Quantum algorithm adopted by Google and IBM

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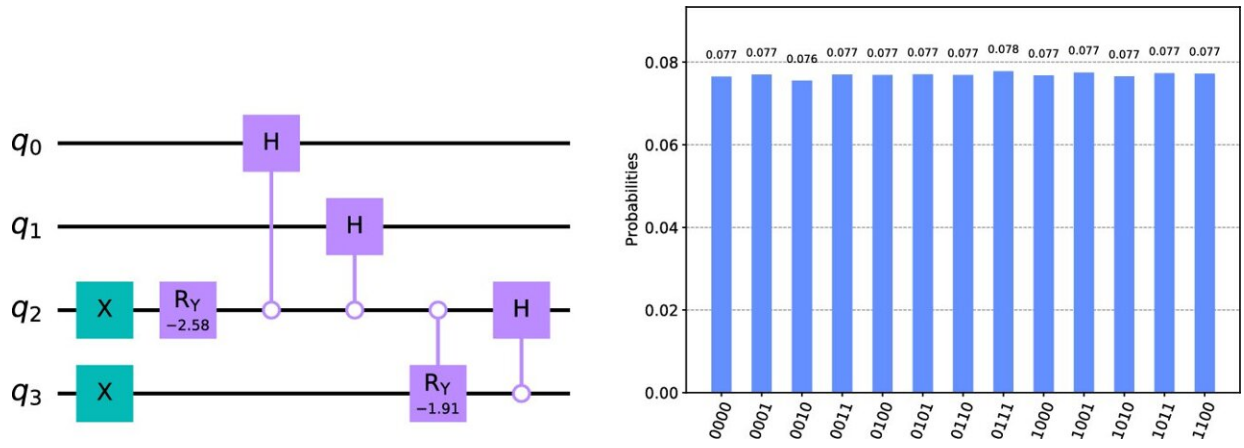

A quantum circuit for creating the uniform quantum superposition state given in Eq. (2.29) is shown on the left. This corresponds to the case ⍰⍰ = 13 in Example 2.4.1. A histogram representing the sampling probabilities of obtaining various computational basis states is shown on the right. Credit: *Quantum Information Processing* (2024). DOI: 10.1007/s11128-024-04258-4

An algorithm developed by Prakash Vedula, Ph.D., a professor at the University of Oklahoma School of Aerospace and Mechanical Engineering, has been incorporated into advanced computing software developed by Google and IBM. The algorithm is remarkable for its exponential improvement over previous methods.

This breakthrough in the field of quantum computing was published in

Quantum Information Processing earlier this year. The algorithm focuses on creating uniform quantum superposition states, a critical part of quantum computing, and drastically reduces the complexity of this step. This efficiency is not just theoretical—it has practical applications across various fields, including quantum search, optimization, solution of differential equations, signal processing, cryptography, finance and artificial intelligence.

The Shukla–Vedula algorithm, named after Vedula and his former student and research collaborator Alok Shukla, Ph.D., offers a substantially more efficient approach to reducing the complexity of a fundamental step required for many quantum algorithms.

Recently, major quantum software platforms developed by Google and IBM—Cirq and Qiskit, respectively—integrated the Shukla–Vedula algorithm into their latest software versions. These platforms are widely used in industry and academia, and the adoption of this algorithm highlights its significance. Additionally, Goldman Sachs has already begun using this algorithm to analyze financial risks in financial derivatives.

"In our research group, we focus on high-risk, high-impact projects. Exponential advancements in any scientific discipline are extremely rare," said Vedula. "Our algorithm demonstrates an exponential improvement over previous methods in the literature, all without the need for additional resources."

As the algorithm continues to gain traction, Professor Vedula is optimistic about its future impact. "We expect this innovation to drive significant improvements in quantum computing across various applications. These are truly exciting times for the field of quantum computing."

Details on the implementation of this algorithm and its associated user interface can be found on the software documentations of Cirq and Qiskit.

More information: Alok Shukla et al, An efficient quantum algorithm for preparation of uniform quantum superposition states, *Quantum Information Processing* (2024). DOI: 10.1007/s11128-024-04258-4

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