Homework 5

(1)

$$|\psi\rangle = \frac{1}{\sqrt{5}}|+;+\rangle + \frac{2i}{\sqrt{5}}|-;+\rangle$$

(a)

$$|\psi\rangle = \frac{1}{\sqrt{5}}\left[|+;+\rangle + 2i|-;+\rangle\right] \qquad |\psi^*\rangle = \frac{1}{\sqrt{5}}\left[|+;+\rangle - 2i|-;+\rangle\right]$$

$$C = P(+;+) + P(-;-) - P(+;-) - P(-;+)$$

$$P_{++} = |\langle +;+|\psi\rangle|^2 = 1/5 \qquad P_{--} = |\langle -;-|\psi\rangle|^2 = 0$$

$$P_{+-} = |\langle +;-|\psi\rangle|^2 = 0 \qquad P_{-+} = |\langle -;+|\psi\rangle|^2 = 4/5$$

$$\boxed{C = 1/5 + 0 - 4/5 + 0 = -3/5}$$

Somewhat anti correlated?

(B) $C = 0 \rightarrow$ No relationship Between two measurements $\Rightarrow$ uncorrelated

No, there is no possible way to make this state correlated!

(2) $|\psi\rangle = a|+;+\rangle + b|+;-\rangle + C|-;+\rangle + d|-;-\rangle$

(a) A correlation of $C = 1$ would mean that the measured values are always aligned. If we are not able to change the state and

$$C = P(+;+) + P(-;-) - P(+;-) - P(-;+)$$

Then we would need $P(+;+)$ and $P(-;-)$ to sum to 1. Therefore, c and d would be 0, $a+b=1$.

(B) yes, they are correlated