

# CS4451 TEST 2 / SPRING 2003

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1. Consider the two Bezier curves with the following control points:

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

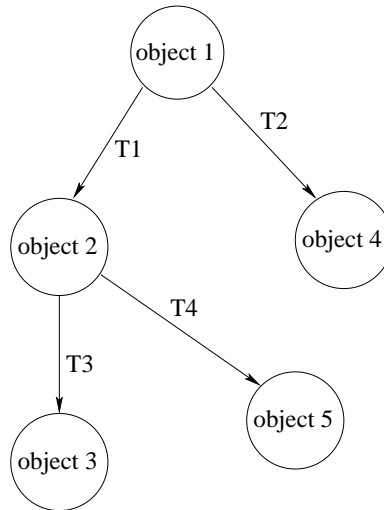
Curve B:  $(3, 3)$ ,  $(4, 4)$ ,  $(5, 5)$ ,  $(6, 8)$ .

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.

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2. Write an OpenGL pseudocode which displays the following scene graph. Use `draw(object N)` to draw object N and `glMultmatrix(TN)` to multiply the current matrix by one at an edge ( $TN=T1 \dots T4$ ).



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3. Here is the Bresenham algorithm for circles. What would happen if

```
y := R;
d := 1/4 - R;

for x:=0 to ceil(R/sqrt(2)) do
  plot_points(x,y);
  d += 2x+1;
  if (d>0)
    d += 2-2y;
    y--;
  plot(x,y);
  plot(x,-y);
  plot(-x,y);
  plot(-x,-y);
  plot(y,x);
  plot(-y,x);
  plot(y,-x);
  plot(-y,-x);
```

Figure 1: Bresenham algorithm

instead of using 8-way symmetry we use 4-way symmetry as in the algorithm given below? Describe (precisely) and draw the output of the algorithm.

```
y := R;
d := 1/4 - R;

for x:=0 to R do
  plot_points(x,y);
  d += 2x+1;
  if (d>0)
    d += 2-2y;
    y--;
  plot(x,y);
  plot(x,-y);
  plot(-x,y);
  plot(-x,-y);
```

Figure 2: Modified Bresenham algorithm

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4. We have talked in class about using a photograph of a reflective sphere as a texture in environment mapping. Is there a way to use a reflective cube for the same task? If you think it can, describe briefly how to obtain texture coordinates for the vertices. Otherwise, explain what is the fundamental reason making a cube unsuitable.

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5. You are applying the Loop subdivision scheme to a tetrahedron. How many triangles, edges and vertices will the resulting mesh have after:

1. 1 subdivision steps
2. 2 subdivision steps
3. 3 subdivision steps
4.  $N$  subdivision steps