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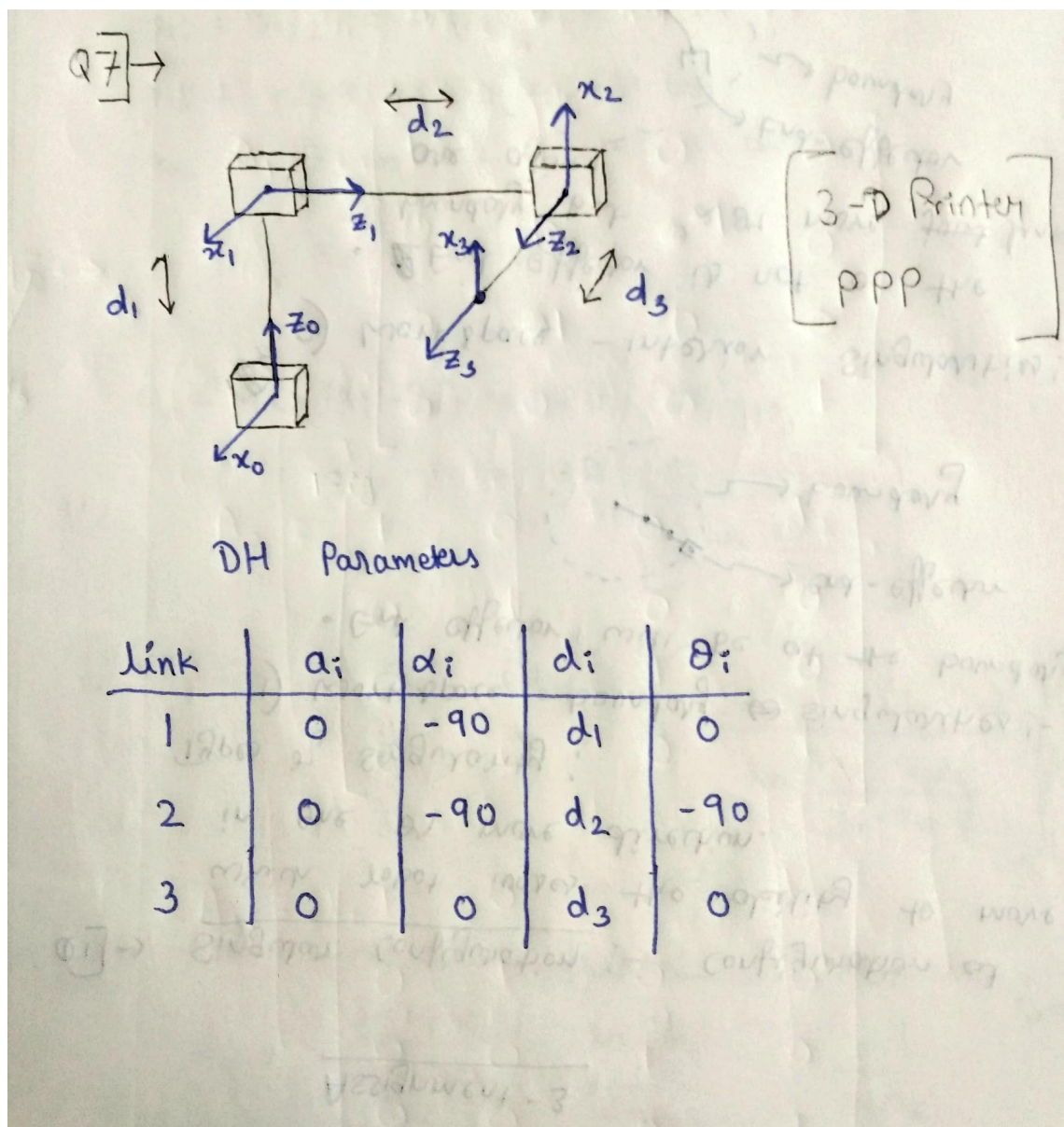
Course:- ME 639: Introduction to Robotics

#### Assignment 4

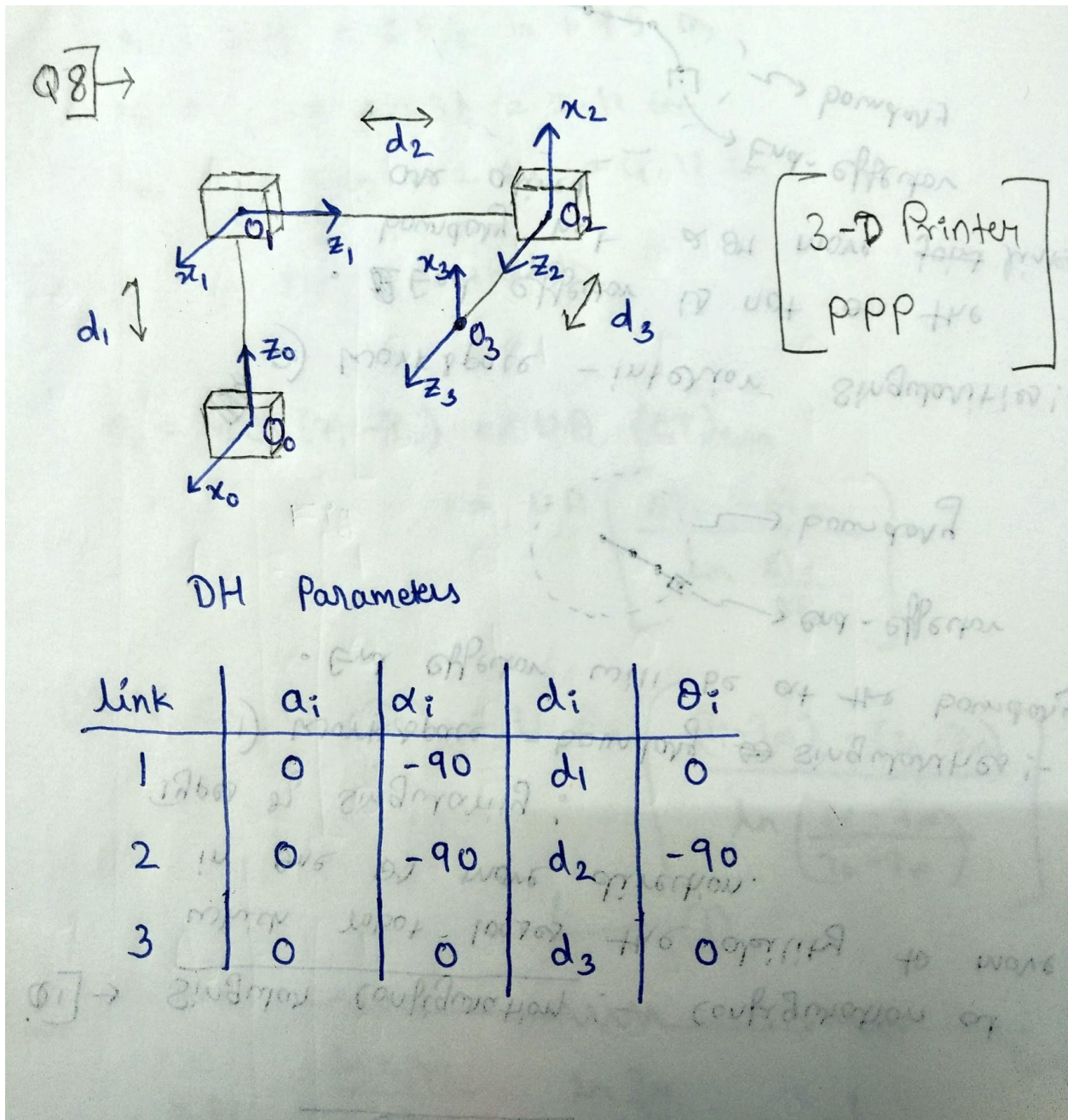
Question 1, 2, 3, 6, 7:

<https://colab.research.google.com/drive/17E2oTUodD7GGgQaEW2DGh6vPXM5H4h8?usp=sharing>

Question 7:



Question 8:





$$A_i = \begin{bmatrix} C_{\theta_i} & -S_{\theta_i} C_{\alpha_i} & S_{\theta_i} S_{\alpha_i} & a_i C_{\theta_i} \\ S_{\theta_i} & C_{\theta_i} C_{\alpha_i} & -C_{\theta_i} S_{\alpha_i} & a_i S_{\theta_i} \\ 0 & S_{\alpha_i} & C_{\alpha_i} & d_i \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$A_1 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & d_1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & d_2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$A_3 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$A_1 A_2 = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & d_2 \\ 1 & 0 & 0 & d_1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$A_1 A_2 A_3 = T = \begin{bmatrix} 0 & 0 & 0 & 1 & d_3 \\ 0 & 0 & -1 & 0 & d_2 \\ 1 & 0 & 0 & 0 & d_1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$d = \begin{bmatrix} d_3 \\ d_2 \\ d_1 \end{bmatrix}$$

$$O_3 = (d_3, d_2, d_1)$$

Position of end-effector is known

$$O_3 = \cancel{(d_x, d_y, d_z)} = (d_x, d_y, d_z), \dots (\text{Assume})$$

Thus.

$$\begin{array}{|l} d_1 = d_z \\ d_2 = d_y \\ d_3 = d_x \end{array}$$