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CSCI 4140U

Laboratory Nine

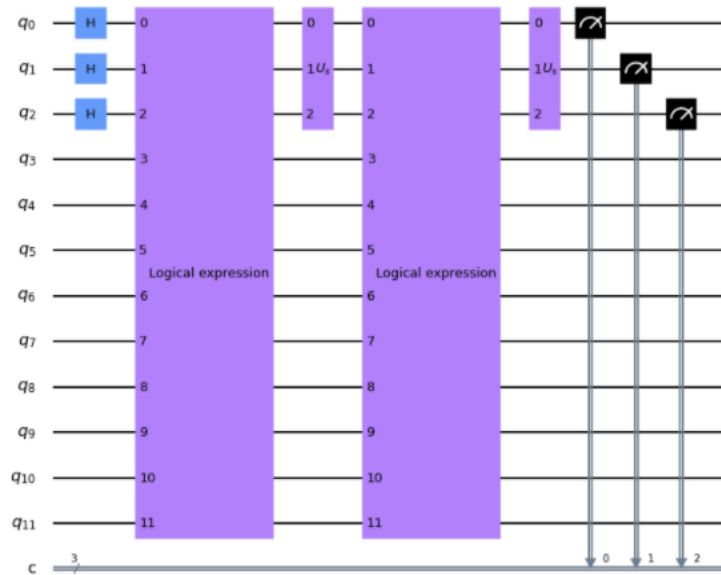
Laboratory Exercise

Now for the interesting part of the experiment. We have only done one iteration of Grover's algorithm. The results that we've got look reasonable. But what happens when we do more iterations? For your part of the laboratory try two and three iterations of Grover's algorithm. Remember increasing the number of iterations is just a matter of cutting and pasting two lines of code. Cut and paste the histograms that you produce into the report for this laboratory. What do you observe from this experiment? Submit your report as a PDF or PNG file.

Two Iterations;

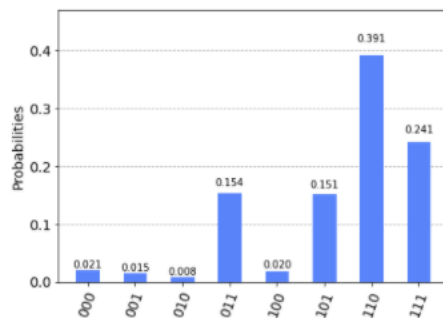
```
In [31]: qc = QuantumCircuit(12,3)
         oracle_gate = orc.to_gate()
         oracle_gate.name = 'Logical expression'
         qc = initialize_s(qc,[0,1,2])
         qc.append(oracle_gate, [0,1,2,3,4,5,6,7,8,9,10,11])
         qc.append(diffuser(3), [0,1,2])
         qc.append(oracle_gate, [0,1,2,3,4,5,6,7,8,9,10,11])
         qc.append(diffuser(3), [0,1,2])
         qc.measure([0,1,2],[0,1,2])
         qc.draw('mpl')
```

Out[31]:



```
In [32]: backend = Aer.get_backend('qasm_simulator')
         results = execute(qc, backend=backend, shots=1024).result()
         answer = results.get_counts()
         plot_histogram(answer)
```

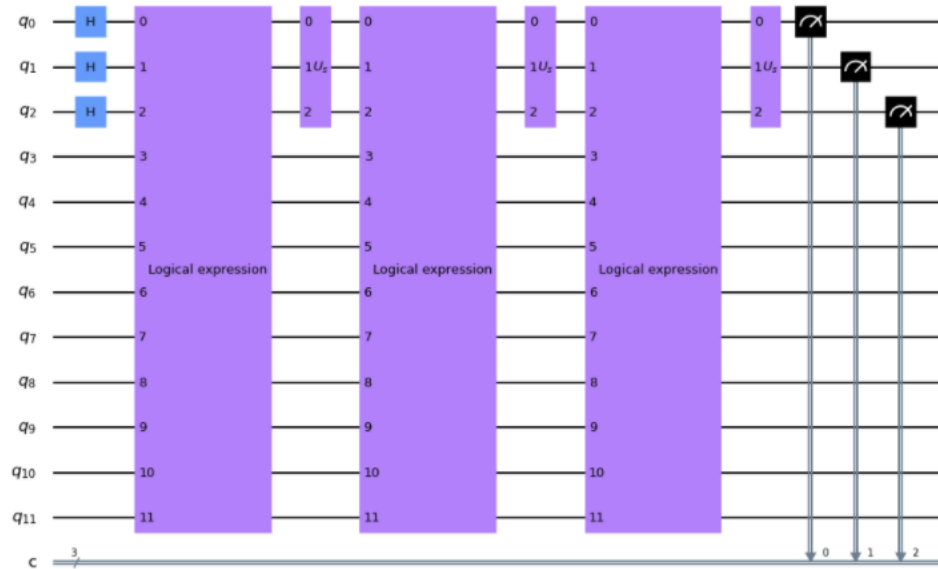
Out[32]:



Three Iterations;

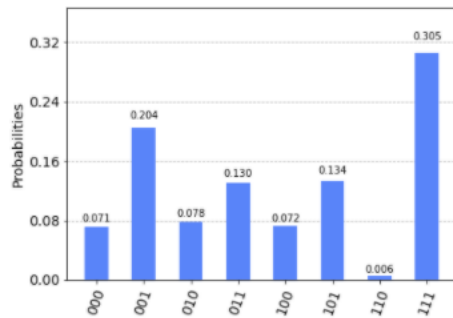
```
In [33]: qc = QuantumCircuit(12,3)
oracle_gate = orc.to_gate()
oracle_gate.name = 'logical expression'
qc = initialize_s(qc,[0,1,2])
qc.append(oracle_gate, [0,1,2,3,4,5,6,7,8,9,10,11])
qc.append(diffuser(3), [0,1,2])
qc.append(oracle_gate, [0,1,2,3,4,5,6,7,8,9,10,11])
qc.append(diffuser(3), [0,1,2])
qc.append(oracle_gate, [0,1,2,3,4,5,6,7,8,9,10,11])
qc.append(diffuser(3), [0,1,2])
qc.measure([0,1,2],[0,1,2])
qc.draw('mpl')
```

Out[33]:



```
In [34]: backend = Aer.get_backend('qasm_simulator')
results = execute(qc, backend=backend, shots=1024).result()
answer = results.get_counts()
plot_histogram(answer)
```

Out[34]:



But what happens when we do more iterations?

The overall values for the probabilities increase with an increase in the number of iterations