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A STUDY OF INCLUSIVE ARRANGEMENT OF QUANTUM GATES WITH CAPACITY GAUGE QUBITS

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ABSTRACT

As quantum computers become available to the general public, the need has arisen to train a cohort of quantum programmers, many of whom have been developing classical computer programs for most of their careers. While currently available quantum computers have less than 100 qubits, quantum computing hardware is widely expected to grow in terms of qubit count, quality, and connectivity. This review aims to explain the principles of quantum programming, which are quite different from classical programming, with straightforward algebra that makes understanding of the underlying fascinating quantum mechanical principles optional. We give an introduction to quantum computing algorithms and their implementation on real quantum hardware. We show how these algorithms can be implemented on IBM's quantum computer, and in each case, we discuss the results of the implementation with respect to differences between the simulator and the actual hardware runs. This article introduces computer scientists, physicists, and engineers to quantum algorithms and provides a blueprint for their implementations. This development in this area has been so pronounced that many in the field of quantum information, specifically researchers who are new to quantum information or people focused on the many other important issues in quantum computation, have found it difficult to keep up with the general formalisms and methodologies employed in this area. Rather than introducing these concepts from a rigorous mathematical and computer science framework, we instead examine error correction and fault-tolerance largely through detailed examples, which are more relevant to experimentalists today and in the near future.

Keywords: Quantum Gates, Capacity Gauge Qubits, Quantum Programmers