

Homework 1: Airbrush

Due: Friday, March 20 (9:30 AM)

Question 1 The “distribution” in this lab is a function that, given the distance from the pixel to the center of the brush region, outputs a value from 0 to 1 that indicates the fraction of the final pixel color contributed by the brush color (naturally, one minus the distribution value would be the fraction of the final pixel color contributed by the current canvas color at that pixel).

For a brush with a radius of 10 pixels, (1) Draw 2D graphs of the brush contribution and the canvas contribution, as functions of distance from the center of the brush, using the linear distribution model; (2) Write down the value of each function at distance 2.5, 5, and 7.5; (3) Write down the equation for the brush contribution in terms of the radius r (in this case $r = 10$) and the distance d .

Question 2 Draw another graph with the brush and canvas contributions for the quadratic distribution. Write down the value of each function at distance 2.5, 5 and 7.5. Give the equation for the brush contribution.

Question 3 The flow rate modulates how much of the brush color is blended with the canvas as well. In the lab, we use the product of the flow rate and the distribution value as the actual contribution of the brush color in the final pixel color. What formula will you use to calculate the final pixel color, given the flow rate (F), the distribution value (M), the airbrush color (C_b) and the canvas color (C_c)?

Question 4 When the user clicks on a point, you will have to loop over part of the canvas, coloring each pixel. This will be a double loop, but over what indices? Express the range of your loops in terms of the click point (mouseX , mouseY) and the mask radius (R). How will this range be affected if the mask extends past the boundaries of the canvas? Give pseudo-code.

Question 5 [Answer if you are doing the scan line conversion option; otherwise, you can leave it blank.]

The start and stop points of the line are $(p1_x, p1_y)$ and $(p2_x, p2_y)$, and the desired line width is 5. How do you pick the start and stop points of the other lines you need to draw to make a line of width 5?

Question 6 [Answer if you are doing the polygon scan line option; otherwise, you can leave it blank.]

You are given a polygon with vertices $(5,5)$, $(8,11)$, $(11,5)$, $(8,8)$. Write out the start and stop pixels on each scan-line that are generated by the scan-line algorithm. Round up at 0.5.

Question 7 [Answer if you are doing the filtering option; otherwise, you can leave it blank.]

Given two user input points $(p1_x, p1_y)$ and $(p2_x, p2_y)$, and a filter of size r (r odd), write the filter pseudo code. Note that this is a quadruple for loop; the two outer for loops go over the rectangle, the inner two loops sum each pixel. Let $I(x,y)$ be the input image pixel, $O(x,y)$ be the output pixel. Do bounds checking.