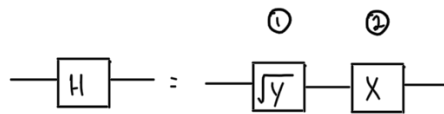


## Practice Assessment 8

(1a)



$$H|0\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$$

$$H|1\rangle = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$$

$|0\rangle$ :

$$0 \text{---} \boxed{H} \text{---} = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$$

$$0 \text{---} \overset{1}{\boxed{\sqrt{y}}} \text{---} \overset{2}{\boxed{X}} \text{---} \xrightarrow{1} \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \xrightarrow{2} \frac{1}{\sqrt{2}} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$|1\rangle$ :

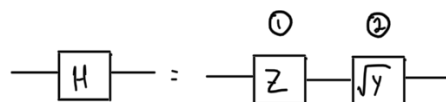
$$= \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle) \quad \checkmark$$

$$1 \text{---} \boxed{H} \text{---} = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$$

$$1 \text{---} \overset{1}{\boxed{\sqrt{y}}} \text{---} \overset{2}{\boxed{X}} \text{---} \xrightarrow{1} \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix} \xrightarrow{2} \frac{1}{\sqrt{2}} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -1 \\ 1 \end{bmatrix} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$= \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle) \quad \checkmark$$

(1b)



$|0\rangle$ :

$$0 \text{---} \boxed{H} \text{---} = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$$

$$0 \text{---} \overset{1}{\boxed{Z}} \text{---} \overset{2}{\boxed{\sqrt{y}}} \text{---} \xrightarrow{1} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \xrightarrow{2} \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$|1\rangle$ :

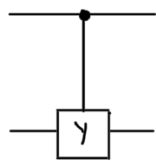
$$= \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle) \quad \checkmark$$

$$1 \text{---} \boxed{H} \text{---} = \frac{1}{\sqrt{2}}(|0\rangle - |1\rangle)$$

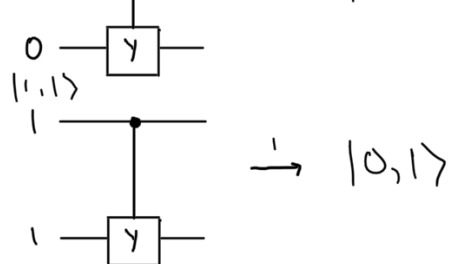
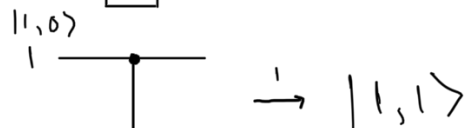
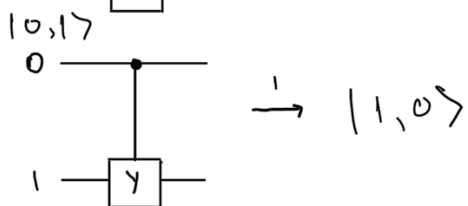
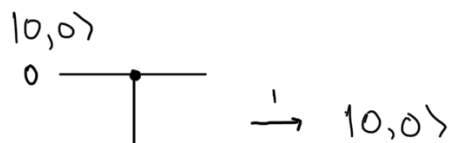
$$I \rightarrow [Z] \rightarrow [\sqrt{Y}] \rightarrow \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \end{bmatrix} \xrightarrow{2} \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ -1 \end{bmatrix} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$= \frac{1}{\sqrt{2}} (|0\rangle - |1\rangle) \quad \checkmark$$

(2) Consider the Controlled-Y gate



(a) Input:  $|0,0\rangle, |0,1\rangle, |1,0\rangle, |1,1\rangle$

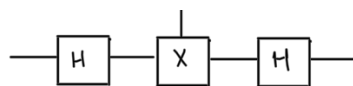


Description  $|0,0\rangle \rightarrow |0,0\rangle, |0,1\rangle \rightarrow |1,0\rangle$

$|1,0\rangle \rightarrow |1,1\rangle, |1,1\rangle \rightarrow |0,1\rangle$

(B)





Also

