Chapter 1 Numerical

Consider three different raster system with resolution of 640×480, 1280×1024 and 2560×2048. What size of frame buffer (in bytes) is needed for each of these system, to store 12 bits per pixel? How much storage is required for each system if 24 bits per pixel are to be stored?

Solution

Case I : For 640×480

resolution = 640×480 pixels

(a) given 1 pixel can store 12 bits

∴ Size of pixel $= \dfrac{640 \times 480 \times 12}{8}$ bytes

$= 460800$ bytes

(b) 1 pixel can store 24 bits

∴ Size of pixel $= \dfrac{640 \times 480 \times 24}{8}$ bytes

$= 921600$ byte.

Case II : For 1280×1024

(a) 1 pixel can store 12 bits

∴ Size of pixel $= \dfrac{1280 \times 1024 \times 12}{8}$

$= 1966080$ byte

(b) 1 pixel can store 24 bits

∴ Size of pixel $= \dfrac{1280 \times 1024 \times 24}{8}$

$= 3932160$ bytes

Case III: For 2560×2048

(a) 1 pixel can store 12 bits

$\therefore$ Size of frame buffer $= \dfrac{2560 \times 2048 \times 12}{8}$

$= 7864320$ byte

(b) 1 pixel can store 24 bits

$\therefore$ Size of frame buffer $= \dfrac{2560 \times 2048 \times 24}{8}$

$= 15728640$ bytes

Q. Consider two raster systems with resolutions of 640×480 and 1280×1024. How many pixels could be accessed per second in each of these system by a display controller that refreshes the screen at a rate of 60 frames per second? What is the access time per pixel in each system.

Solution:

Case I: For 640×480

(a) Total no. of pixels required for 640×480 resolution $= 640 \times 480$ pixels

i.e. no. of pixels contained by a frame.

Controller can access 60 frames/sec.

$\therefore$ Total no. of pixels accessed $= 60 \times 640 \times 480$/sec.

Now,

Access time per pixel $= \dfrac{1}{60 \times 640 \times 480}$

$= 5.43 \times 10^{-8}$ sec/pixels

Case II : For 1280×1024

resolution $= 1280 \times 1024$ pixels

So Total no. of pixels accessed $= 60 * 1280 * 1024$

Then,

Access time per pixel $= \dfrac{1}{60 * 1280 * 1024}$

$= 1.27 \times 10^{-3}$ seconds/pixel

Q. How many kilo bytes does a frame buffer need in a 600×400 pixel?

Solution

Suppose 1 pixel can store 'n' bits

$\therefore$ Size of frame buffer $= n * 600 * 400$ bits

$= \dfrac{n * 600 * 400}{8}$ bytes

$= \dfrac{n * 600 * 400}{8 * 1024}$ kbytes

$= 29.29n$ KB

Q. How much time is spend scanning across each row of pixels during screen refresh on a raster system with resolution of 1280×1024 and a refresh rate of 60 frames per second.

Solution

Resolution $= 1280 \times 1024$ pixels

i.e. System contains 1024 scan lines and each scan line contains a 1280 pixels.

refresh rate $= 60$ frames/sec.

i.e. 1 frame takes $\frac{1}{60}$ sec.

One frame consists of 1024 scan lines

so 1024 scan lines takes $\frac{1}{60}$ seconds

and one scan line takes $\frac{1}{60} * \frac{1}{1024}$ seconds

$= 1.63 \times 10^{-5}$ sec.

Q. How long would it take to load a 640X 480 frame buffer with 12 bits per pixels, if 10^5 bits can be transferred per second? How long would it take to load a 24 bits per pixel frame buffer with a resolution of 1280×1024 using the same transfer rate.

Solution:

Case I:

Total bits for the frame $= 640 \times 480 \times 12$ bits

time needed to load the frame buffer

$= \frac{640 \times 480 \times 12}{10^5}$ sec

$= 36.864$ s.

Case – II

Total bits for the frame $= 1280 \times 1024 \times 24$ bits

Time needed to load the frame buffer

$= \frac{1280 \times 1024 \times 24}{10^5}$ sec

$= 314.5728$ sec.