Exercises on change of basis; image compression

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31.1

The four orthonormal basis for Haar wavelet are:

$$w_1 = \frac{1}{2}\begin{bmatrix}1\\1\\1\\1\end{bmatrix} \quad w_2 = \frac{1}{2}\begin{bmatrix}1\\1\\-1\\-1\end{bmatrix} \quad w_3 = \frac{1}{\sqrt{2}}\begin{bmatrix}1\\-1\\0\\0\end{bmatrix} \quad w_4 = \frac{1}{\sqrt{2}}\begin{bmatrix}0\\0\\1\\-1\end{bmatrix}$$

31.2

Two different basis for this space are $\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix} \begin{bmatrix}0 & 1\\1 & 0\end{bmatrix}$ and $\begin{bmatrix}1 & 0\\0 & 0\end{bmatrix} \begin{bmatrix}0 & 1\\0 & 0\end{bmatrix} \begin{bmatrix}0 & 0\\1 & 0\end{bmatrix} \begin{bmatrix}0 & 0\\0 & 1\end{bmatrix}$.

The first one is good for diagonal matrices because it is diagonal itself. The second one is good for triangular matrices. The second one is better for symmetric