

## 1 Textures

To do spherical environment mapping, we used a photograph of a reflective sphere as the texture. Is it possible to use a photograph of a reflective cube instead? Explain why.

## 2 Shadow volumes

Assume your graphics card treats the stencil buffer entries as nonnegative integers and, when it decrements the stencil value, it subtracts one if that entry is positive and leaves it invariant if it's zero. Assuming this is the only thing we change, would the shadow algorithm work if we swapped the second and third passes (recall that the second pass is when we draw shadow polygons with back face culling on and the third - when we draw them with front face culling on; we now want to do them in the opposite order)? Will the altered algorithm work if the stencil buffer entries are 'normal' signed integers?

## 3 Bezier curves

Let  $P_0 = (0, 0)$ ,  $P_1 = (0, 1)$ ,  $P_2 = (1, 1)$ ,  $P_3(1, 0)$ . What is  $B_{P_0P_1P_2P_3}(.5)$ ?

## 4 Bresenham algorithm

Here is the Bresenham algorithm for lines as covered in class As you may remem-

```

d := q_x;
y := 0;
for x:=0 to q_x do
  plot(x,y);
  d := d - 2*q_y;
  if d<0 then
    y := y+1;
    d := d+2*q_x

```

ber, it draws a line starting at the origin and ending at  $q = (q_x, q_y)$ , assuming that  $q$  is in the first octant, i.e.  $0 \leq q_y \leq q_x$ . Describe precisely the output of the algorithm be if  $q$  were:

- a) in the second octant, i.e. above the line  $x = y$  and to the right of the y-axis, or equivalently  $0 \leq q_x \leq q_y$
- b) in the fourth quadrant, i.e. below the x-axis and to the right of the y-axis, or  $q_x > 0 > q_y$

## 5 Subdivision

How many vertices, edges and triangles are there in a tetrahedron after:

- 1 One subdivision step (Loop or Butterfly)
- 2 Two subdivision steps
- 3 Three subdivision steps
- 4  $N$  subdivision steps, any  $N$

## 6 Bezier curves

Consider the two Bezier curves with the following control points:

Curve A:  $(0, 0)$ ,  $(0, 1)$ ,  $(2, 1)$ ,  $(3, 3)$

Curve B:  $(3, 3)$ ,  $(4, 4)$ ,  $(5, 5)$ ,  $(6, 8)$ .

Do they join smoothly at  $(3, 3)$ ? If not, move the point where they join (i.e. replace the control point  $(3, 3)$  for both curves by some other point) so that they do.

## 7 B-splines

Consider a cubic degree B-spline curve with control points  $P_0, P_1, \dots$ . What is its starting point?