Quantum Computing

Exercises 8: Quantum Phase Estimation

Quantum Phase Estimation is an algorithm developed to estimate the phase θ of given Unitary U with eigenvalues $e^{2i\pi\theta}$.

1. *Implement the Quantum Phase Estimation algorithm for the T-gate*

$$T = \begin{bmatrix} 1 & 0 \\ 0 & e^{i\pi/4} \end{bmatrix}$$

to show that it correctly estimates the phase as $\theta = \frac{1}{8}$ *only using n=3 ancilla qubits.*

2. *Show what would happen, in general if the target state is*
(a) The superpostion state $|\psi\rangle = \frac{1}{\sqrt{2}}(|u\rangle + |v\rangle)$*. Where these states are eigenvectors of the unitary.*
(b) Any arbitrary $|\psi\rangle$