MIS Problem Report

Report generated on: 2025-07-24 15:07:51

Graph Details

Number of Nodes: 4
Edges of Nodes: [(0,1), (0,2), (1,2), (1,3)]

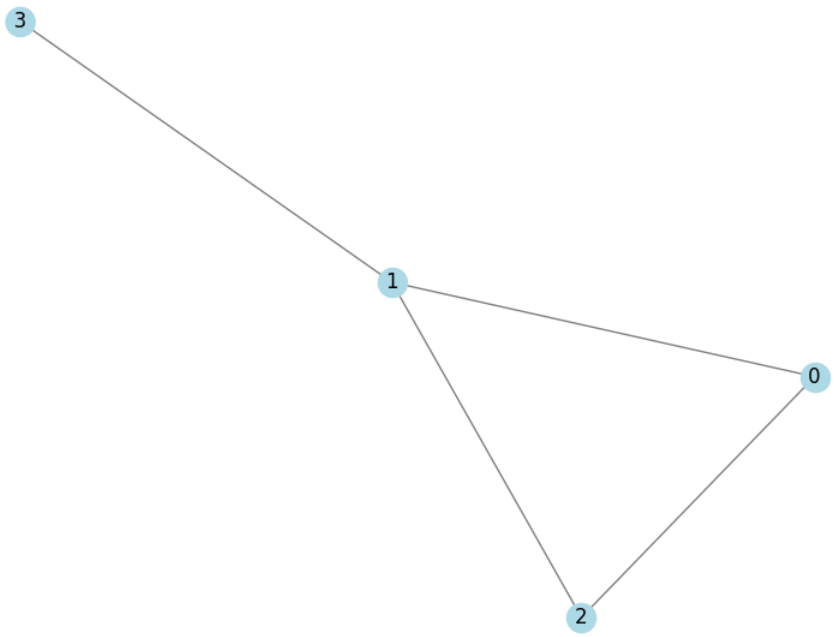

Figure 1: Graph Visualization

0.1 QUBO Matrix Visualization

Converted QUBO matrix visualization:

$$\begin{array}{cccc} -1.0 & 2.0 & 2.0 & 0.0 \\ 0.0 & -1.0 & 2.0 & 2.0 \\ 0.0 & 0.0 & -1.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & -1.0 \end{array}$$

0.2 Oracle Visualization

The corresponding oracle for the MIS is shown below:

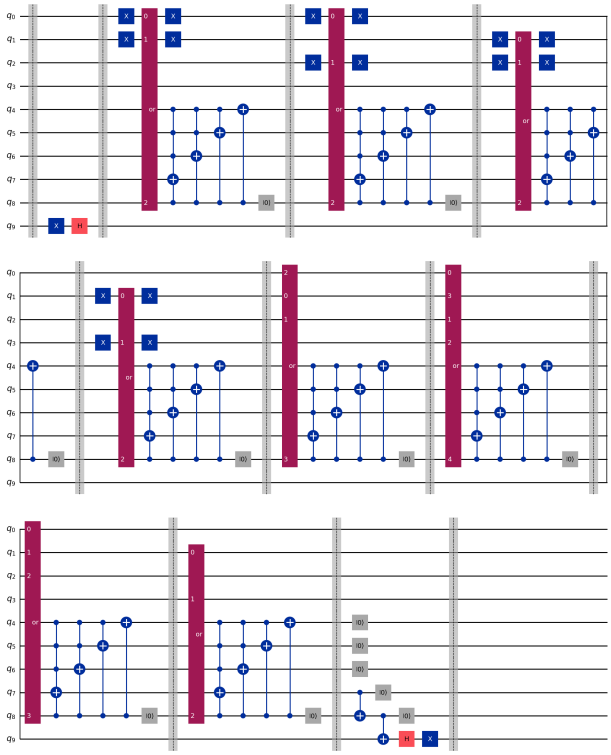

Figure 2: Corresponding Oracle Visualization for the MIS Problem

QAOA Optimization Results

Most Probable Solution for QAOA:

- Variable x_1 is set to true
- Variable x_2 is set to true

- Variable x_3 is set to false
- Variable x_4 is set to false

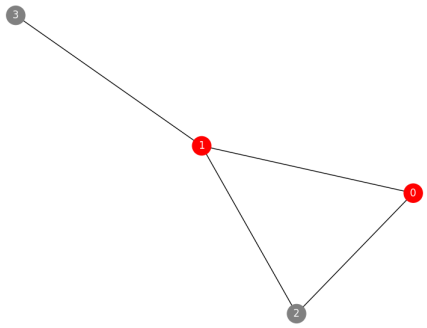

Figure 3: QAOA Result

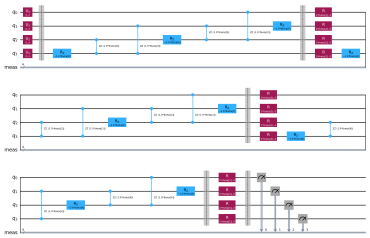

Figure 4: QAOA Quantum Circuit

VQE Optimization Results

Most Probable Solution for VQE:

- Variable x_1 is set to true
- Variable x_2 is set to true
- Variable x_3 is set to false
- Variable x_4 is set to false

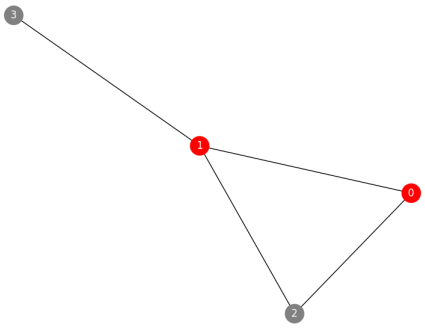

Figure 5: VQE Result

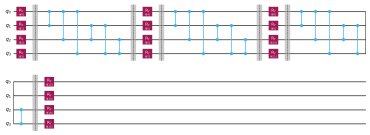

Figure 6: VQE Quantum Circuit

Grover's Algorithm Results

Most Probable Solution for Grover's Algorithm:

- Variable x_1 is set to true
- Variable x_2 is set to true
- Variable x_3 is set to true
- Variable x_4 is set to true

Device Recommendation Summary

\textbf{Here is the device recommendation summary based on error, time, and price:}\
- Lowest error: Quantinuum H1 from Azure Quantum with a calculated error of 3.9%, time to execute: 1939.2 seconds and a price of $56625.0.
- Lowest time: IQM Garnet from Amazon Braket with a calculated error of 79.98%, time to execute: 0.183 seconds and a price of $87.5.
- Lowest price: Rigetti Ankaa-9Q-3 from Azure Quantum with a calculated error of 50.68%, time to execute: 0.33 seconds and a price of $0.43.

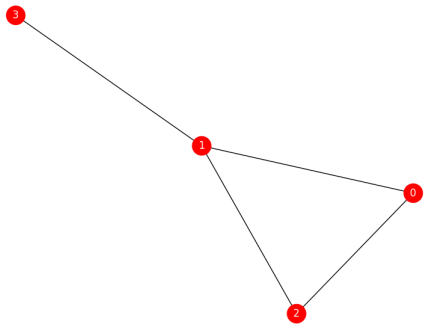

Figure 7: Grover's Algorithm Result

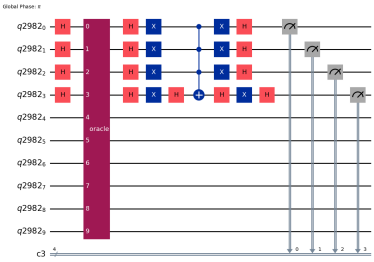

Figure 8: Grover's Quantum Circuit

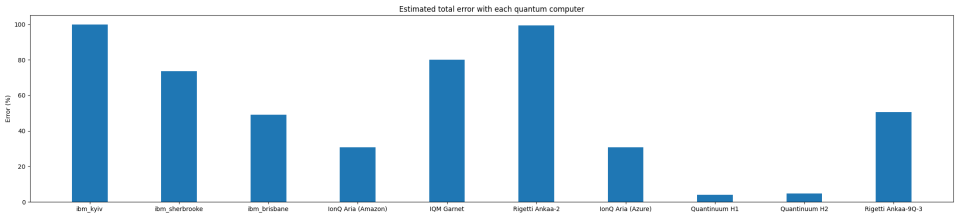

Figure 9: Estimated total error with each quantum computer

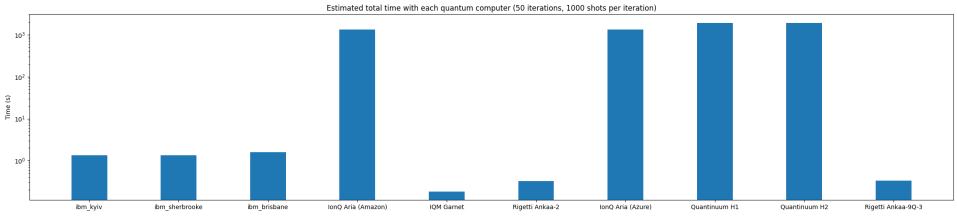

Figure 10: Estimated total time with each quantum computer

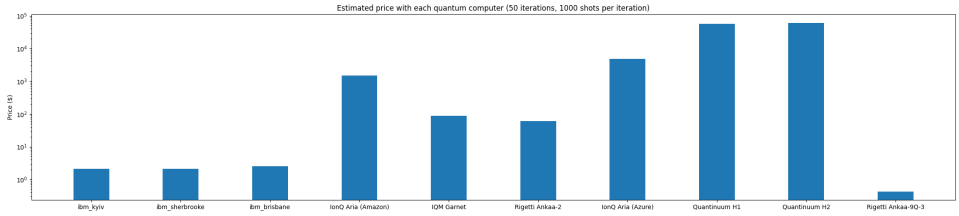

Figure 11: Estimated price with each quantum computer