Verify the following spin operator table from "Quantum Mechanics" by Susskind and Friedman, page 350.

	$|uu\rangle$	$|ud\rangle$	$|du\rangle$	$|dd\rangle$
σ_z	$|uu\rangle$	$|ud\rangle$	$-|du\rangle$	$-|dd\rangle$
σ_x	$|du\rangle$	$|dd\rangle$	$|uu\rangle$	$|ud\rangle$
σ_y	$i|du\rangle$	$i|dd\rangle$	$-i|uu\rangle$	$-i|ud\rangle$
τ_z	$|uu\rangle$	$-|ud\rangle$	$|du\rangle$	$-|dd\rangle$
τ_x	$|ud\rangle$	$|uu\rangle$	$|dd\rangle$	$|du\rangle$
τ_y	$i|ud\rangle$	$-i|uu\rangle$	$i|dd\rangle$	$-i|du\rangle$

For single spins we have

$$|u\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad |d\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

For a system of two spins we use the Kronecker product of $|u\rangle$ and $|d\rangle$. Hence

$$|uu\rangle = |u\rangle \otimes |u\rangle = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \quad |ud\rangle = \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix}, \quad |du\rangle = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \end{pmatrix}, \quad |dd\rangle = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$$

The spin operators for single spins are

$$\sigma_z = \tau_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, \quad \sigma_x = \tau_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad \sigma_y = \tau_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$$

For a system of two spins, we again use the Kronecker product.

$$\sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \otimes I, \quad \tau_z = I \otimes \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, \quad \text{etc.}$$

Click "Demo" to see and run the Eigenmath code.