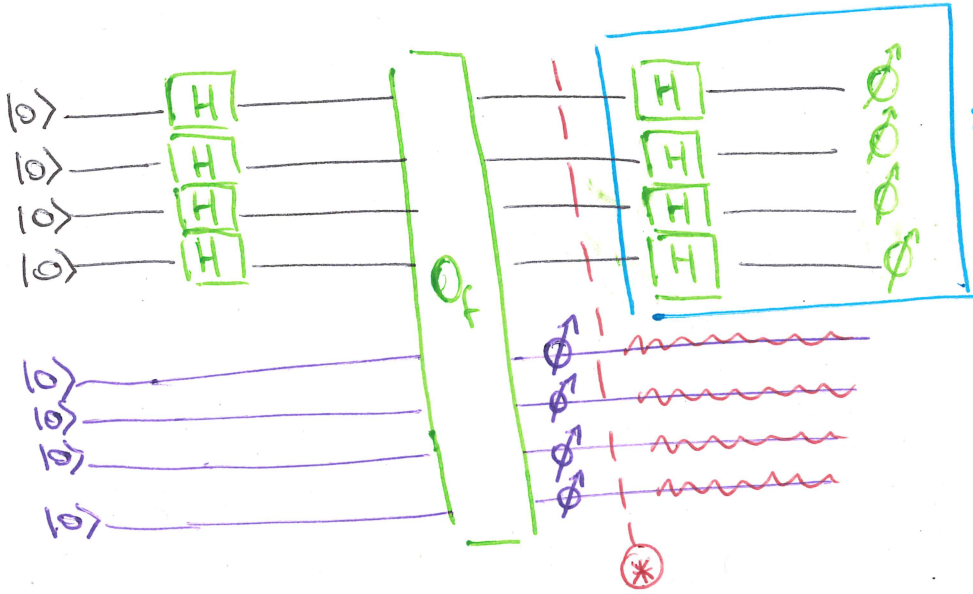


Pre-image of a function

Consider a function $f: \{0,1\}^n \rightarrow \{0,1\}^n$



see Simon's algorithm

$$|0\rangle^{\otimes n} \otimes |0\rangle^{\otimes n}$$

$$(|0\rangle + |1\rangle)^{\otimes n} \xrightarrow{H^{\otimes n} \otimes I}$$

$$\frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n-1} |x\rangle |0\rangle^{\otimes n}$$

$$\downarrow U_f \quad |0\rangle \otimes |f(x)\rangle$$

$$\frac{1}{\sqrt{2^n}} \sum_{x=0}^{2^n-1} |x\rangle |f(x)\rangle$$

$$\downarrow \text{Measurement} \rightarrow y$$

$$\frac{1}{\sqrt{|f^{-1}(y)|}} \sum_{x: f(x)=y} |x\rangle \text{ if measured } y \quad *$$

of x s.t. $f(x)=y$