2x2 Tensor Product

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For two 2×2 matrices A and B where

$$A = \begin{pmatrix} a_1 & a_2 \\ a_3 & a_4 \end{pmatrix}, \qquad B = \begin{pmatrix} b_1 & b_2 \\ b_3 & b_4 \end{pmatrix} \tag{1}$$

Then the tensor product between A and B is as follows:

$$A \otimes B = \begin{pmatrix} a_1 \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix} & a_2 \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix} \\ a_3 \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix} & a_4 \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix} \end{pmatrix} = \begin{pmatrix} a_1b_1 & a_1b_2 & a_2b_1 & a_2b_2 \\ a_1b_3 & a_1b_4 & a_2b_3 & a_2b_4 \\ a_3b_1 & a_3b_2 & a_4b_1 & a_4b_2 \\ a_3b_3 & a_3b_4 & a_4b_3 & a_4b_4 \end{pmatrix} \tag{2}$$