

Exercise Set 4

Quantum Computer Programming

Exercises from [Asfaw19] 1.4 Single Qubit Gates:

1.
 - (a) Write the H -gate as the outer products of vectors $|0\rangle$, $|1\rangle$, $|+\rangle$ and $|-\rangle$
 - (b) Show that applying the sequence of gates: HZH , to any qubit state is equivalent to applying an X -gate.
 - (c) Find a combination of X , Z and H -gates that is equivalent to a Y -gate (ignoring global phase).

2.
 - (a) If we initialize our qubit in the state $|+\rangle$, what is the probability of measuring it in state $|-\rangle$?
 - (b) Use Qiskit to display the probability of measuring a $|0\rangle$ qubit in the states $|+\rangle$ and $|-\rangle$ (Hint: you might want to use `.get_counts()` and `plot_histogram()`).
 - (c) Try to create a function that measures in the Y -basis.

References

- [Asfaw19] Abraham Asfaw et al., Learn Quantum Computation Using Qiskit. Qiskit Development Team. 2019