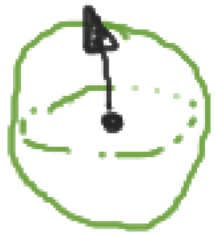
1-Q: $|0\rangle =$  ; $|1\rangle =$ 

$|\tilde{0}\rangle =$  ; $|\tilde{1}\rangle =$ 

$$|\tilde{x}\rangle = \frac{1}{\sqrt{2}}\sum_{y=0}^{y=2-1} e^{i2\frac{\pi}{2}x\cdot y}|y\rangle \Rightarrow \frac{1}{2}\left[e^{\frac{\cancel{2}\pi i}{\cancel{2}}x\cdot 0}|0\rangle + e^{\frac{\cancel{2}\pi}{\cancel{2}}i x\cdot 1}|1\rangle\right]$$

$$\Rightarrow \boxed{\frac{1}{\sqrt{2}}\left[|0\rangle + e^{i\pi x}|1\rangle\right]}$$

$$QFT|0\rangle = \frac{1}{\sqrt{2}}\left[|0\rangle + e^{i\pi\cdot 0}|1\rangle\right] = \underbrace{\frac{1}{\sqrt{2}}\left[|0\rangle + |1\rangle\right]} = |+\rangle$$

$$QFT|1\rangle = |-\rangle$$

$e^{i\theta} = \cos\theta + i\,\mathrm{sen}\,\theta$

$\theta = \pi \Rightarrow \boxed{e^{i\pi} + 1 = 0}$

2: Ingredientes

1) $\underline{H}\,|x_k\rangle \Rightarrow |\tilde{0}\rangle = (|\underline{0}\rangle + |\underline{1}\rangle)/\sqrt{2}$

$|\tilde{1}\rangle = (|\underline{0}\rangle - |\underline{1}\rangle)/\sqrt{2}$

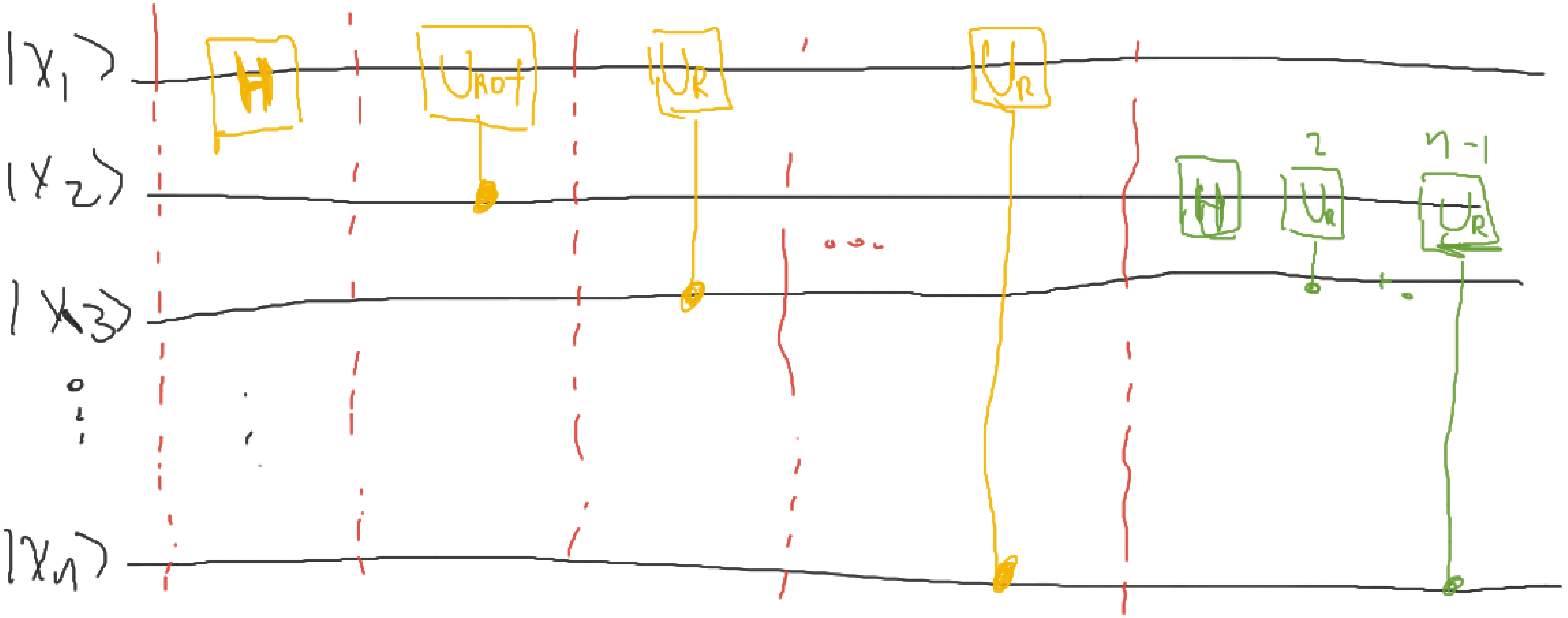
$= \left(|0\rangle + e^{i\pi x_k}|1\rangle\right)/\sqrt{2}$

2) $U_{ROT_k}|x_j\rangle = e^{\frac{2\pi i x_j}{2^k}}|x_j\rangle$; x_j : $e^{\frac{2\pi i \cdot 0}{2^2}}|0\rangle = |0\rangle$

$\downarrow$

$|1\rangle \Rightarrow e^{\frac{2\pi i}{2^k}}|1\rangle$

$\begin{pmatrix} 1 & 0 \\ 0 & e^{2\pi i/2^k} \end{pmatrix}$



Step 0: $|x_1, x_2, x_3, \ldots, x_n\rangle$

Step 1: $\left[|0\rangle + e^{\frac{2\pi i}{2^1} x_1} |1\rangle\right] \otimes |x_2, x_3, \ldots, x_n\rangle$

Step 2: $\left[|0\rangle + e^{\frac{2\pi i}{2^2} x_2} e^{\frac{2\pi i}{2^1} x_1}\right] \otimes |x_2, x_3, \ldots, x_n\rangle$

Step N:

$$\left[|0\rangle + e^{\frac{2\pi i}{2^n}x_n} \cdot e^{\frac{2\pi i}{2^{n-1}}x_{n-1}} \cdots e^{\frac{2\pi i}{2}x_1}|1\rangle\right] \otimes \left[|x_2, x_3, \ldots x_n\rangle\right]$$

QFT → Circuito

$$|\tilde{x}\rangle = \frac{1}{\sqrt{N}} \sum_{y=0}^{y=N-1} e^{\frac{i2\pi x \cdot y}{N}} |y\rangle$$