CS 428 (Computer Graphics)
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Fall 2009

Homework #1

Due date: 09/29/09

Exercise 1:
Let $V_1 = [2,3,4]^T$ and $V_2 = [1,1,3]^T$ two vectors in the Euclidean vector space R^3, answer the following questions:

1. Compute the inner product $I = V_1 \bullet V_2$ as well as the vector product $V = V_1 x V_2$.
2. Determine the cosine of the angle formed by V_1 and V_2.
3. Determine the sine of the angle formed by V_1 and V_2.
4. Approximate the measure of the angle formed by the two vectors V_1 and V_2.
5. If you divide the area of the parallelogram formed by V_1 and V_2 into two triangles, what is the area of each triangle formed?
6. Compute the area of a polygon which has the vertices $P_0 = [2,1,5]^T$, $P_1 = [1,2,7]^T$, $P_2 = [1,1,1]^T$, and $P_3 = [-2,3,5]^T$ and P_4 has the same coordinates as P_0.

Exercise 2:
Write a JAVA program that draws a set of concentric pairs of squares, each consisting of a square with horizontal and vertical edges and one rotated through 45◦. Except for the outermost square, the vertices of each square are the midpoints of the edges of its immediately surrounding square, as Figure 1.12 shows. It is required that all lines are exactly straight, and that vertices of smaller squares lie exactly on the edges of larger ones.

Exercise 3:
Write a JAVA program that:
1. Transforms logical coordinate points into device coordinate points and vice versa
2. Draws the polygon formed by these points.
3. Computes the area of this polygon and display it on the screen.

Exercise 4:
1. How many pixels are put on the screen by each of the following calls?

g.drawRect (20,20,5,5)
g.drawLine (5,10,30,30)
g.fillRect (10,12,10,50)

2. Draw these shapes using JAVA.