Welcome To My Assignment

Assignment on Spatial Exercise

ASSIGNMENT OF CSE444

SUBMITTED TO

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Ans to the Q: 1

$$[T(3,-5,3) * Rot\,z(45) * T(2,3,5)]^{-1} * [2,5,7] = P$$

$$Rot\,z(45) * T(2,3,5) =$$

$$\begin{bmatrix} \cos(45) & -\sin(45) & 0 & 0 \\ \sin(45) & \cos(45) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.707 & -0.707 & 0 & 0 \\ 0.707 & 0.707 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.707 & 0.707 & 0 & -0.707 \\ 0.707 & 0.707 & 0 & 3.535 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Again,

$$[T(3,-5,3) * Roty(60) * Rotz(45) * T(2,3,5)]^{-1} * Q(2,5,7) = P$$

$$T(3,-5,3) * Roty(60) =$$

$$\begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos(60) & 0 & \sin(60) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(60) & 0 & \cos(60) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.5 & 0 & 0.866 & 0 \\ 0 & 1 & 0 & 0 \\ -0.866 & 0 & 0.5 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.5 & 0 & 0.866 & 3 \\ 0 & 1 & 0 & -5 \\ -0.866 & 0 & 0.5 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Again,

$$[T(3,-5,3) * Roty(60) * RotZ(45) * T(2,3,5)]^{-1}$$

$$Q[2,5,7] = P$$

$$T(3,-5,3) * Roty(60) * RotZ(45) * T(2,3,5) =$$

$$\begin{bmatrix} 0.5 & 0 & 0.866 & 3 \\ 0 & 1 & 0 & -5 \\ -0.866 & 0 & 0.5 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.707 & -0.707 & 0 & -707 \\ 0.707 & 0.707 & 0 & 3.535 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.3535 & -0.3535 & 0.866 & 6.9765 \\ 0.707 & 0.707 & 0 & -1.465 \\ -0.612262 & 0.612262 & 0.5 & 6.112262 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$[T(3,-5,3) * Roty(60) * Rotz(45) * T(2,3,5)]^{-1}$$

$$= \begin{bmatrix} 0.3535 & -0.3535 & 0.866 & 6.975 \\ 0.707 & 0.707 & 0 & -1.465 \\ -0.612262 & 0.612262 & 0.5 & 6.112262 \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1}$$

$$= \begin{bmatrix} 0.3535 & 0.707 & -0.612262 & -8.25 \\ -0.3535 & 0.707 & 0.612262 & -0.25 \\ 0.866 & 0 & 0.5 & -0.91 \\ 6.975 & -1.465 & 6.112262 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\therefore P = \begin{bmatrix} 0.35 & 0.707 & -0.61 & -8.25 \\ 0.35 & 0.707 & 0.61 & -0.25 \\ 0.866 & 0 & 0.5 & 0.91 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 \\ 5 \\ 7 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -8.285 \\ 6.855 \\ 4.322 \end{bmatrix}$$

Ans to the Q: 2

Here,

$$[T(3,-5,3) * Rot\,y(45) * Rot\,x(60) * T(2,3,5)]^{-1} * Q[2,5,7] = P$$

$$\therefore Rot\,x(60) * T(2,3,5) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(60) & -\sin(60) & 0 \\ 0 & \sin(60) & \cos(60) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.50 & -0.866 & 0 \\ 0 & 0.866 & 0.50 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 0.50 & -0.866 & -2.53 \\ 0 & 0.866 & 0.50 & 5.098 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Again,

$$T(3,-5,3) * RotY(45) = \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos(45) & 0 & \sin(45) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(45) & 0 & \cos(45) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.707 & 0 & 0.707 & 0 \\ 0 & 1 & 0 & 0 \\ -0.707 & 0 & 0.707 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.707 & 0 & 0.707 & 3 \\ 0 & 1 & 0 & -5 \\ -0.707 & 0 & 0.707 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$\therefore T(3,-5,3) * RotY(45) * RotX(60) * T(2,3,5)$

$$= \begin{bmatrix} 0.707 & 0 & 0.707 & 3 \\ 0 & 1 & 0 & -5 \\ -0.707 & 0 & 0.707 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 0.50 & -0.866 & -2.83 \\ 0 & 0.866 & 0.50 & 5.098 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0.707 & 0.612 & 0.353 & 8.018 \\ 0 & 0.50 & -8.66 & -7.83 \\ -0.707 & 0.612 & 0.355 & 2.19 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$\therefore [T(3,-5,3) * Roty(45) * Rot x(60) * T(2,3,5)]^{-1}$

$$= \begin{bmatrix} 0.707 & 0.612 & 0.353 & 8.018 \\ 0 & 0.50 & -8.66 & -7.83 \\ -0.707 & 0.612 & 0.355 & 2.19 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.707 & 0 & -0.707 & -4.12 \\ 0.612 & 0.50 & 0.612 & -2.33 \\ 0.353 & -8.66 & 0.355 & -71.42 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$\therefore P = [T(3,-5,3) * Roty(45) * Rot x(60) * T(2,3,5)]^{-1} * Q[2,5,7]$

$$\begin{bmatrix} 0.707 & 0 & -0.707 & -4.12 \\ 0.612 & 0.50 & 0.612 & -2.33 \\ 0.353 & -8.66 & 0.355 & -71.42 \\ 0 & 0 & 0 & 1 \end{bmatrix} X \begin{bmatrix} 2 \\ 5 \\ 7 \\ 1 \end{bmatrix} = \begin{bmatrix} -7.655 \\ 5.678 \\ -72.559 \\ 1 \end{bmatrix}$$

$\therefore P = [-7.7, 5.7, -72.6]^T$ Ans.

Ans to the Q : 3

Here,

$$[T(3,-5,3) * Roty(45) * Rotz(30) * T(2,3,5)]^{-1} * Q[2,5,7] = P$$

$$\therefore Rotz(30) * T(2,3,5) = \begin{bmatrix} \cos(30) & -\sin(30) & 0 & 0 \\ \sin(30) & \cos(30) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.866 & -0.50 & 0 & 0 \\ 0.50 & 0.866 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.866 & -0.50 & 0 & 0.232 \\ 0.50 & 0.866 & 0 & 3.598 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$\therefore T(3,-5,3) * \text{Roty}(45)$

$$= \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos(45) & 0 & \sin(45) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(45) & 0 & \cos(45) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.707 & 0 & 0.707 & 0 \\ 0 & 1 & 0 & 0 \\ -0.707 & 0 & 0.707 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.707 & 0 & 0.707 & 3 \\ 0 & 1 & 0 & -5 \\ -0.707 & 0 & 0.707 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Again,

$$T(3,-5,3) * \text{RotY}(45) * \text{RotZ}(30) * T(2,3,5)$$

$$= \begin{bmatrix} 0.866 & -0.50 & 0 & 0.232 \\ 0.50 & 0.866 & 0 & 3.598 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0.707 & 0 & 0.707 & 3 \\ 0 & 1 & 0 & -5 \\ -0.707 & 0 & 0.707 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0.612 & -0.50 & 0.612 & 5.33 \\ 0.3535 & 0.866 & 0.3535 & 0.768 \\ -0.707 & 0 & -0.707 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Again,

$$[T(3,5,3) * \text{RotY}(45) * \text{RotZ}(30) * T(2,3,5)]^{-1}$$

$$\begin{bmatrix} 0.612 & 0.3535 & -0.707 & 2.13 \\ -0.50 & 0.866 & 0 & 1.98 \\ 0.612 & 0.3535 & -0.707 & -9.17 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 \\ 5 \\ 7 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} 0.612 & -0.50 & 0.612 & 5.33 \\ 0.3535 & 0.86 & 0.3535 & 0.768 \\ -0.707 & 0 & -0.707 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1}$$

$$= \begin{bmatrix} 0.612 & 0.3535 & -0.707 & 2.13 \\ -0.50 & 0.866 & 0 & 1.98 \\ 0.612 & 0.3535 & -0.707 & -9.17 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\therefore P = [T(3,-5,3) * RotY(45) * RotZ(30) * T(2,3,5)]^{-1} * a[2,5,7]$$

$$= \begin{bmatrix} 0.612 & 0.3535 & -0.707 & 2.13 \\ -0.50 & 0.866 & 0 & 1.98 \\ 0.612 & 0.3535 & -0.707 & -9.17 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 \\ 5 \\ 7 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.1725 \\ 5.31 \\ -11.13 \\ 1 \end{bmatrix}$$

$\therefore P = [0.17, 5.31, -11.13]^T$ Ans.

Ans to the Q No: 4

Here,

$$[T(3,-5,3) * Rot\,y(30) * Rot\,x(45) * T(2,3,5)]^{-1} * Q[2,3,5] = P$$

$$\therefore Rot\,x(45) * T(2,3,5)$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(45) & -\sin(45) & 0 \\ 0 & \sin(45) & \cos(45) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.707 & -0.707 & 0 \\ 0 & -0.707 & 0.707 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 0.707 & -0.707 & -1.41 \\ 0 & -0.707 & 0.707 & 1.41 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\therefore [T(3,-5,3) * Roty(30) * Rotx(45) * T(2,3,5)]^{-1}$$

$$= \begin{bmatrix} 0.866 & 0 & -0.50 & -3.1 \\ 0.35 & 0.707 & -0.612 & 4.4 \\ 0.35 & -0.707 & 0.612 & -8.41 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\therefore P = [T(3,-5,3) * Roty(30) * Rotx(45) * T(2,3,5)]^{-1} * Q \quad Q[2,5,7]$$

$$= \begin{bmatrix} 0.866 & 0 & -0.50 & -3.1 \\ 0.35 & 0.707 & 0.612 & 4.4 \\ 0.35 & -0.707 & 0.612 & -8.41 \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 \\ 5 \\ 7 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -4.9 \\ 4.4 \\ -7 \\ 1 \end{bmatrix} \quad \therefore P = [-4.9, 4.4, -7] \text{ Ans.}$$