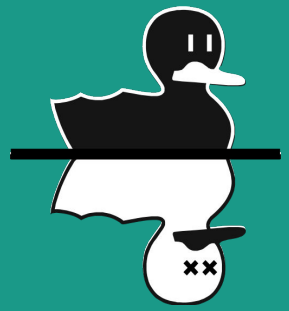
q

iQuHack 2023



x

IQuEra

Computing Inc.

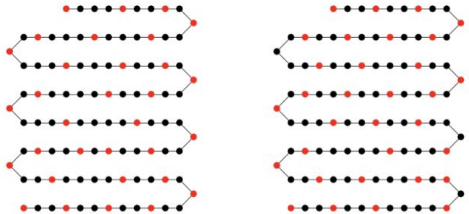
Problem

Find the Maximal Independent Set of a graph on a neutral atom quantum computer.

Approach

Adjusting Graphs

1. Higher number of qubits and density
2. Cycling through different, random graph types



State Preparation and Optimizers Approach

Adiabatic Evolution

1. Strength of the transverse field (Ω)
2. Strength of the detuning Δ
3. Phase Factor φ

QAOA

Approach

Choose the graph – applications?

Take the radius into account as the Unit Disk Graph (UDG) is generated

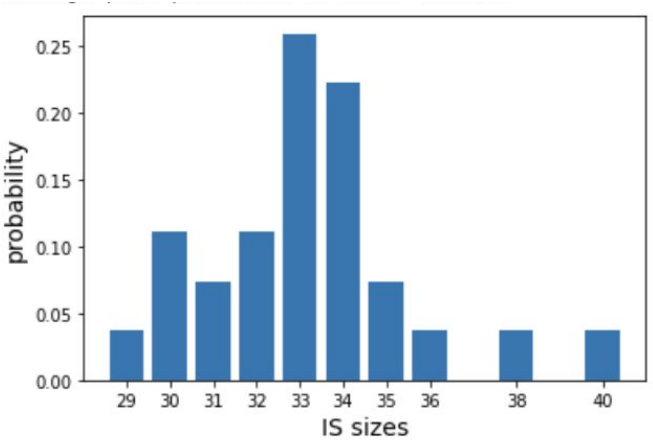
Balance optimization of the graphs, the pulse parameters (amplitude, detuning, phase), and protocols other than adiabatic evolution

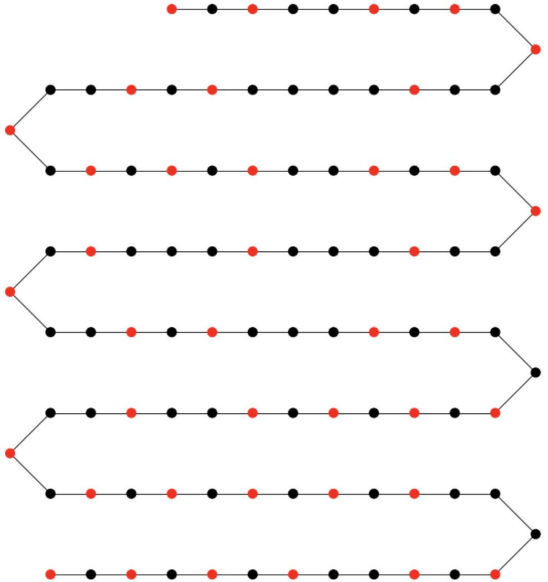
Graph, Hamiltonian parameters, optimization protocol

Implementation and Results

100 Node/Qubit “Snake”

70 shots





Average pre-processed size: 34.9571
Average post-processed IS size: 33.1852

King's Graph

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Average pre-processed size:  28.5714
Average post-processed IS size: 27.0667
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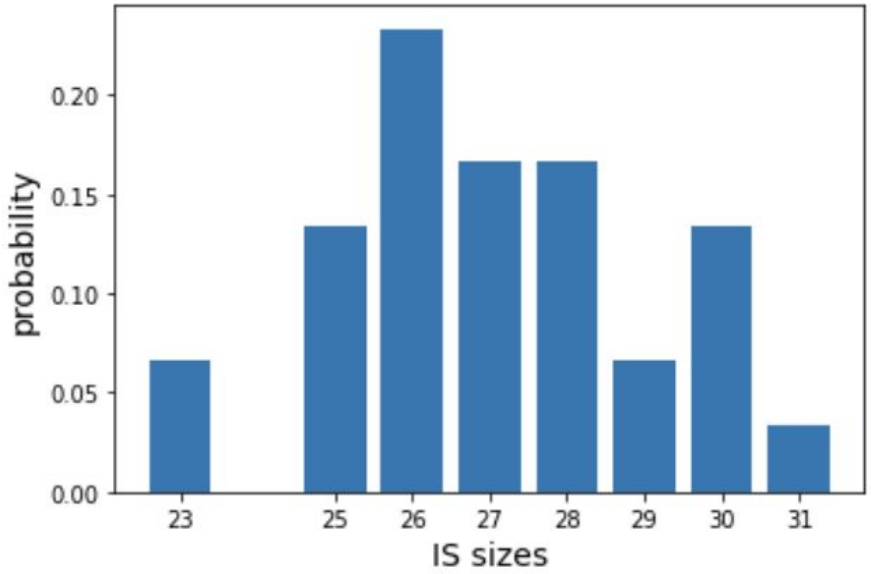
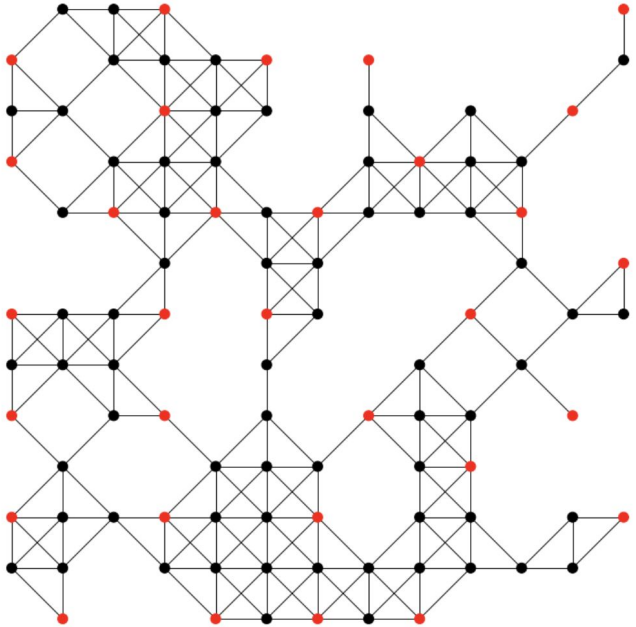
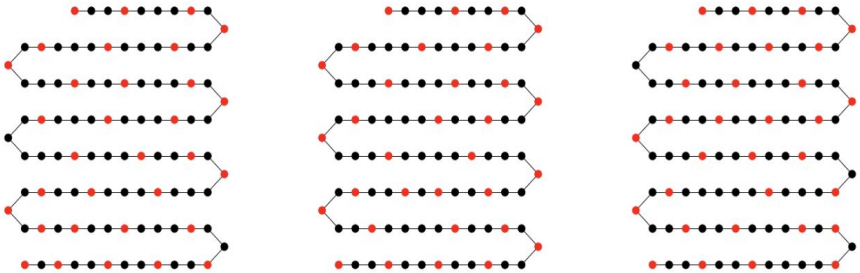




100 Node “Snake” 70 shots

Adiabatic evolution from Pitcher et. al.
Smaller blockade radius



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Average pre-processed size:  31.4429
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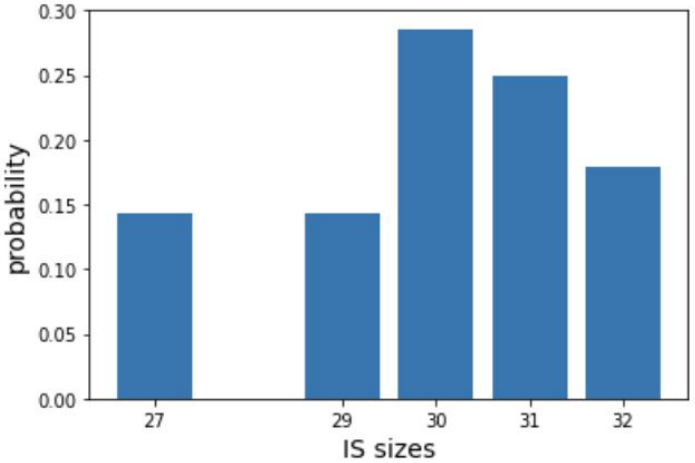
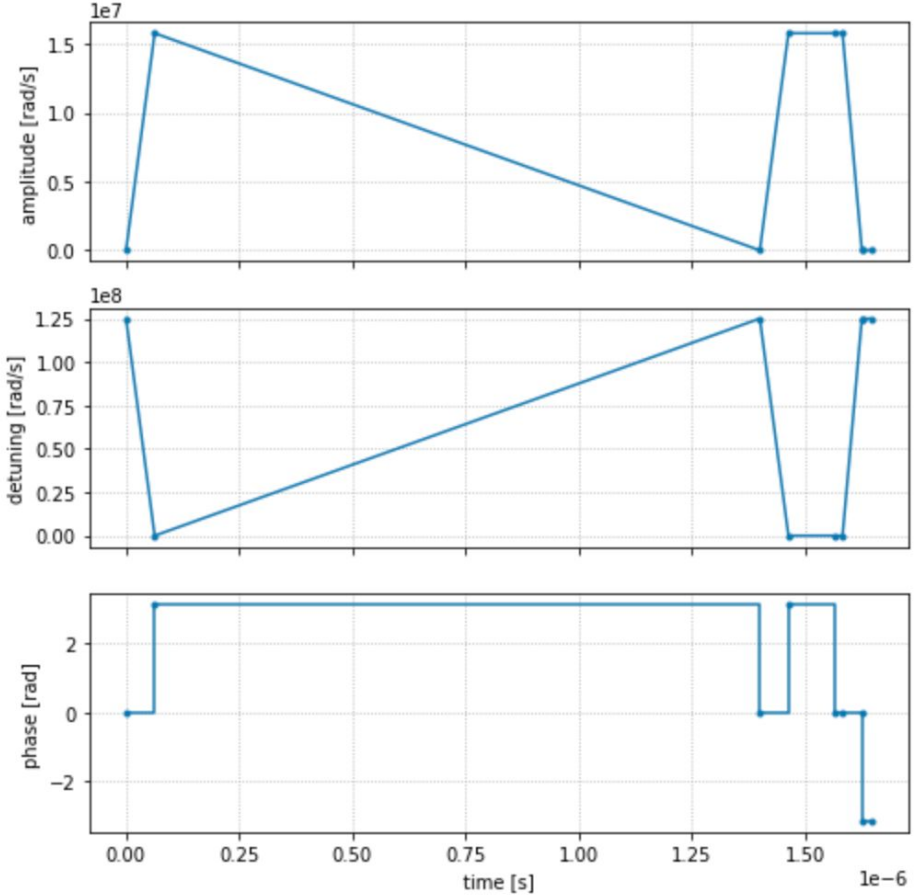


QAOA

Results not shown –failed to converge to MIS due to converging at local minima



Future Work

- In-depth analysis of how optimization protocols (state preparation) correlate to the graph type
- Exploring control of individual Rydberg blockade radii when that functionality is added
- Improving and increasing classical optimization protocol use
- Applying our research to map coordinates or other “real-world” problems