

Exercise 5.2

If we have $|j\rangle = |0\rangle = |00 \dots 0\rangle$, we can adopt Fourier transformation and get the final state as

$$F|0\rangle = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} e^{i2\pi 0k} |k\rangle = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} |k\rangle \quad (1)$$