

Homework 4
CS 354
Due Tuesday April 30 at the beginning of class

Name

UT EID

1. (15 points) Consider a line from point $(0.1, 0.7)$ to $(5.3, 2.3)$. Compute which pixels should be filled in according to Bresenham's algorithm by filling out the table below. Show your work.

k	x	d	y
0	1/2		
1	3/2		
2	5/2		
3	7/2		
4	9/2		
5	11/2		

2. (15 points) You wish to determine the two intersection points between a ray R and a sphere S . Ray R starts at $(1, 2, 1)$ and heads in the direction $(0.3, 0.8, 0.5)$. Sphere S is centered at the point $(6, 7, 4)$ and has a radius of length $\sqrt{26}$. At what two points does the ray intersect the sphere? Which point is closer to the origin of the ray? Hint: First parameterize the ray as $R(t)$ and then solve for the value of t for each point of intersection.

3. (10 points) Consider 4 squares each with side length = 2. Their center points and normals are given below:

name	center	normal
A	(0, 1, 1)	(1, 0, 0)
B	(1, 0, 1)	(0, 1, 0)
C	(0, 3, 1)	(1, 0, 0)
D	(1, 1, 1)	(-1, 0, 0)

Let f_{AB} be the form factor between squares A and B . Let the other form factors be named similarly. Give f_{AB} , f_{AC} , and f_{AD} in sorted order from least to greatest. Explain why they are sorted in that order. You do not need to compute the form factors.

4. (10 points) A quadratic Bezier curve has the form

$$P(t) = (1-t)^2 P_0 + 2t(1-t)P_1 + t^2 P_2 \quad \text{for } 0 \leq t \leq 1$$

Given control points $P_0 = (0, 0)$, $P_1 = (0, 1)$, $P_2 = (1, 0)$, sketch the Bezier curve. Label and give exact coordinates for points at $t = 1/4$, $t = 1/2$, and $t = 3/4$.