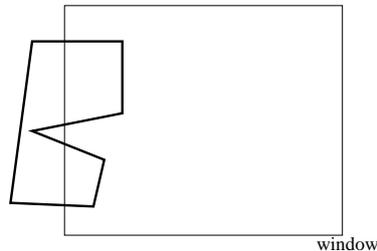


1. Discuss pros and cons of raster graphics compared with vector graphics. [5pt]
2. Frame buffers are described as having a certain depth. What does the depth refer? What is stored in the frame buffer when a color map lookup table is used? [5pt]
3. For a line segment that starts from (0, 1) and ends at (2, 4). Its equation is given by $3x - 2y + 2 = 0$. To use Bresenham's line drawing algorithm on this line, show the steps for three consecutive points from (0,1). [10pt]
4. Compare supersampling and A-buffer for antialiasing. [5pt]
5. Define the Nyquist limit. Why it is important for sampling? [5pt]
6. Calculate a 4x4 matrix that aligns a line from [0, 0, 0] to [1, 1, 1] to z-axis. Show your work using an orthogonal matrix. [10pt]
7. Complete the following normalizing transformation sequence for oblique parallel projections. [10pt]
 - A. translate VRP to the origin of the WC
 - B. _____
 - C. _____
 - D. translate and scale into the parallel-projection canonical view volume
8. Calculate the region of 3D clipping for a line from $P1 = [3, y1, z1, 3]$ to $P2 = [-1, y2, z2, 1/2]$. Show x values of the clipped line with $W=1$. [5pt]
9. When is it advantageous to use the Cohen-Sutherland line clipping algorithm instead of the Cyrus-Beck clipping algorithm? [5pt]

10. Draw the polygon that will result when this polygon is clipped against the boundary shown in the order up, down, left, right when using the Sutherland-Hodgman algorithm. How do you solve the problem of this approach? [10pt]



11. Answer True/False: (2 points each) [12pt]
- A. 2D rotations are commutative.
 - B. 3D rotations are commutative.
 - C. Translation and scaling are commutative.
 - D. Perspective transformation preserve parallel lines.
 - E. Every orthonormal matrix defines a rotation.
 - F. An affine transformation of two perpendicular vectors might produce two vectors which are not perpendicular.
12. Show an example with results of interiors which are different when we use Parity fill and Winding number approaches. [5pt]
13. Discuss three reasons why quaternion is useful for animations. [3pt]
14. Explain the following compression techniques: [6pt]
- A. run-length encoding
 - B. LZW encoding
15. Answer the following questions: [4pt]
- A. Show the homogeneous matrices that represent the rotation of 90 degree about the z-axis and the translation of (3, 0, 0), respectively.
 - B. Let R be the rotation matrix and T be the translation matrix from the above, what are the results of the vector (1, 0, 0) multiplied by T after R and point (1, 0, 0) multiplied by T after R?