**Exercise sheet # 7**
Quantum non-locality

**Exercice 7.1.**
Show directly from the definition that the set $QC_{m,n}$ of quantum correlations is convex.

**Exercice 7.2.**
Give an explicit family of observables on $\mathbb{C}^2$, as well as a state on $\mathbb{C}^2 \otimes \mathbb{C}^2$, which show that the matrix $\frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$ belongs to $QC_{2,2}$.

**Exercice 7.3. Optimality of the CHSH violation**

1. Show that if $X_1$, $X_2$, $Y_1$, $Y_2$ are self-adjoint operators satisfying $X_1^2 = X_2^2 = \mathrm{Id}_{\mathcal{H}_A}$ and $Y_1^2 = Y_2^2 = \mathrm{Id}_{\mathcal{H}_B}$ then the operator $B = X_1 \otimes Y_1 + X_1 \otimes Y_2 + X_2 \otimes Y_1 - X_2 \otimes Y_2$ satisfies $\|B\| \leqslant 2\sqrt{2}$. (Hint : compute $B^2 + [X_1, X_2] \otimes [Y_1, Y_2]$).
2. Deduce that any matrix $(a_{ij})$ in $LC_{2,2}$ satisfies the inequality $a_{11} + a_{12} + a_{21} - a_{22} \leqslant 2\sqrt{2}$.