Quiz 8

1, We assume the system of qbits has the corresponding density matrix ρ and finite Hilbert space. The Von Neumann entropy is

$$S(\rho) = -Tr(\rho)\ln(\rho)$$

In Computational basis $\{|0\rangle, |1\rangle\}$, the eigenvalues of $\rho\ln\rho$ are $p_x \ln p_x$ and $S(\rho) = -\sum_x p_x \ln p_x = H(X)$

With a pure state $|\varphi\rangle$; the density matrix is $\rho = |\varphi\rangle\langle\varphi|$

the eigenvalues are 1 and 0; thus;

$$S|\varphi\rangle\langle\varphi| = 0$$

...

2) $|\varphi\rangle = \alpha|0\rangle + \beta|1\rangle$

$|0\rangle \longrightarrow |000\rangle$

$|1\rangle \longrightarrow |111\rangle$

$\rightarrow |\varphi\rangle = \alpha\left(|0\rangle \otimes |0\rangle \otimes |0\rangle\right) + \beta\Big($

$|001\rangle =$

$|000\rangle = |0\rangle$

$|010\rangle = |1\rangle$

$|001\rangle = |2\rangle$

$$\begin{pmatrix}1\\0\end{pmatrix} \otimes \begin{pmatrix}0\\1\end{pmatrix} \Big(\qquad \begin{pmatrix}1\\0\end{pmatrix}\begin{pmatrix}0\\1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix}$$

$$\begin{pmatrix}0\\1\\0\\0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} \quad \begin{matrix}0\\0\\0\\0\end{matrix} \qquad \begin{pmatrix}0\\1\\0\\0\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} = \begin{pmatrix}0\\0\\1\\0\\0\\0\\0\\0\end{pmatrix} = |2\rangle$$

$$\begin{pmatrix}1\\0\end{pmatrix}$$