$$Q|0\rangle = |0\rangle$$

$$Q|1\rangle = -|1\rangle$$

$$R|0\rangle = |1\rangle$$

$$R|1\rangle = |0\rangle$$

$$S = \frac{-Z-X}{\sqrt{2}} = \frac{1}{\sqrt{2}}\begin{pmatrix} -1 & -1 \\ -1 & 1 \end{pmatrix};$$

$$T = \frac{Z-X}{\sqrt{2}} = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}$$

$$S|0\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} -1 & -1 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ 0 \end{pmatrix} = \frac{1}{\sqrt{2}}\begin{pmatrix} -1 \\ -1 \end{pmatrix} = -\frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$S|1\rangle = -\frac{1}{\sqrt{2}}[|0\rangle - |1\rangle] = -\frac{1}{\sqrt{2}}[|0\rangle + |1\rangle]$$

$$T = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix}$$

$$T|0\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & -1 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$= \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \end{pmatrix} = \frac{|0\rangle - |1\rangle}{\sqrt{2}}$$

$$T|1\rangle = -\frac{|0\rangle + |1\rangle}{\sqrt{2}}$$

$$\langle QS \rangle = \frac{1}{2}\left[(\langle 011| - \langle 101|) QS \left(|01\rangle - |10\rangle\right)\right]$$

$$= \frac{1}{2}\left[\begin{array}{l} \langle 011|QS|01\rangle - \langle 011|QS|10\rangle \\ - \langle 101|QS|01\rangle + \langle 101|QS|10\rangle \end{array}\right]$$

$$\Rightarrow \langle 011|QS|01\rangle$$

$$\langle 011|\left(-\frac{1}{\sqrt{2}}\right)\left(|00\rangle - |\underline{11}\rangle\right)$$

$$= \frac{1}{\sqrt{2}}$$

$$\langle RS \rangle = \frac{1}{\sqrt{2}}$$

$$\langle RT \rangle = \frac{1}{\sqrt{2}}$$

$$\langle QT \rangle = -\frac{1}{\sqrt{2}}$$

$$\langle QS \rangle + \langle RS \rangle + \langle RT \rangle - \langle QT \rangle = 2\sqrt{2}$$

$$\leq 2$$