Quantum Computing **Project Abstract**

Prioritizing Patch Management for Cybersecurity using Quantum-Inspired Vertex Cover Algorithm

Introduction

Patch management is crucial for cybersecurity, as unpatched vulnerabilities create pathways for attackers. Traditional prioritization methods often rely on severity scores, which might not capture the interconnectedness of vulnerabilities. This project explores the potential of quantum computing for prioritizing patches by applying the Minimum Vertex Cover problem to identify critical vulnerabilities, effectively disrupting potential attack paths.

Problem Statement

Existing patch management approaches often prioritize vulnerabilities based on individual severity scores, neglecting the interconnectedness of vulnerabilities and potential "kill chains" used by attackers. This project addresses the challenge of developing a novel approach that prioritizes patches by considering the network structure and connections between vulnerabilities.

Methodology

This project leverages the Minimum Vertex Cover problem and quantum computing frameworks like Classiq to analyse vulnerability data represented as a bipartite graph. A dual graph capturing connections between vulnerabilities is constructed. By solving the Minimum Vertex Cover problem on the dual graph using the QAOA algorithm, we aim to identify a minimal set of vulnerabilities to patch, effectively disrupting potential kill chains.

Expected Outcomes

We expect this project to demonstrate the potential of quantum computing for prioritizing patch management by:

- Identifying critical vulnerabilities that disrupt a larger number of potential attack paths.
- Comparing the effectiveness of the quantum-inspired approach with traditional methods based on metrics like reduced kill chains and prioritization efficiency.
- Highlighting the potential of quantum-inspired algorithms for future advancements in cybersecurity optimization.

References

- Patching Management - Classiq
- [2211.13740] Cutting Medusa's Path -- Tackling Kill-Chains with Quantum Computing (arxiv.org)
- [1907.04769] Improving Variational Quantum Optimization using CVaR (arxiv.org)