Assignment 3

1. Explain 2D basic geometric transformation with an example.
2. Explain 2D translations in details with suitable examples. Translate a triangle ABC with co-ordinates A(0, 0), B(5, 0) and C(5, 5) by 2 units in x-direction and 3 units in y-directions.
3. Define 2D rotation. Rotate a triangle (5, 5), (7, 3), (3, 3) about fixed point (5, 4) in counter clockwise by 90 degrees.
4. Given a triangle with vertices A(2,3), B(5,5), C(4,3) by rotating 90 degree about the origin and then translating two unit in each direction. Use homogenous transformation matrix to find the new vertices of the triangle Note.
5. Define 2D scaling. Find the scaled triangle with vertices A(0, 0), B(1, 1) & C(5, 2) after it has been magnified twice its size.
6. Rotate a triangle A(7, 15), B(5, 8) & C(10, 10) by 45 degree clockwise about origin and scale it by (2, 3) about origin.
7. Explain 2D reflection and shearing in details. Find the composite transformation matrix for reflection about a line y=mx+c.
8. Explain in detail the concepts of two-dimensional transformations such as translation, rotation, scaling, reflection, and shearing. Include examples of how these transformations can be represented using matrices. Additionally, describe how homogeneous coordinates are used to simplify the mathematical representation of these transformations and how composite transformations are applied in practice.
9. Discuss the process of transformation between coordinate systems in two-dimensional space. Explain how transformations are used to map one coordinate system to another, with examples. Highlight the importance of homogeneous coordinates in handling these transformations and demonstrate how a sequence of transformations (e.g., rotation followed by scaling) can be combined into a single transformation matrix.
10. Describe the two-dimensional viewing pipeline in computer graphics. Explain the steps involved in the process, including windowing, viewport mapping, and the transformation from world coordinates to screen coordinates. Provide a detailed explanation of the window-to-viewport transformation and its mathematical formulation, with an example of how a point is transformed from one coordinate space to another.
11. Explain the importance of filling algorithms in graphics applications. Differentiate between boundary and flood fill algorithm with algorithm.

Assignment 4

12. Explain 3D basic geometric transformation with an example.
13. Explain 3D basic geometric reflection with an example. A homogenous coordinate point P(3, 2, 1) is translated in x, y, z direction by -2, -2 & -2 unit respectively followed by successive rotation of 600 about x- axis. Find the final position of homogenous coordinate.
14. Explain 3D rotation. Find the new co-ordinates of a unit cube 90 degree rotated about an axis defined by its end points A(2, 1, 0) and B(3, 3, 1).
15. Explain 3D scaling and shearing in details.
16. Explain the various types of three-dimensional geometric transformations including translation, rotation, scaling, reflection, and shearing. For each transformation, provide detailed mathematical representations using matrices and homogeneous coordinates.

Illustrate how these transformations are applied to points and objects in 3D space, and discuss the differences compared to their two-dimensional counterparts.

17. Discuss the concept of three-dimensional composite transformations and their importance in computer graphics. Explain how multiple transformations (e.g., scaling, rotation, and translation) can be combined into a single composite transformation matrix. Provide examples of scenarios where composite transformations are used, such as modeling or animations, and demonstrate the mathematical process of combining these transformations step by step.