HW 2

1. A (2, 4, 3) B (2, -8, 0)
   C (1, -3, 5) D (4, 1, -7)

$\underline{S}_1 = \underline{r}_2 - \underline{r}_1 = [2-(-2), -8-4, 0-3]$

$= (4, -12, -3)$

$\underline{S}_{OL1} = \underline{r}_1 \times \underline{S}_1 = \text{cross}([-2, 4, 3], [4, -12, -3])$

$\underline{S}_{OL1} = [24, 6, 8]$

$L_1 = \{4, -12, -3; 24, 6, 8\}$

$\underline{S}_2 = \underline{r}_4 - \underline{r}_3 = [4-1, 1-(-3), -7-5]$

$= [3, 4, -12]$

$\underline{S}_{OL2} = \underline{r}_3 \times \underline{S}_2 = \text{cross}([1, -3, 5], [3, 4, -12])$

$\underline{S}_{OL2} = [16, 27, 13]$

$L_2 = \{3, 4, -12; 16, 27, 13\}$

MATLAB →

$$mm = \underline{S}_1 \cdot \underline{S}_{OL2} + \underline{S}_2 \cdot \underline{S}_{OL1}$$

$$d = \frac{-mm}{\underline{S}_1 \times \underline{S}_2 \cdot \frac{\underline{S}_1 \times \underline{S}_2}{\|\underline{S}_1 \times \underline{S}_2\|}}$$

$d = 1.7692 m$

(see MATLAB script / function)

2. $\underline{r}_{CA} = [0.4833, 0.8463, -0.2795]^T$

$\underline{r}_{CO} = [0.2982, -0.9361, -0.1853]^T$

(a) $\underline{S}_1 = \underline{r}_{CA}$ $\quad A(0, 300, 0)$

$\underline{r}_{OA} = [0, 300, 0]$

$\underline{S}_{OL1} = \underline{r}_{OA} \times \underline{S}_1$

$\underline{S}_{OL1} = [-83.877, 0, -136.017]$

$\underline{S}_2 = \underline{r}_{CO}$ $\quad O(0, 0, 0)$

$\underline{r}_O = [0, 0, 0]$

$\underline{S}_{OL2} = [0, 0, 0]$

$L_1 = \{0.45337, 0.84633, -0.27959; -83.877, 0, -136.017\}$ Camera to A

$L_2 = \{0.29892, -0.93611, -0.18533; 0, 0, 0\}$ Camera to origin

(b) MATLAB $\rightarrow$

$$mm = \underline{S}_1 \cdot \underline{S}_{OL2} + \underline{S}_2 \cdot \underline{S}_{OL1}$$

$$d = \frac{-mm}{\underline{S}_1 \times \underline{S}_2 \cdot \frac{\underline{S}_1 \times \underline{S}_2}{\|\underline{S}_1 \times \underline{S}_2\|}}$$

$d = 0.1702\ m$

(See MATLAB)

(c) $\because mm = 0.1355\ m \neq 0$ $\leftarrow$

$\therefore$ The two lines don't intersect.

Midpoint $(1\ m; -60.0316, 187.8513, 37.1194)$