Q.N.1.: Consider a RGB raster system is to be designed using 8 inch by 10 inch screen with a resolution of 100 pixels per inch in each direction. If we want to store 8 bits per pixel in the frame buffer, how much storage do we need for the frame buffer?

Solution:

Size of screen = 8 inch × 10 inch

Pixel per inch (Resolution) = 100

Total no. of pixel = (8*100)*(10*100) = 800000 pixels

Per pixel storage = 8 bit

Total storage required in frame buffer = 800000*8 bits = 6400000 bits

= 6400000/8 bytes = 800000 bytes

Q.N.2.: There is a system with 24 bits per pixel and resolution of 1024 by 1024. Calculate the size of frame buffer.

Solution:

Resolution = 1024 × 1024

Total number of pixel = 1024*1024 = 1048576 pixels

Per pixel storage = 24 bits

Total storage required in frame buffer = 1048576*24 = 25165824 bits

= 25165824/8 byte

= 25165824/(8*1024) kb

= 25165824/(8*1024*1024)Mb

= 3 Mb

Q.N.3.: Consider raster system with resolution 1280 ×1024.

a) How much pixel could be accessed per second by the video controller that refreshes the screen at the rate of 60 frames / second?

b) What is the access time per pixel?

Solution:

a) No. of pixel accessed per second = 1280*1024*60 = 78643200 pixels

b) Since 78643200 pixels are accessed in 1 second

Access time per pixel = 1/78643200 sec

= 12.7 $nanosec.$

Q.N.4.: Consider a raster scan system having 12 inch by 12 inch with a resolution of 100 pixels per inch in each direction. If display controller of this system refreshes the screen at the rate of 50 frames per second, how many pixels could be accessed per second and what is the access time per pixel of the system.

Solution:

Size of screen = 12 inch × 12 inch

Resolution = 100 pixels per inch

Total no. of pixels in one frame = (12*100)*(12*100)

Refresh rate = 50 frames per second

i.e. 50 frames can be accessed in 1 sec.

Total no. of pixel accessed in 1 sec = 50*(12*100)*(12*100) = 72000000 pixels

Again,

50 frames can be accessed in 1 sec.

1 frame can be accessed in 1/50 sec.

(12*100*12*100) frames can be accessed in 1/50 sec.

Then, 1 pixel can be accessed in 1/(50*12*100*12*100) sec.

$= 10^9/(50*12*100*12*100)$ ns

= 13.88 ns.

Q.N.5.: How many K bytes does a frame buffer needs in 600 × 400 pixels?

Solution:

Suppose n bits are required to store 1 pixels.

Then, the size of frame buffer = resolution * bits per pixel

= (600*400)*n bits

= 240000 n/(8*1024) KB

= 29.30 n KB

Q.N.6.: Find the aspect ratio of raster system using 8 × 10 inches screen and having 100 pixels/inch.

Solution:

We know that,

Aspect ratio = $width/height$ = (8∗100)/(10∗100) = 4/ 5

So, aspect ratio = 4:5

Q.N.7.: What is the time required to display a pixel on the monitor of size 1024 × 768 with refresh rate of 60 Hz?

Solution:

Refresh rate = 60Hz i.e. 60 frames per second

Total no. of pixel in one frame = 1024*768 = 786432 pixels

60 frames need 1 sec.

1 frame need 1/60 sec.

786432 pixels need 1/60 sec.

1 pixel need 1/(60*786432) sec. = 10^9/(60*786432) ns = 21.19 ns

Q.N.8.: How much time is spent scanning across each row of pixels during screen refresh on a raster system with resolution 1280 ×1024 and refresh rate of 60 frames per second?

Solution:

Resolution = 1280 × 1024

i.e. one frame contains 1024 scan line and each scan line consists of 1280 pixels.

Refresh rate = 60 frames per second

i.e. 60 frames take 1 second.

1 frame takes 1/60 second.

i.e. 1024 scan line take 1/60 second i.e. 0.0166 sec.

1 scan line take 0.0166/1024 =1.627*10^{-5} sec.

Q.N.9.: If a pixel is accessed from the frame buffer with an average access time of 300ns then will this rate produce an un-flicking effect for the screen size of 640 × 480.

Solution:

Size of screen = 640 × 480

Total no. of pixels = 640*480=307200

Average access time of one pixel = 300 ns

Total time required to access entire pixels of image in the screen = 307200*300 = 92160000ns

= 92160000/10^9 sec

= 0.09216 sec

i.e. one cycle take 0.09216 sec.

Now, no. of cycles per second i.e. refresh rate =?

0.09216 sec = 1 cycle

1 sec = 1/0.09216

=10.86

Refresh rate = 10.86 cycles per second.

Since the minimum refresh rate for unflicker image is 60 frames per second, hence we can say the monitor produces flickering effect.

Q.N.10.: Calculate the total memory required to store a 10 minutes video in a SVGA system with 24 bits true color and 25 fps.

Solution:

The SVGA system allows resolution = 800 × 600

Refresh rate = 25 fps

To calculate the memory required for one frame, we multiply the number of pixels by the number of bits per pixel:

Memory per frame = (800 pixels) x (600 pixels) x (24 bits/pixel) = 11,520,000 bits

Since the frame rate is given as 25 frames per second, we multiply the memory per frame by the frame rate to get the memory required per second:

Memory per second = 11,520,000 bits/frame x 25 frames/second = 288,000,000 bits/second

Finally, to calculate the total memory required for a 10-minute video, we multiply the memory per second by the duration in seconds:

Memory for 10-minute video = Memory per second x (10 minutes x 60 seconds/minute)

= 288,000,000 bits/second x 600 seconds

= 172,800,000,000 bits

Converting to a more common unit of memory, we can divide the result by 8 to get the memory in bytes:

Memory for 10-minute video = 172,800,000,000 bits / 8 = 21,600,000,000 bytes

Therefore, approximately 21.6 gigabytes (GB) of memory would be required to store a 10-minute video in a SVGA system with 24 bits true color and a frame rate of 25 fps.

Q.N.11.: If the pixel values are accessed from the frame buffer with an average access time (for one single pixel) of 20 ns and the total resolution of the screen is 1024 X 800 , will there be a flickering effect seen on the screen ?

 To glow one single pixel takes = 20 ns

To glow all pixel on screen it takes = 1024 X 800 X 20ns

= 16,384,000ns

= 0.01638 second

Now

frequency(F) = 1/T

= 1/0.01638

= 61.05 HZ

since it is above 60 times/sec there will be no flickering effect seen on screen

Q.N.12:. In case of raster system with resolution 1024 X 1280, how many pixel could be accessed per second in the system by a display controller at a rate of 60 frames per second? what is accessed time per pixel in this system ?

Ans :

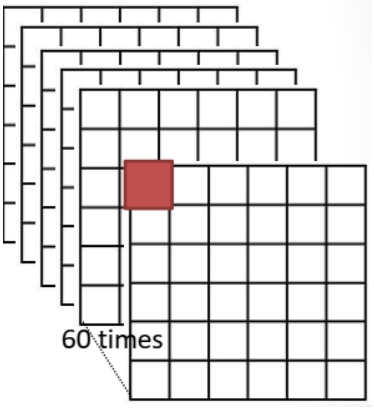
1. Pixel accessed :

= 1024 X 1280 X 60 pixel can be accessed in this system

2. Access time per pixel:

= 1/(1024 X 1280 X 60)

= 12.71ns



= = =

Q.N.13.: How long would it takes to load a 640 X 480 frame buffer with 12 bit per pixels if 10^5 bits can be transferred per second.

Ans :

total size of frame buffer : = 640 X 480 X 12

it takes = $(640 \times 480 \times 12)/10^5$

*Formula:

Required size of frame= Resolution or total no. of pixel X no. of bit per pixel on screen

Q.N.14.: If the total number of intensities achievable out of a single pixel on the screen is 1024 and the total resolution of the screen is 1024 X 800 , what will be the required size of frame buffer in this case for the display purpose ?

Ans :

(Note : 2^n = pixel on the screen) where n= no. of bit on screen

So, $2^n = 1024$

n = 10 bit

Required size of frame buffer = 10 X 1024 X 800
= 8,192,000 bit

*Formula:
Required size of frame= Resolution or total no. of pixel X no. of bit per pixel on screen
where single pixel on screen = 2^n and n= no. of bit per pixel on screen

Q.N.15.: Consider three different raster system with resolution 640 by 400, 1280 by 1024 and 2560 by 2048. what size frame buffer (in byte) is needed for each of the system to store 12 bits per pixel? How much storage is required for each system if 24 bit per pixel are to be stored.

Ans :

1) **for 12 bit per pixel system**

the frame buffer(in byte) size needed

a. for 640 by 400 resolution = $\frac{(640 \text{ X } 400 \text{ X } 12)}{8}$ =384000 byte

b. for 1280 by 1024 resolution = $\frac{(1280 \text{ X } 1024 \text{ X } 12)}{8}$ =1966080 byte

c. for 2560 by 2048 resolution = $\frac{(2560 \text{ X } 2048 \text{ X } 12)}{8}$ =7864320 byte

2) **for 24 bit per pixel system**

the frame buffer(in byte) size needed

a. for 640 by 400 resolution = $\frac{(2560 \text{ X } 2048 \text{ X } 24)}{8}$ =768000 byte

b. for 1280 by 1024 resolution = $\frac{(1280 \text{ X } 1024 \text{ X } 24)}{8}$ =3932160 byte

c. for 2560 by 2048 resolution = $\frac{(2560 \text{ X } 2048 \text{ X } 24)}{8}$ =15728600byte

Q.N.16.: Suppose an RGB raster system is to be designed using 8-inch by 10-inch screen with a resolution of 100 pixels per inch in each direction. If we want to store 9 bit per pixel in the frame buffer. How much storage (in byte) do we need for the frame buffer?

Ans :

Size of screen = 8 inch × 10 inch.

Pixel per inch(Resolution) = 100.

Then, Total no of pixels = 8 x100 by 10x100 pixels

= (8*100 X 10*100) pixels

= 8,00,000

Bit per pixel storage = 9

Therefore, total storage required in frame buffer = $\frac{8,00,000 \text{ X } 9}{8}$

= 9,00,000 bytes

Q.N.17.: How long would it take to load a 640 by 480 frame buffer with 12 bits per pixel, if 10^5 bit can be transferred per second? How long would it take to lead a 24-bit per pixel frame buffer with a resolution of 1280 by 1024 using this same transfer rate?

Ans :

 for 640 X 480 frame buffer with 12 bits for pixels

total pixel = 640 X 480 X12

time required = $\frac{(640 \text{ X } 480 \text{ X}12)}{10^5}$

= 36.864 second

 for 1280 X 1024 frame buffer with 24 bits for pixels

total pixel = 1280 X 1024 X 24

time required = $\frac{(1280 \text{ X } 1024 \text{ X } 24)}{10^5}$

= 314.57 second

Q.N.18.: Consider two raster system with resolution of 640 by 480 and 1280 by 1024. how many pixels could be accessed per second in each of these system by a display controller that refreshes the screen at the rate of 60 frames per second? What is the access time per pixel in each system?

Ans :

for a raster system with resolution of 640 by 480,

i) No.of pixel accessed per second = 640 X 480 X 60

ii) Total access time = 1/60 = 0.0167

access time per pixel = (0.0167)/(640 X 480)

= 54.36 ns

for a raster system with resolution of 1280 by 1024,
i) No.of pixel accessed per second = 1280 X 1024 X 60
ii) Total access time = 1/60 = 0.0167
access time per pixel = (0.0167)/(1280 X 1024)
= 12.7 ns

Q.N.19.: A raster system can produce a total number of 1024 different level of intensities from a single pixel composed of red, green and blue phosphor dots. If the resolution of the screen is 1280 X 1024, what will be the required size of frame buffer for the display purpose?

Ans :

(Note : 2^n = pixel on the screen) where n= no. of pixel

So, $2^n = 1024$

n = 10 bit

Required size of frame buffer = 10 X 1280 X 1024
= 13107200 bit
= 1638400 byte

Q.N.20. : A system with 24 bits per pixel and resolution of 1024 by 1024. Calculate the size of frame buffer (in Megabytes).

Ans :

Frame size in bits= 24*1024*1024 bits

Frame size in bytes= 24*1024*1024 / 8 bytes
(since, 8 Bits = 1 Byte)
Frame size in kilobytes= 24*1024*1024 / 8 * 1024 kb
(since, 1024 Bytes = 1 KB)
So, Frame size in megabytes= 24*1024*1024 / 8*1024*1024 MB
(since, 1024 KB = 1 MB)
= 3 MB.

Q.N.21.: How Many K bytes does a frame buffer needs in a 600 x 400 pixel ?

Ans:

Resolution is 600 x 400.

Suppose 1 pixel can store n bits

Then, the size of frame buffer = Resolution * bits per pixel

= (600 * 400) * n bits

= 240000 n bits

$= \frac{240000 \text{ n kb}}{1024 * 8}$ (as 1kb = 1024 bites)

= 29.30 n k bytes.