Graphics B–Exam

Fall 1995

Question 1 *Develop a Bresenham–like algorithm for scan converting the parabola* $y = x^2/2a$ *for* $-a \leq x \leq a$. *You may assume that* a *is an integer. Your algorithm should use only integer variables and addition. Please be sure to provide a diagram to illustrate how your algorithm selects pixels.*

Question 2 *Construct an algorithm to clip lines to a circular window. The circle is defined by a radius* R *and a center point* $C = (a, b)$ *lying in the* xy*–plane. The lines are defined by their end points. Develop all the formulas you need for quick accept reject tests and intersection computations.*

Question 3 *Starting with the outline of a square, consider iterating the procedure which replaces each straight line segment by a square bump whose sides are 1/3 the size of the original segment (see Figure 1).*

a. *Write a program to draw the* N^{th} *level of this curve.*

b. *Compute the following:*

   i. *The fractal dimension of the curve.*

   ii. *The perimeter of the curve.*

   iii. *The area inside the curve.*

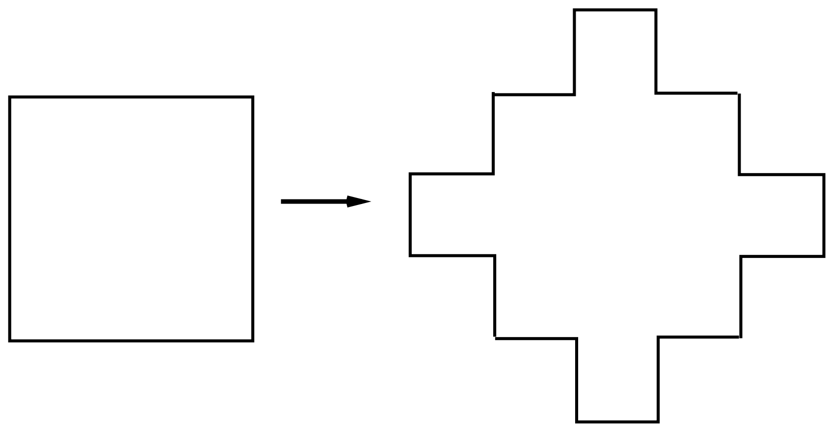

Figure 1: A square bump placed on each side of a square.

Question 4 *a. Explain the difference between ambient light, diffuse reflection, and specular reflection.*

b. Consider Figure 2 below. Give formulas for the contributions to the overall intensity at P of the ambient light, the diffuse reflection, and the specular reflection in terms of the vectors L, V, N and the intensity I of the light source.

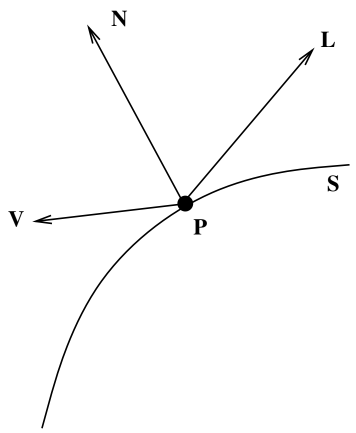

Figure 2: At the point P on the surface S, the vector L points to the light source, the vector V points towards the viewer's eye, and the vector N is normal to the surface S.