1 Introduction and overview

Exercises: 1.1, 1.2.

1.1

If the function is balanced and we select two random inputs the probability of obtaining the same output is

$$\frac{\frac{2^n}{2} - 1}{2^n - 1} = \frac{2^n - 2}{2^n - 1} \times \frac{1}{2} < \frac{1}{2},$$

so with two evaluations, it is possible to solve Deutsch-Jozsa's problem with error probability $\epsilon < 1/2$.

1.2

If a device can distinguish between two non-orthogonal states $|\psi\rangle$ and $|\phi\rangle$ then it knows each components' amplitudes and phases, so upon identifying the state it can create a copy of it through some unitary acting upon a standard state $|s\rangle$.

Conversely, if a device can clone the states $|\psi\rangle$ and $|\phi\rangle$ then it can create several copies of each, allowing us to perform several measurements and get information about the amplitudes and phases with arbitrary precision, thus allowing us to completely distinguish them.