

Computer Graphics Algorithms - Spring 2003 - Comp Exam

Student ID:

(1) Describe the following space coordinate systems in computer graphics: device space, screen space, image space, object space, world space. (20 pts)

(2) Consider the 3D triangle (a, b, c) given by the points $a = [1, 2, 0]^T$, $b = [0, 1, 2]^T$ and $c = [0, 3, 0]^T$. A 3-D point p can be represented using triangle barycentric coordinates as $p = \alpha \mathbf{a} + \beta \mathbf{b} + \gamma \mathbf{c}$, where $\alpha = (1 - \beta - \gamma)$. Using barycentric coordinates, show that the point $p = [1, 1, 1]^T$ is outside the triangle. (20 pts)

(3) Write a basic algorithm to perform hidden surface elimination using the z-buffer method. (20 pts)

(4) Consider the specular reflection term in the Phong illumination model. What is the equation for this term and what types of surfaces are best modelled using it? (20 pts)

(5) Consider the surface given by $z(x, y) = x^2 + 3xy + 3y^2$ and assume that the light direction is given by $\mathbf{l} = [l_x, l_y, l_z]^T$. What is the expression that describes the pixel intensities for this surface under the Lambertian illumination model? (20 pts)