(2.2 a)

$$|\psi\rangle_{AB} = \frac{1}{\sqrt{2}}(|01\rangle + |10\rangle)$$

Para hallar la matriz de densidad se debe aplicar el producto externo

$$|\psi\rangle\langle\psi| = \frac{1}{2}(|01\rangle + |10\rangle)(\langle 01| + \langle 10|)$$

$$\frac{1}{2}(|01\rangle\langle 01| + |01\rangle\langle 10| + |10\rangle + |10\rangle + |10\rangle\langle 10|)$$

Recordar que

$$|01\rangle = |0\rangle \otimes |1\rangle = [0,1,0,0]^T$$

$$|10\rangle = |1\rangle \otimes |0\rangle = [0,0,1,0]^T$$

$$|\psi\rangle\langle\psi| = \frac{1}{2}\begin{vmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$