Overview of Computer Graphics
Topics

Solved Problems

Solved Problems

2.1 What is the resolution of an image?

SOLUTION

The number of pixels (i.e., picture elements) per unit length (e.g., inch) in the horizontal as well as vertical direction.

2.2 Compute the size of a 640 × 480 image at 240 pixels per inch.

SOLUTION

640/240 by 480/240 or $2\frac{2}{3}$ by 2 inches.

Solved Problems

2.3   Compute the resolution of a 2×2 inch image that has 512×512 pixels.

SOLUTION

$512/2$ or 256 pixels per inch.

2.4   What is an image's aspect ratio?

SOLUTION

The ratio of its width to its height, measured in unit length or number of pixels.

Solved Problems

2.5 If an image has a height of 2 inches and an aspect ratio of 1.5, what is its width?

SOLUTION

$$width = 1.5 \times height = 1.5 \times 2 = 3 \text{ inches}.$$

2.6 If we want to resize a 1024×768 image to one that is 640 pixels wide with the same aspect ratio, what would be the height of the resized image?

SOLUTION

$$height = 640 \times 768/1024 = 480.$$

2.7 If we want to cut a 512×512 sub-image out from the center of an 800×600 image, what are the coordinates of the pixel in the large image that is at the lower left corner of the small image?

SOLUTION

$$[(800 - 512)/2, (600 - 512)/2] = (144, 44).$$

2.8 Sometimes the pixel at the upper left corner of an image is considered to be at the origin of the pixel coordinate system (a left-handed system). How to convert the coordinates of a pixel at (x, y) in this coordinate system into its coordinates (x', y') in the lower-left-corner-as-origin coordinate system (a right-handed system)?

SOLUTION

$(x', y') = (x, m - y - 1)$ where m is the number of pixels in the vertical direction.

Solved Problems

2.9 Find the CMY coordinates of a color at $(0.2, 1, 0.5)$ in the RGB space.

SOLUTION

$$(1 - 0.2, 1 - 1, 1 - 0.5) = (0.8, 0, 0.5).$$

2.10 Find the RGB coordinates of a color at $(0.15, 0.75, 0)$ in the CMY space.

SOLUTION

$$(1 - 0.15, 1 - 0.75, 1 - 0) = (0.85, 0.25, 1).$$

2.11 If we use direct coding of RGB values with 2 bits per primary color, how many possible colors do we have for each pixel?

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SOLUTION

$$2^2 \times 2^2 \times 2^2 = 4 \times 4 \times 4 = 64.$$

2.12   If we use direct coding of RGB values with 10 bits per primary color, how many possible colors do we have for each pixel?

SOLUTION

$$2^{10} \times 2^{10} \times 2^{10} = 1024^3 = 1073,741,824 > 1 \text{ billion}.$$

2.13   The direct coding method is flexible in that it allows the allocation of a different number of bits to each primary color. If we use 5 bits each for red and blue and 6 bits for green for a total of 16 bits per pixel, how many possible simultaneous colors do we have?

SOLUTION

$$2^5 \times 2^5 \times 2^6 = 2^{16} = 65,536.$$

2.14   If we use 12-bit pixel values in a lookup table representation, how many entries does the lookup table have?

SOLUTION

$$2^{12} = 4096.$$

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2.15 If we use 2-byte pixel values in a 24-bit lookup table representation, how many bytes does the lookup table occupy?

SOLUTION

$2^{16} \times 24/8 = 65{,}536 \times 3 = 196{,}608.$

2.16 True or false: fluorescence is the term used to describe the light given off by a phosphor after it has been exposed to an electron beam. Explain your answer.

SOLUTION

False. Phosphorescence is the correct term. Fluorescence refers to the light given off by a phosphor while it is being exposed to an electron beam.

2.17 What is persistence?

SOLUTION

The duration of phosphorescence exhibited by a phosphor.

2.18 What is the function of the control electrode in a CRT?

SOLUTION

Regulate the intensity of the electron beam.

2.19 Name the two methods by which an electron beam can be bent?

SOLUTION

Electrostatic deflection and magnetic deflection.

Thanks