Entangled Quantum States and the Kronecker Product

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Entangled quantum states are an important component of quantum computing techniques such as quantum error-correction, dense coding and quantum teleportation. We determine the requirements for a state in the Hilbert space $\mathbf{C}^m \otimes \mathbf{C}^n$ for $m, n \in \mathbf{N}$ to be entangled and a solution to the corresponding "factorization" problem if this is not the case. We consider the implications of these criteria for computer algebra applications.

Key words: Entangled States; Quantum Computing; Computer Algebra; Hilbert Space.