HW3

1. $$\begin{bmatrix} a_{11}b_{11} + a_{12}b_{12} + a_{21}b_{21} + a_{22}b_{22} & a_{21}b_{11} + a_{22}b_{12} + a_{22}b_{21} + a_{23}b_{22} \\ a_{21}b_{11} + a_{22}b_{12} + a_{31}b_{21} + a_{32}b_{22} & a_{22}b_{11} + a_{23}b_{12} + a_{32}b_{21} + a_{33}b_{22} \end{bmatrix}$$

2. Image Columns Matrix:

$$\begin{bmatrix} a_{11} & a_{12} & a_{21} & a_{22} \\ a_{12} & a_{13} & a_{22} & a_{23} \\ a_{21} & a_{22} & a_{31} & a_{32} \\ a_{22} & a_{23} & a_{32} & a_{33} \end{bmatrix}$$

Kernel Vector:

$$\begin{bmatrix} b_{11} \\ b_{12} \\ b_{21} \\ b_{22} \end{bmatrix}$$

3. The matrix derived from the 2D convolution, multiplied by the kernel vector represents a specific rearrangement of the input image. This rearrangement allows the convolution operation to be executed as a single matrix-vector multiplication