

As quantum computers become a practical reality, there is a need for development tools to enable their usage without requiring developers to assimilate detailed knowledge of quantum informatics processing (QIP). As developers begin to generate new software for quantum computers, a need will arise to generate quantum computer (QC) programs that adhere to the requirements for QIP. For example, a developer who wishes to apply Grover's search algorithm for a custom searching application will need to at least specify the oracle in some form.

As a consequence of the axioms of quantum mechanics, QIP operations are mathematically modeled as unitary transformations over finite Hilbert spaces. Therefore, such operations are necessarily reversible meaning that the underlying transformations are bijective. It is necessary to convert irreversible functions into reversible forms to adhere to QC paradigms and to minimize quantum cost. To achieve this goal, we created the *RTT* methodology to produce reversible specifications of an irreversible function while minimizing the number of required ancilla and garbage qubits. To validate the functionality and effectiveness of the *RTT* method, we implemented the algorithms and ran them in an environment where benchmark irreversible functions were used and mapped to reversible forms. In each case we were able to create reversible forms of these functions that use less ancilla and garbage qubits than those present in the RevLib collection.

A) In each case we were able to create reversible forms of these functions to achieve our theoretical minimum number of ancilla and garbage bits.

B) In each case we were able to create reversible forms of these functions that use less ancilla and garbage qubits than those determined by RevLib.