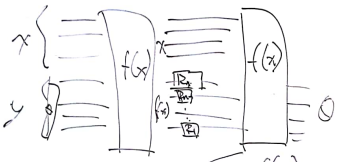
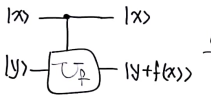
HW7. Q1.

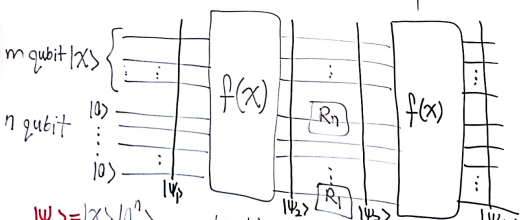




$$e^{\frac{-2\pi i f(x)}{2^n}} = e^{\frac{-2\pi i \sum_j [f(x)]_j 2^j}{2^n}} = \prod_j e^{\frac{-2\pi i [f(x)]_j 2^j}{2^n}}$$

R_{n-j}

$$-2\pi : \left(\sum_k \frac{1}{2^k} (\quad)\right) \quad = f(x)$$



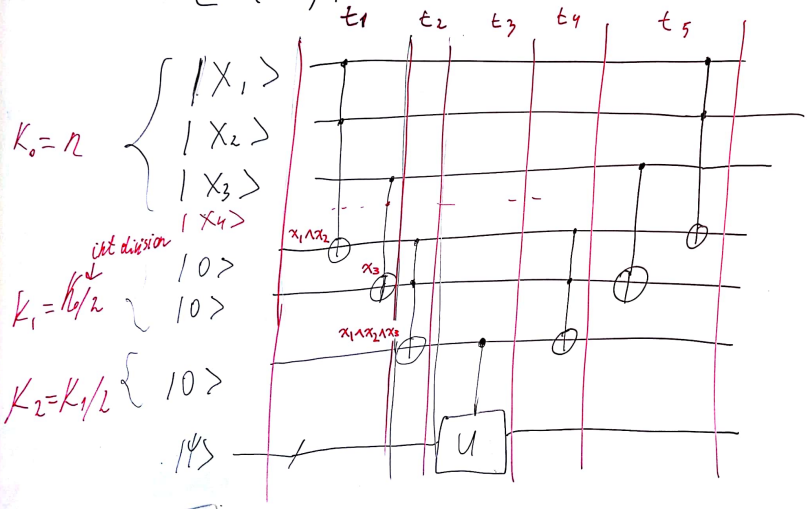
$|\psi_1\rangle = |x\rangle|0^n\rangle \rightarrow |x\rangle|f(x)\rangle \rightarrow |x\rangle R_1 \cdots R_n |f(x)\rangle$

$|\psi_2\rangle$ $|\psi_3\rangle = \exp\left(\frac{-2\pi i f(x)}{2^n}\right)|x\rangle|f(x)\rangle$

$$|\psi_4\rangle = \exp\left(\frac{-2\pi i f(x)}{2^n}\right)|x\rangle|0\rangle$$

HW7. Q2.

$$C^{n}(U)\,|x_1 x_2 \ldots x_n\rangle\,|\psi\rangle = |x_1 x_2 \ldots x_n\rangle\, U^{x_1 x_2 \ldots x_n}\,|\psi\rangle$$



$n = 3$, $|t| = 5$, $n = 4$, $|t| = 5$

$n = 2$, $|t| = 3$, $n = 1$, $|t| = 1$

$n = 2^K$ $\quad \log_2 n = K$

K groups

$|t| = 2K + 1 = O(K) \Rightarrow$

$\Rightarrow |t| = O(\log n)$