CSS364/AM792: Homework #3

Due on April 8, 2020 at 3:10pm

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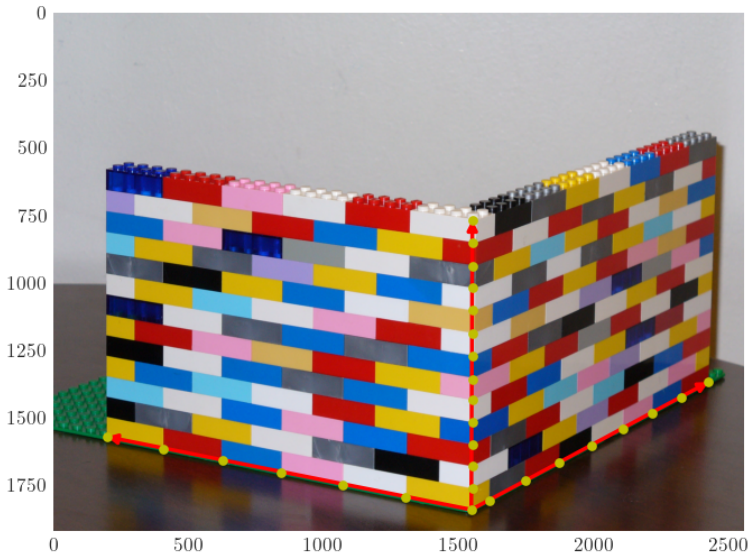
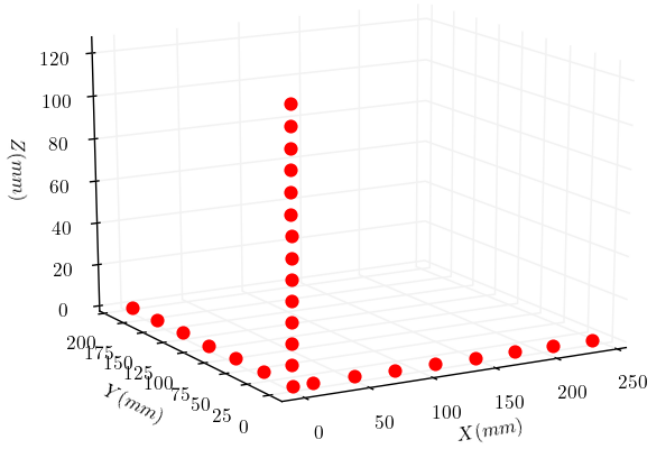
Problem 1

(a)

The points identified here for correspondence were along the each of the axes to simply matters.



Using the given Lego dimensions, we can the corresponding points in the 3D world coordinate system. Doing so, I produced the figure below



The camera matrix P was found to be (rounded to 5 decimal places)

$$P = \begin{bmatrix} 3.1300\text{e}{-3} & -4.0800\text{e}{-3} & -2.0000\text{e}{-4} & -8.5530\text{e}{-2} \\ -6.0000\text{e}{-4} & -4.0000\text{e}{-4} & -5.1700\text{e}{-3} & -9.9631\text{e}{-1} \\ 0 & 0 & 0 & 5.9000\text{e}{-4} \end{bmatrix} \tag{1}$$

(b)

Prove that the $R = W\hat{Q}^{\mathsf{T}}$ is orthogonal, we show that $RR^{\mathsf{T}} = I$

$$\begin{aligned} RR^{\mathsf{T}} &= W\hat{Q}^{\mathsf{T}}(W\hat{Q}^{\mathsf{T}})^{\mathsf{T}} \\ &= W\hat{Q}^{\mathsf{T}}(\hat{Q}^{\mathsf{T}})^{\mathsf{T}}W^{\mathsf{T}} \\ &= W\hat{Q}^{\mathsf{T}}\hat{Q}W^{\mathsf{T}} \\ &= WIW^{\mathsf{T}} && \text{By definition from -decomposition is orthogonal} \\ &= I && \text{W orthogonal and real symmetric} \end{aligned}$$

To prove that K is upper-triangular, we need to show that $K - K^{\mathsf{T}} = 0$