University of Toronto

Department of Computer Science

CSC 418/2504: Computer Graphics

Midterm Examination

Winter 2008

Duration: 60 minutes

No aids allowed

There are 5 pages (including this page)

First name: _____

Last name: _____

Student number: _____

Question	Marks
1	/35
2	/30
3	/15
4	/20
Total	/100

1. Answer the following questions without explanation. (*7 marks each question*)

A. Name three application areas of computer graphics.

_____

_____

_____

B. The color of a pixel with RGB values [1.0,1.0,0.0] is _____ .

C. The Euclidean coordinates of the midpoint of the two homogeneous vectors (6 12 9 3) and (12 4 14 2) are _____.

D. True or false: if two straight lines in 3D project under orthographic projection to parallel lines in the image, then the two lines must be parallel in 3D _____ .

E. True or false: the image of a 3D square under perspective projection is always a parallelogram (assuming the square is not projected to a line) _____ .

2. Consider a Lambertian surface satisfying the equation

$$x^2 + y^2 + z^2 + xy + xz + yz = 6$$

The surface is illuminated by a distant light source with direction vector $L = (1, -1, 1)^t/\sqrt{3}$ (L is the light vector as discussed in class. The incident light is travelling in the $-L$ direction). The light intensity is 3 and the surface is not absorbing any light.

A. Compute the unit surface normal at point $(1,1,1)^t$. (*15 marks*)

B. Compute the radiance (emitted intensity) at point $(1,1,1)^t$. (*15 marks)*

3. In this question we will examine Bresenham's line drawing algorithm between two pixels $p_1=(x_1,y_1)$ and $p_2=(x_2,y_2)$. Suppose we measure the digital length of a digital line in the following way: as we traverse the pixels from p_1 to p_2, every step up, down, left or right is counted as 1. Every step in any diagonal direction is counted as 1.414 (approximately $\sqrt{2}$). The digital length is the sum of the lengths of the steps as we go from p_1 to p_2. What is the digital length of the line from (0,0) to (100,653)? Write a short explanation. (*15 marks*)

4. Find a 3×3 transformation matrix for transforming homogeneous coordinates in the plane that performs the transformation shown below. (*20 marks*)