

The classical solution to this problem requires two calls to the black box, since the function might be constant or not. In the quantum version, you are given an implementation of f as a quantum circuit on two quantum bits,

$$|x_1\rangle \otimes |x_0\rangle \mapsto |x_1\rangle \otimes |x_0 \oplus f(x_1)\rangle, \quad (3.4)$$

with $x_1, x_0 \in \mathbf{F}_2 = \{0, 1\}$. The quantum version can be solved with a single call to the black box. The problem and its solution were suggested by Deutsch in 1985; it is historically one of the first quantum algorithms.