

Independent Set Problem Report

Report generated on: 2025-06-09 11:10:44

Graph Details

Number of Nodes: 4

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

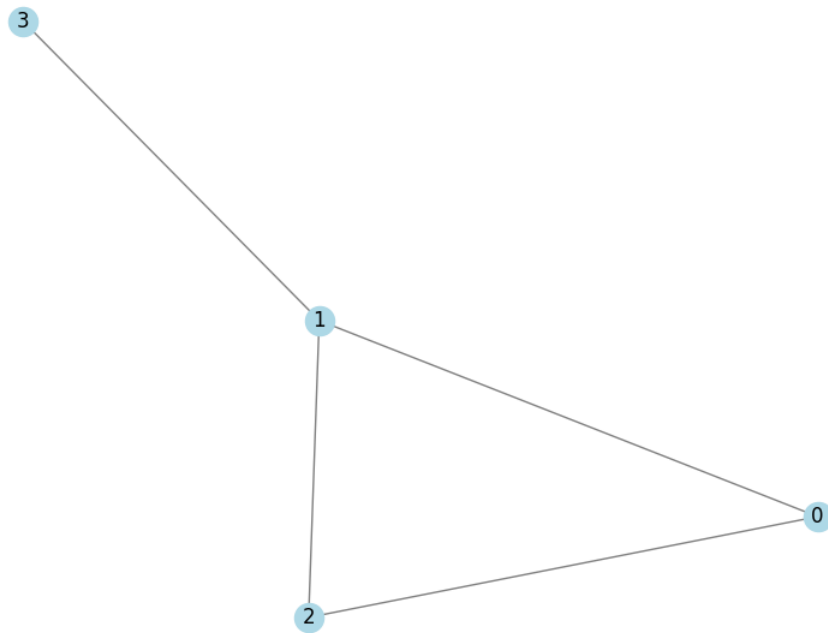


Figure 1: Graph Visualization

0.1 QUBO Matrix Visualization

Converted QUBO matrix visualization:

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

0.2 Oracle Visualization

The corresponding oracle for the Independent Set problem is shown below:

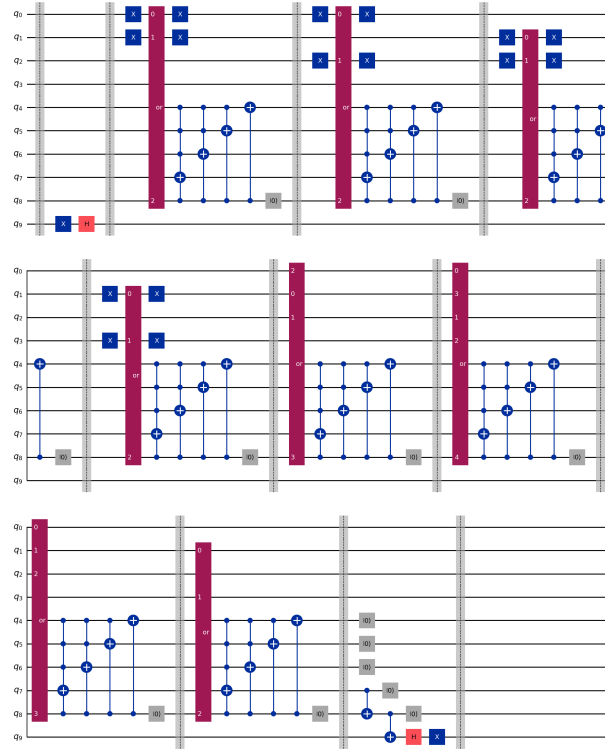


Figure 2: Corresponding Oracle Visualization for the Independent Set Problem

QAOA Optimization Results

Most Probable Solution for QAOA:

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

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

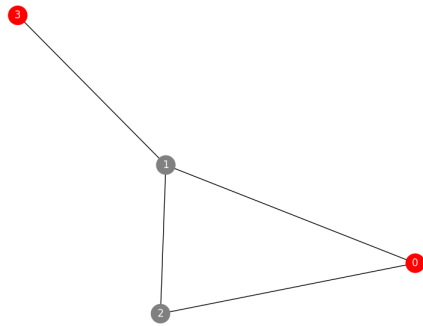


Figure 3: QAOA Result

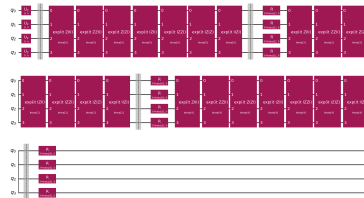


Figure 4: QAOA Quantum Circuit

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

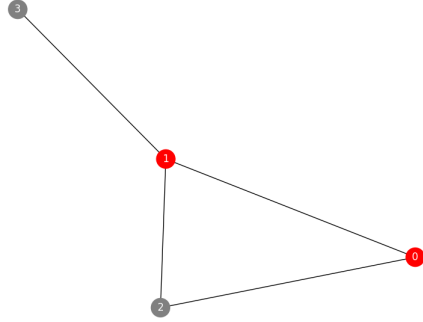


Figure 5: VQE Result

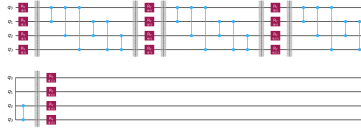


Figure 6: VQE Quantum Circuit

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 false

Device Recommendation Summary

Here is the device recommendation summary based on error, time, and price:\

- Lowest error: Quantinuum H1 from Azure Quantum with a calculated error of 2.55%, time to execute: 15162.352941 seconds and a price of \$44750.0.
- Lowest time: IQM Garnet from Amazon Braket with a calculated error of 26.28%, 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 31.76%, time to execute: 0.192 seconds and a price of \$0.25.

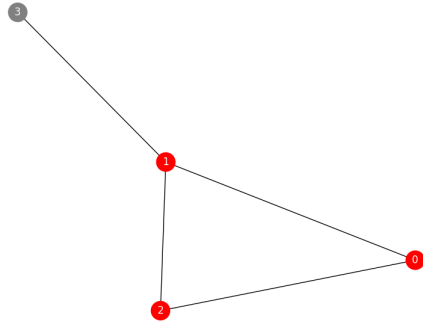


Figure 7: Grover's Algorithm Result

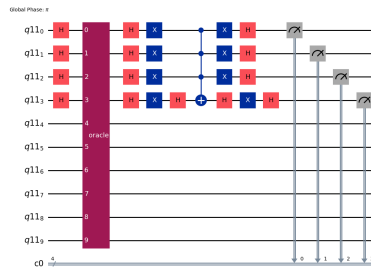


Figure 8: Grover's Quantum Circuit

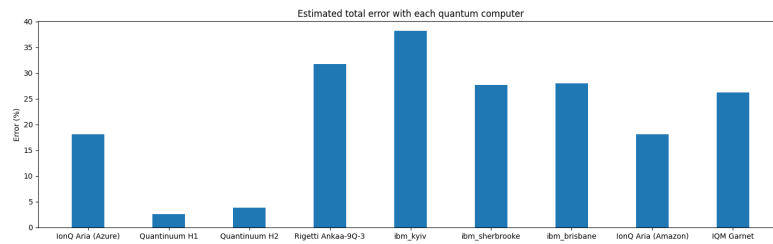


Figure 9: Estimated total error with each quantum computer

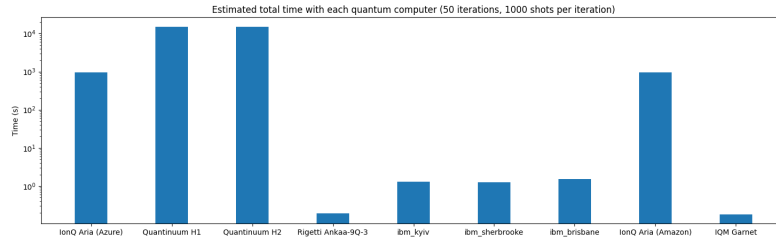


Figure 10: Estimated total time with each quantum computer

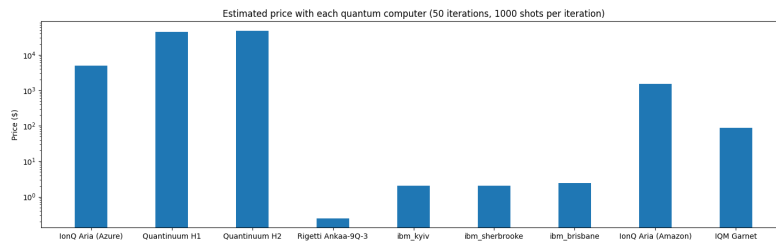


Figure 11: Estimated price with each quantum computer