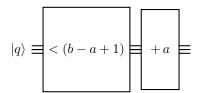
Documentation of Implementation B

Documentation for implementing the oracle 'Interval [a, b]' using the implementation B (previously described).

Oracle as Black Box



Oracle as its components



Unitary Matrix of Oracle

Ideas inspiring the oracle

This oracle reuses the less-than oracle and the addition oracle. Firstly, it applies a less-than oracle (give a π -phase to a number of states) and then applies an addition oracle, shifting the marked states to the desired positions. Firstly it applies the oracle 'less-than b-a+1', and then the oracle '+a', marking all the states in the interval [a, b].

Classical algorithm which builds the oracle

Parameters needed for the classical algorithm which builds the oracle.

Parameters of the function:

- a: Lower boundary of the range of integers.
- b: Upper boundary of the range of integers.
- n: Number of qubits.

Parameters of the oracle:

• Which qubits of the general circuit is the oracle applied to.

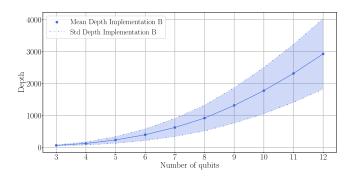
Conditions:

- Precondition: Input state must be the full superposed state with relative 0-phase.
- Postcondition: Full superposed state with a π -phase on states within range [a, b].

Oracle Circuit

The details in this section are given with respect to a specific backend. In this case, FakeWashingtonV2 from Qiskit.

Depth:



Gate Set:

- The oracle requires a universal gate set (Clifford and T gates).
- The backend FackeWashingtonV2 has the following gate set: CX, RZ, S, X.

Assumptions over connections:

• The oracle assumes that each qubit is connected to the rest of the qubits.