1. a) Explain the relationship between the rotations $R_{\theta}$, $R_{-\theta}$ and $R_{\theta}^{-1}$.
b) What are the advantages of the ray tracing method?
c) Explain the advantages of B-splines over Bezier splines.
d) Describe the transformation $M_L$ that reflects an object about a line $L$.
e) Explain the shape interpolation.
f) What is the Euler angle representation?
g) Explain the special effect morphing in computer animation.

(7x4)

2. a) Consider a rectangle ABCD in the given figure. Apply the following transformations on rectangle ABCD:
   i) Rotate the rectangle ABCD with 90 degree in clockwise direction with respect to the point (2,2).
   ii) Magnify the rotated figure twice to its size in X-direction and half to its size in Y-direction keeping point A (2,2) as fixed point.

   Find out the composite transformation matrices to perform the given transformations. Also show output and input matrices.

b) Describe the Sutherland Hodgman polygon clipping algorithm.

(9+9)

3. a) Find the perspective projection onto the view plane $Z=d$ where the centre of projection is the origin (0, 0, 0).
b) What is temporal aliasing? What types of problem does it pose when you are animating 3D objects having a time dimension?
c) For the given \( B_0[1,1] \), \( B_1[2,3] \), \( B_2[4,3] \) and \( B_3[3,1] \) the vertices of a Bezier polygon. Determine points on the Bezier curve at \( t = (0.15, 0.5, 0.85) \).
4. Explain the constructive solid geometry method of solid modeling.
   a) How does the Z-buffer algorithm determine Hidden Surfaces?
   b) Given points $P_1(1, 2, 0)$, $P_2(3, 6, 20)$, $P_3(2, 4, 6)$ and a viewpoint $C(0, 0, -10)$, determine which points obscure the others when viewed from $C$. (6+6+6)

5. a) Describe the methodology for converting RGB color parameters to HSV values.
   b) How many intensity levels can be displayed with halftone approximations using $n$ by $n$ pixel grids where each pixel can be displayed with $m$ different intensities? (8+10)

6. a) Describe the Phong shading model. What are its advantages and disadvantages over Gourad Shading model?
   b) Discuss with an example, how a visible surface detection method can be combined with an intensity model for displaying a set of polyhedrons with opaque surfaces. (8+10)

7. a) Describe the steps required in a designing of animation sequences.
   b) Design a story board layout and accompanying key frames for an animation of a single polyhedron. How will you expand this to include two or more moving objects? (9+9)