1. Perspective Projection and Texture Mapping (15 points)
   1. Explain how perspective projection maps a 3D point onto a 2D screen using homogeneous coordinates.
      1. Transform the 3D points with the inverse camera matrix
      2. Transform the point with the clip space matrix, which scales the X and Y with the field of view and aspect ratio, and scales the z by the near and far planes. This also applies the perspective divide
      3. Apply clipping
      4. Transform the x and y coordinates with respect to W and half the screen width and height. This puts the coordinates in viewport coordinates
   2. Why does perspective-incorrect interpolation occur in texture mapping, and how can it be corrected?
      1. Normal linear interpolation of UVs in screen space doesnt account for perspective. This is fixed by dividing the interpolated UV coordinates by 1/w
2. Depth and Transparency (15 points)
   1. Describe how a Z-buffer works and why it is important in rendering.
      1. The Z buffer stores the depth information for each pixel. It is important for doing various sorting operations on pixel rendering, from culling to transparency sorting. It also allows for various rendering affects
   2. What is premultiplied alpha, and why is it preferable for blending semi-transparent objects?
      1. Premultiplied alpha is where the RGB channels of the blended object are multiplied by the alpha first, and then traditional blending is used. This is better than keeping the alpha disconnected, as it results in less artifacts during interpolation and filtering
3. Geometry Representation (15 points)
   1. Compare and contrast implicit and explicit representations of geometry, providing an example of each.
      1. Explicit representations of geometry are generally easier to create for extremely complex objects, while implicit representations can be more difficult and in some cases have geometry that isnt possible using implicit while being possible to do in explicit, depending on the implicit method used
      2. An explicit method is using polygons
      3. An implicit method is using a signed distance function
   2. What are Bezier curves, and why are they commonly used in graphics?
      1. Bezier curves are mathematically defined curves, and they are commonly used as they are able to be scaled indefinitely and use comparatively little amount of stored data to represent shapes
4. Meshes and Digital Geometry Processing (15 points)
   1. Define manifold and explain why manifold meshes are important in computer graphics.
      1. A manifold is where each edge is shared by exactly two faces, not more and not less. They are important as it ensures a smooth and continuous surface, that gives a distinct definition of inside and outside. This is useful in the context of normal faces and triangle culling
   2. What are the key operations in mesh simplification, and why would we want to simplify a mesh?
      1. Edge collapsing and vertex clustering. Simplifying a mesh is important because it can reduce the file size of the mesh significantly, and can also decrease the amount of time it takes to render on the screen through various optimizations, both in triangle fill rate and avoiding duplicate work per pixel if the triangle count takes up less than 4 pixel area