Geometric-Transformation-Example2-Solutions

Question 1

	$x=0$	$x=1$	$x=2$
$y=0$	1	10	100
$y=1$	4	40	200
$y=2$	7	60	150

The above picture is transformed by a geometric transformation. The (forward) description of this transformation is:

> The pixel at coordinate (x, y) in the original picture moves to the location $(y, 3x-2y)$ in the new picture.

Computing the inverse transformation we get:

$$\text{new } x = \frac{2x+y}{3}, \quad \text{new } y = x$$

The following table specifies where each pixel is coming from:

	$x=0$	$x=1$	$x=2$
$y=0$	$(x=0, y=0)$	$(x=2/3, y=1)$	$(x=4/3, y=2)$
$y=1$	$(x=1/3, y=0)$	$(x=1, y=1)$	$(x=5/3, y=2)$
$y=2$	$(x=2/3, y=0)$	$(x=4/3, y=1)$	$(x=2, y=2)$

A.

Compute the transformed image using Nearest-Neighbor interpolation.

Rounding gives the following coordinate table for where each pixel is coming from:

	$x=0$	$x=1$	$x=2$
$y=0$	$(x=0, y=0)$	$(x=1, y=1)$	$(x=1, y=2)$
$y=1$	$(x=0, y=0)$	$(x=1, y=1)$	$(x=2, y=2)$
$y=2$	$(x=1, y=0)$	$(x=1, y=1)$	$(x=2, y=2)$

This gives the following transformed image:

	$x=0$	$x=1$	$x=2$
$y=0$	1	40	60
$y=1$	1	40	150
$y=2$	10	40	150

B.

Compute the first line of the transformed image using Bilinear interpolation.

	$x=0$	$x=1$	$x=2$
$y=0$	1	$4(\frac{1}{3}) + 40(\frac{2}{3}) = 28$	$60(\frac{2}{3}) + 150(\frac{1}{3}) = 90$