MIS Problem Report

Report generated on: 2025-10-02 13:53:42

Graph Details

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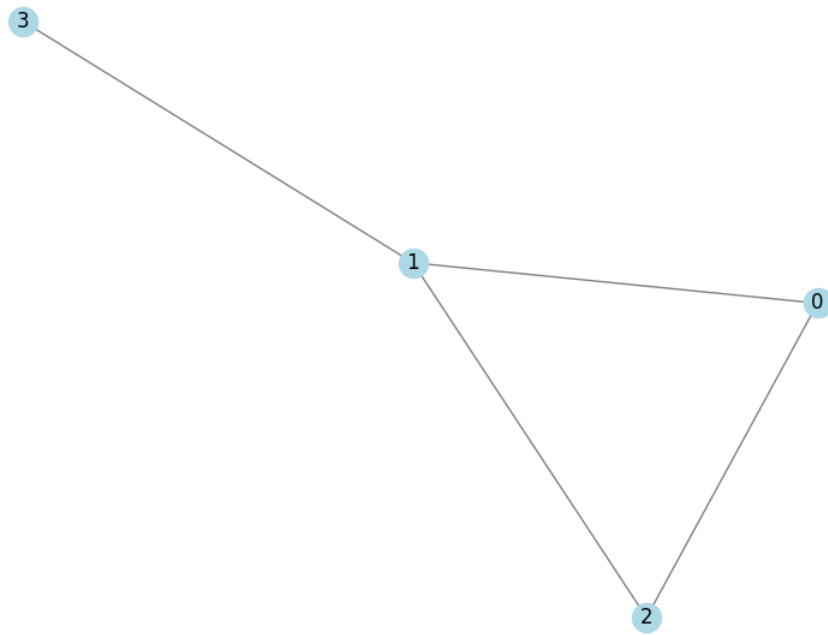

Figure 1: Graph Visualization

0.1 QUBO Matrix Visualization

Converted QUBO matrix visualization:

$$
\begin{matrix}
-1.0 & 2.0 & 2.0 & 0.0 \\
0.0 & -1.0 & 2.0 & 2.0 \\
0.0 & 0.0 & -1.0 & 0.0 \\
0.0 & 0.0 & 0.0 & -1.0
\end{matrix}
$$

0.2   Oracle Visualization

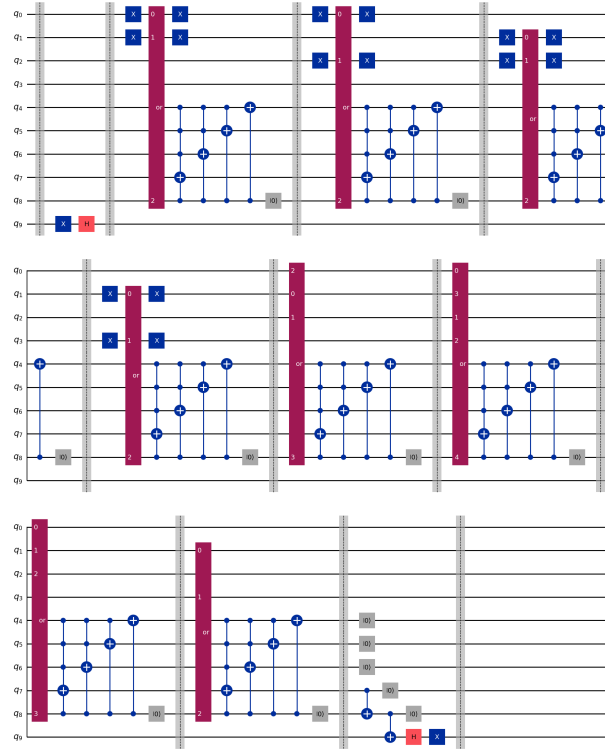The corresponding oracle for the MIS is shown below:

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
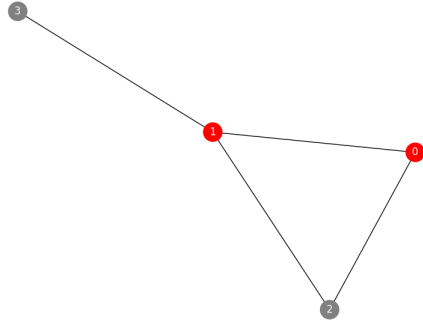
- Variable x_4 is set to false
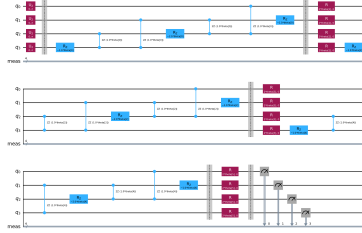

Figure 3: QAOA Result

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

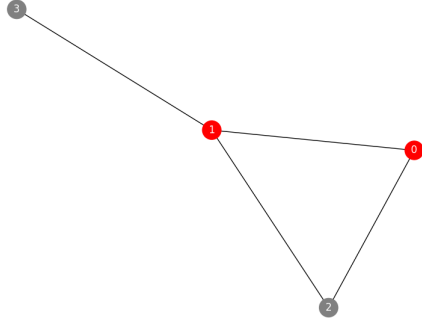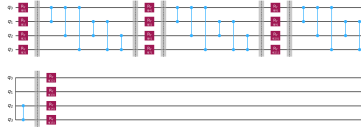- Variable x_4 is set to false

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 false

- 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: 712.95 seconds and a price of $56625.0.
- Lowest time: IQM Garnet from Amazon Braket with a calculated error of 31.58%, 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.
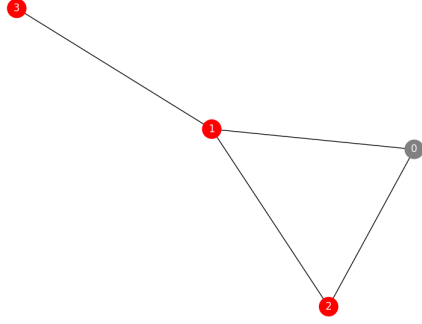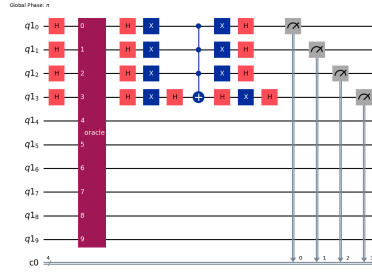
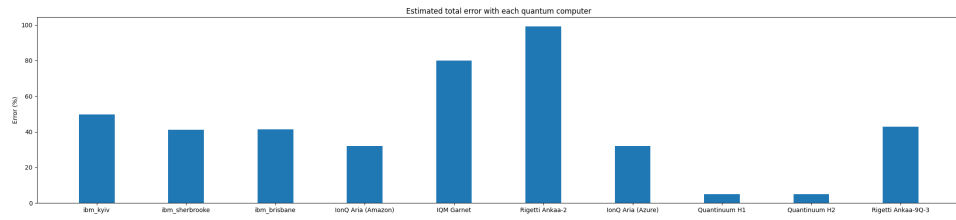Figure 7: Grover's Algorithm Result

Figure 8: Grover's Quantum Circuit

Figure 9: Estimated total error with each quantum computer
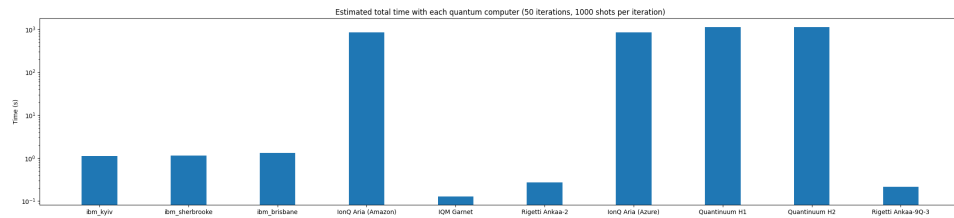
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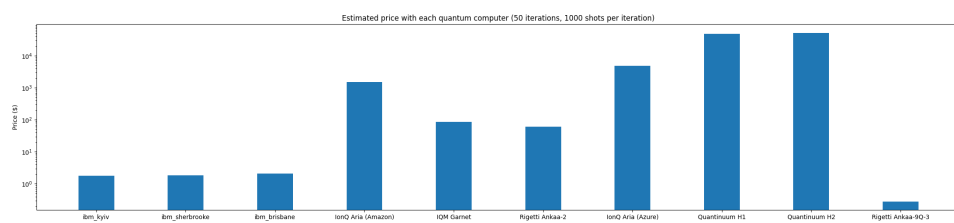Figure 10: Estimated total time with each quantum computer

Figure 11: Estimated price with each quantum computer