Problem 1

Show that $U_{QFT} |0\rangle^\otimes n = H^\otimes n |0\rangle^\otimes n$

Problem 2

Use Shor’s Algorithm to factor the number 15. (Show every step and draw the appropriate order finding circuit)
Problem 3: Grover Search (with QuTip!)

In this problem, you will be using QuTip to implement Grover’s Search Algorithm for an unsorted list of length 4! Here is the circuit for Grover’s algorithm that you should implement in QuTip:

In blue, we provide the 4 different oracles for a list of length 4. Implement all 4 of them and test them with the indicated input. **Attach a copy of your code and output to the pset.** Below, next to each of the oracle names write which state it produces: \( |00\rangle, |01\rangle, |10\rangle, \text{ or } |11\rangle.\)

**Oracle A)**

**Oracle B)**

**Oracle C)**

**Oracle D)**

What do each of the output states represent in Grover’s algorithm?

How much time did you spend on this pset