German University in Cairo
Media Engineering and Technology
DMET 502 Computer Graphics, Winter 2023
Assoc. Prof. Dr. Rimon Elias

Practice assignment 5

3D Transformations

Q 1: A tetrahedron is to be rotated through an angle of 45° about a line passing through the points $[2, 1, 0]^T$ and $[6, 5, 0]^T$. Derive the required 3D transformation matrix.

Q 2: A unit cube is centered at $[2, 5, 3]^T$. This cube is to be rotated through an angle of 45° about a line passing through its center and parallel to the y-axis. Derive the required 3D transformation matrix.

Q 3: A unit cube is centered at $[2, 5, 3]^T$. Rotate this cube through an angle of 45° about a line passing through the origin and having a direction vector $[7, 7, 7]^T$. Derive the required 3D transformation matrix.

Q 4: Derive the transformation matrix that applies the following series of 3D transformations to a 3D object:

1. a translation by the vector $[2, 4, 6]^T$,
2. a shearing transformation in the x and y directions with the shearing factors 5 and 3 respectively,
3. a scaling of the object using factors 5 and 3 in the x and y directions respectively,
4. a rotation of the object through an angle of 70° about the z-axis.