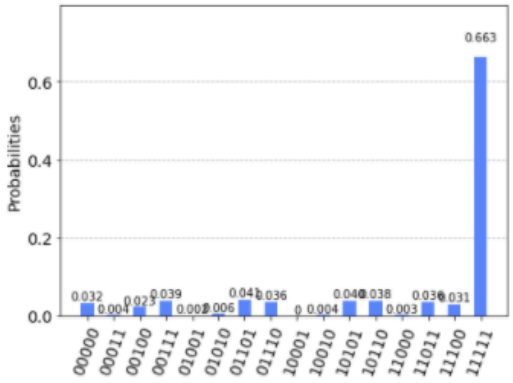
```
Solutions:
|00100>
```

Out[51]:



In [53]:
```
backend = Aer.get_backend('qasm_simulator')
results = execute(qc, backend=backend, shots=1024).result()
answer = results.get_counts()
plot_histogram(answer)
```

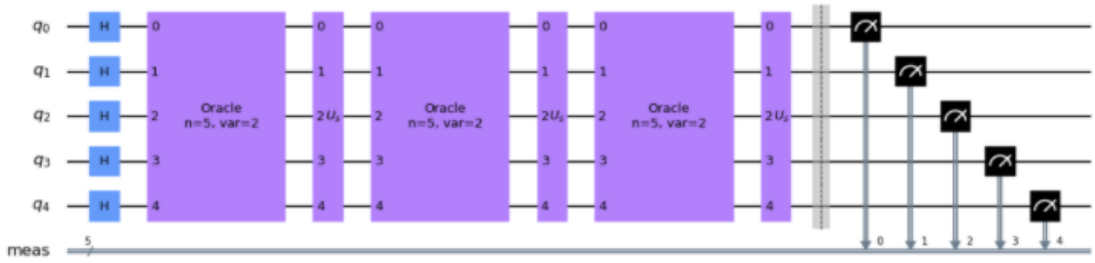
Out[53]:



In [55]:
```
#three iterations
n = 5
oracle = grover_problem_oracle(n, variant=2, print_solutions = True)
qc = QuantumCircuit(n)
qc = initialize_s(qc, [0,1,2,3,4])
qc.append(oracle, [0,1,2,3,4])
qc.append(diffuser(n), [0,1,2, 3,4])
qc.append(oracle, [0,1,2,3,4])
qc.append(diffuser(n), [0,1,2,3,4])
qc.append(oracle, [0,1,2,3,4])
qc.append(diffuser(n), [0,1,2,3,4])
qc.measure_all()
qc.draw('mpl')
```

```
Solutions:
|00100>
```

Out[55]:



In [56]:
```
backend = Aer.get_backend('qasm_simulator')
results = execute(qc, backend=backend, shots=1024).result()
answer = results.get_counts()
plot_histogram(answer)
```

Out[56]: