



Date : 24 / sep / 2020

Department of Computer Science Summer Semester 2020

Final-Term Examination

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Course Title: Computer Graphics

Question No: 01

Explain the difference between True Colour and HD Colour System. Why don't we use True Colour in every device if the technology is available? What are the Limitations

Answer :

True Colour system :

Refers to any graphics device or software that uses at least 24 bits to represent each dot or pixel. Using 24 bits means that more than 16 million unique **colors** can be represented

HD Colour System :

identify display **systems** that can make use of more than 8-bits per **color** channel (10:10:10:2 or 16:16:16:16 rendering formats) from traditional 8-bit per **color** channel formats.

((**True colour** is the specification of the color of a pixel on a display screen using a 24-bit value, which allows the possibility of up to 16,777,216 possible colors. Many displays today support only an 8-bit color value, allowing up to 256 possible colors))) .

((**HD Color**" refers to the concept that superior **color** is a valuable and achievable objective, and to the HELIOS tools that make it possible. As a **color** management server and image conversion engine, a HELIOS server is a key solution for **color**-matching, image repurposing, proofing, and PDF and print production)))

...difference between True Colour and HD Colour System ...

True color allows more hues than the eye can distinguish, so most operating systems offer the option of 16-bit high color (Thousands of Colors on Macintosh). In high color, the monitor actually displays only 32 distinct levels of red, 32 of

blue, and 64 of green. The visual difference is almost unnoticeable, but reducing the color depth to 16 bits per pixel boosts video performance ,

.... Why don't we use True Colour in every device if the technology is available...

True color is an RGB color model standard that specifies 256 shades for red, green and blue spaces, totaling 16 million colors, much more than what the human eye can distinguish, which is only 10 million colors. This allows for very complex graphics and images, hence the name.

.....device if the technology is available? What are the Limitations.....

True Color imagery was designed to display the Earth in colors similar to what we might see with our own eyes. The product is primarily a combination of the three channels that are sensitive to the red, green, and blue visible light, but some information from the nearinfrared is included improve the color of green vegetated regions. A Rayleigh atmospheric 'correction' is applied to each band to improve product clarity. True Color imagery facilitates rapid delineation of surface types (desert, vegetation, snow cover) and atmospheric features (e.g., clouds, smoke, dust, smog, haze, and volcanic ash).

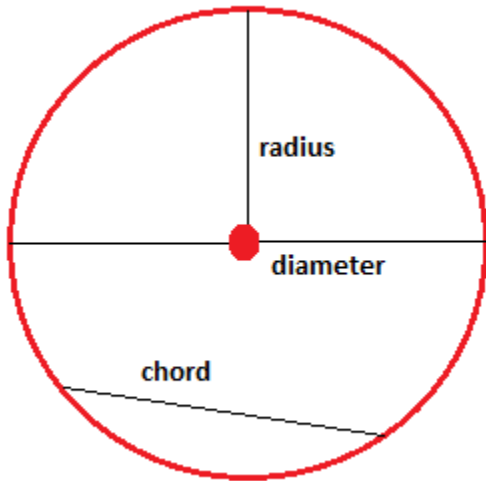
Question No: 02

- a. When drawing Circles, we calculate the values for just one piece of the circle and remaining can be manipulated. How is this possible? What is the reason behind the possible manipulation of the calculated values of just one octant?

Answer : a)

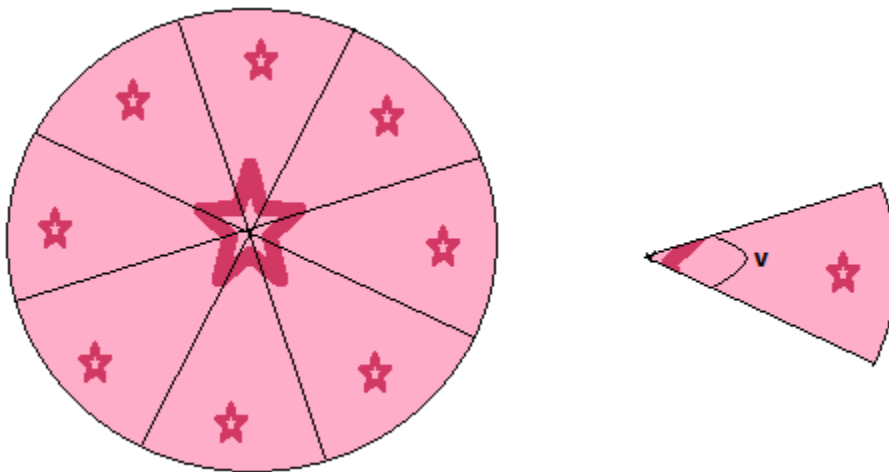
We should go for the solution until that know about these points to clear all concept

A circle is all points in the same plane that lie at an equal distance from a center point. The circle is only composed of the points on the border. You could think of a circle as a hula hoop. It's only the points on the border that are the circle. The points within the hula hoop are not part of the circle and are called interior points .



A circle is the same as 360° . You can divide a circle into smaller portions .

When diameters intersect at the central of the circle they form central angles. Like when you cut a cake you begin your pieces in the middle.



Eight-Way Symmetry

The first thing we can notice to make our circle drawing algorithm more efficient is that circles centred at $(0, 0)$ have *eight-way symmetry* .

Circle Drawing Using Cartesian Coordinates

for $x = \text{radius} - x_{\text{center}}$ to $\text{radius} + x_{\text{center}}$

$$y = y_c + \sqrt{r^2 - (x - x_c)^2}$$

drawPixel (x, y)

$$y = y_c - \sqrt{r^2 - (x - x_c)^2}$$

drawPixel (x, y)

these are the two main techniques

Example

As in the cake above we divide our circle into 8 pieces with the same angle. The circumference of the circle is 20 length units. Determine the length of the arc of each piece.

First we need to find the angle for each piece, since we know that a full circle is 360° we can easily tell that each piece has an angle of $360/8=45^\circ$. We plug these values into our formula for the length of arcs:

$$l = C \cdot \frac{\theta}{360} = C \cdot \frac{\theta}{360}$$

$$l = 20 \cdot \frac{45}{360} = 2.5 \quad l = 20 \cdot \frac{45}{360} = 2.5$$

Hence the length of our arcs are 2.5 length units. We could even easier have told this by simply dividing the circumference by the number of same size pieces:
 $20/8=2.5$

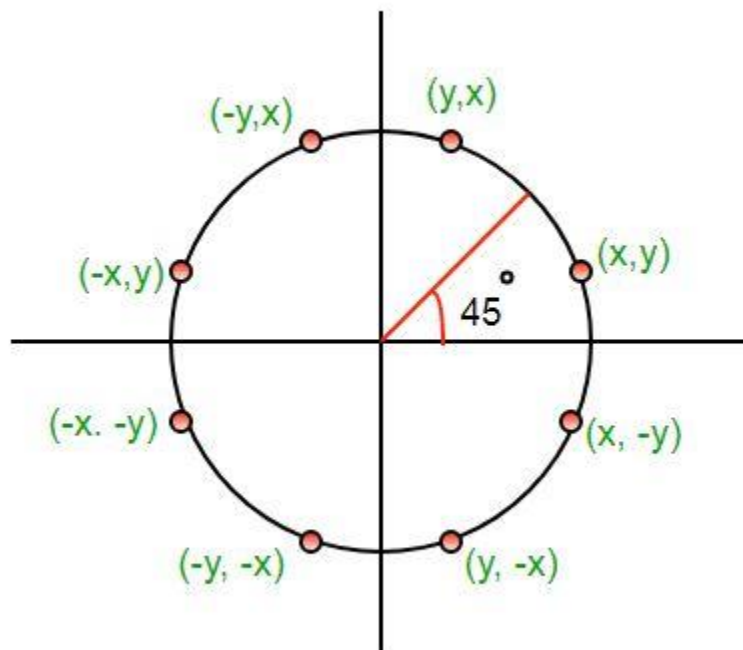
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B) Explain the working of Midpoint Circle algorithm in your own words. How does it find the value of the next pixel and what are the drawbacks

Answer : b) :

The **mid-point** circle drawing algorithm is an algorithm used to determine the points needed for rasterizing a circle.

We use the **mid-point** algorithm to calculate all the perimeter points of the circle in the **first octant** and then print them along with their mirror points in the other octants. This will work because a circle is symmetric about its centre.



This is an **algorithm** which is used to calculate the entire perimeter points of a **circle** in a first octant so that the points of the other octant can be taken easily as they are mirror points; this is due to **circle** property as it is symmetric about its center.

In the mid-point circle algorithm we use eight-way symmetry so only ever calculate the points for the top right eighth of a circle, and then use symmetry to get the rest of the points

For any given pixel (x, y) , the next pixel to be plotted is either $(x, y+1)$ or $(x-1, y+1)$. This can be decided by following the steps below.

1. Find the mid-point **p** of the two possible pixels i.e (x-0.5, y+1)
2. If **p** lies inside or on the circle perimeter, we plot the pixel (x, y+1), otherwise if it's outside we plot the pixel (x-1, y+1)

Boundary Condition : Whether the mid-point lies inside or outside the circle can be decided by using the formula:-

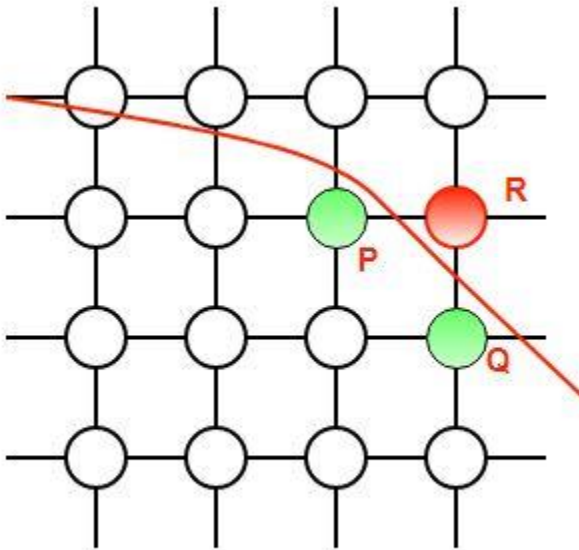
Given a circle centered at (0,0) and radius *r* and a point *p(x,y)*

$$F(p) = x^2 + y^2 - r^2$$

if $F(p) < 0$, the point is inside the circle

$F(p) = 0$, the point is on the perimeter

$F(p) > 0$, the point is outside the circle



Drawbacks of Mid Point Circle Drawing Algorithm

- Accuracy of the generating **points** is an issue in this **algorithm**.
- The **circle** generated by this **algorithm** is not smooth.
- This **algorithm** is time consuming.

Question No: 03

Colours are all same, but we have different Colour Models in computer graphics. Explain what can be the possible reason behind this. Also explain the different categories of Colour models in your own words, reflecting the difference among them.

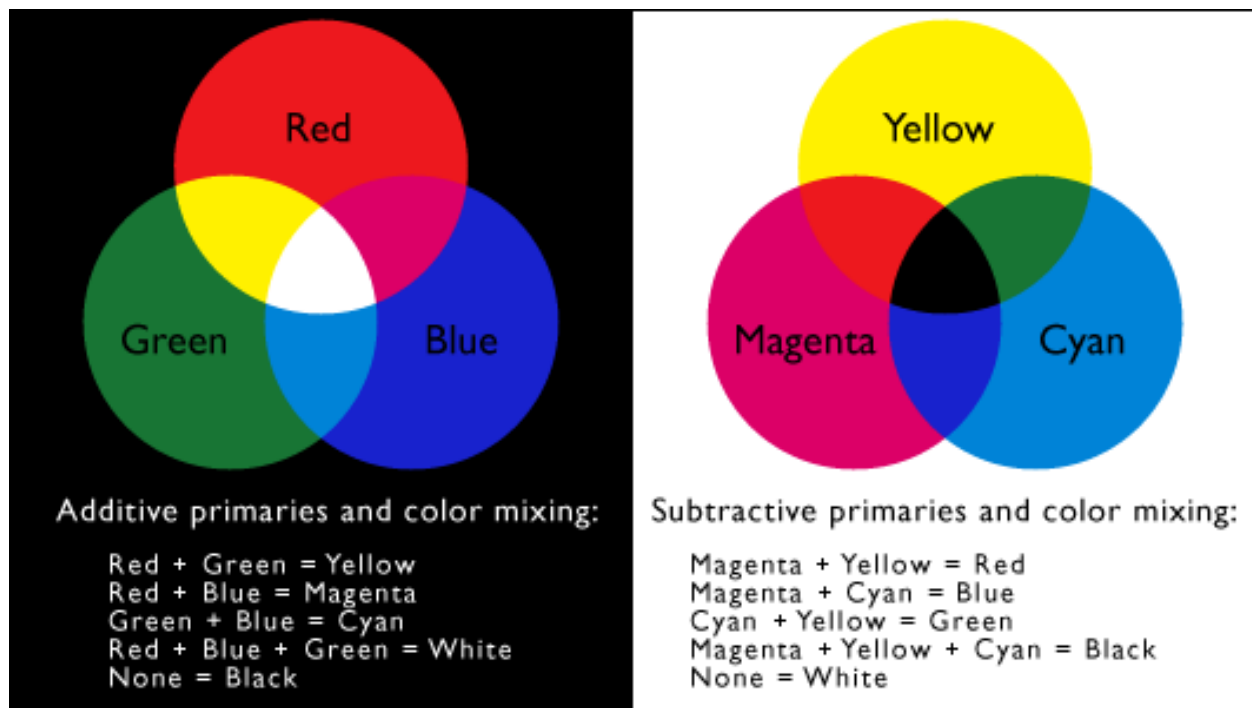
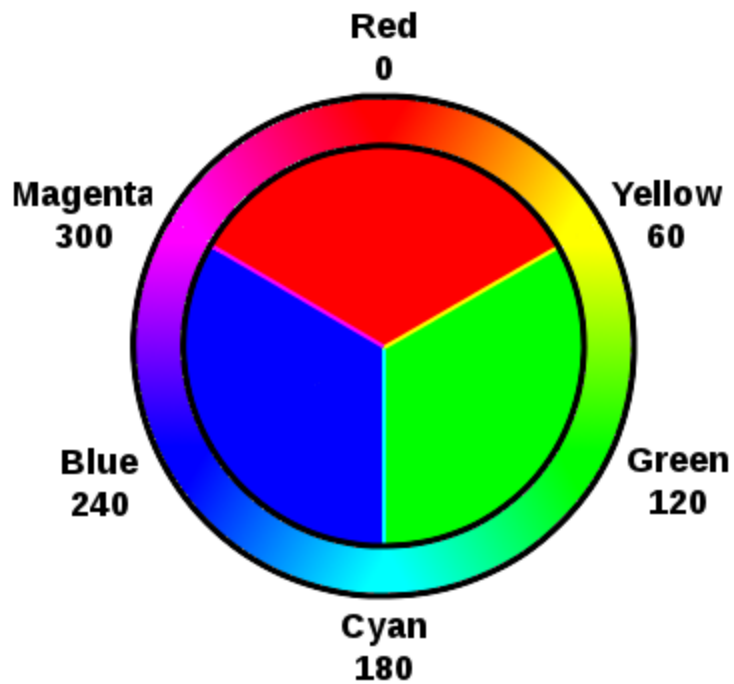
Answer :

Before this we should understand some other points and concern about color ...

First, "color" refers to the human brain's subjective interpretation of combinations of a narrow band of wavelengths of light. For this reason, the definition of "color" is not based on a strict set of physical phenomena. Therefore, even basic concepts like "primary colors" are not clearly defined. For example, traditional "Painter's Colors" use red, blue, and yellow as the primary colors, "Printer's Colors" use cyan, yellow, and magenta, and "Light Colors" use red, green, and blue.^[1] "Light colors", more formally known as additive colors, are formed by combining red, green, and blue light. This article refers to additive colors and refers to red, green, and blue as the primary colors

There are two **types of color models**, those that are subtractive and those that are additive. Additive **color models** use light to display **color** while subtractive **models** use printing inks. **Colors** perceived in additive **models** are the result of transmitted light.

The additive **color** model used for **computer graphics** is **represented** by the RGB **color** cube, where R, G, and B represent the **colors** produced by red, green, and blue phosphors, respectively. To produce blue, one would mix cyan and magenta inks, as they both reflect blue while each absorbing one of green and red.



- There are several established color models used in computer graphics, but the two most common are the **RGB model** (Red-Green-Blue)

for **computer display** and the **CMYK model (Cyan-Magenta-Yellow-Black)** for printing .\

one color different from the other

Objects appear **different colours** because they absorb some **colours** (wavelengths) and reflected or transmit **other colours**. ... For example, a red shirt looks red because the dye molecules **in** the fabric have absorbed the wavelengths of light from the violet/blue end of the spectrum

Colour models can be divided into two main categories:

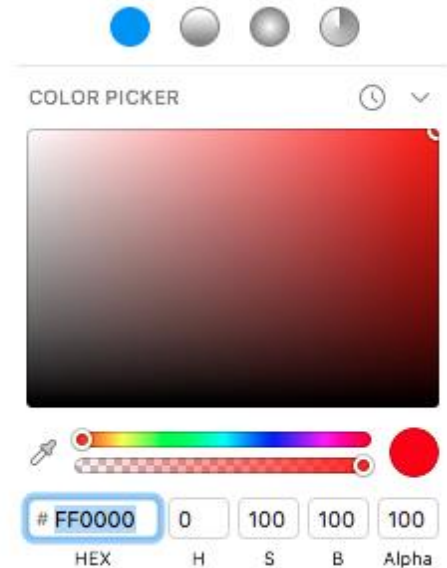
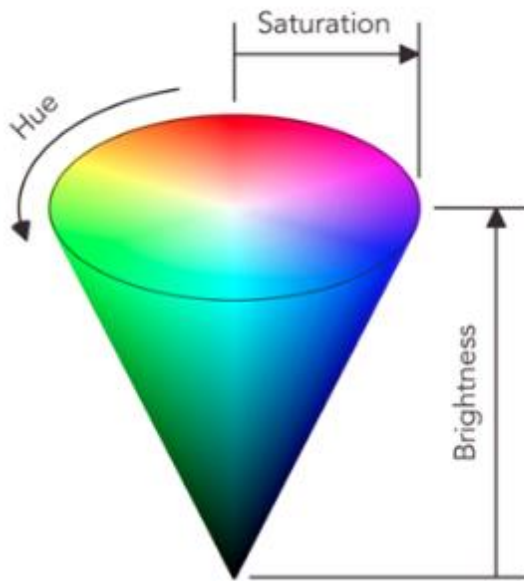
- > Perceptually-based color model
- > Display-based (device-dependent) color model.

1: Perceptually-based models includes two sets as HSB or HLS model. The abbreviation HSB means hue, saturation and brightness). The abbreviation HLS means hue, lightness and saturation.

They are organized in a way similar to how humans perceive colour in everyday experience.

Brightness or lightness refers to the amount of light energy used to create the colour.

In computer, drawing or painting applications use HSB and HLS tools in the form of percentages



2: The Device-dependent models are display-based models. It includes the RGB model which denotes the use of red, green and blue colors.

These are used to create millions of colours on a computer monitor or a television screen by combining different values of red, green, and blue.

RGB is an example of a device-dependent colour model.

In computers, the appearance of colour depends on the settings of the display device. Each device, whether it is a computer monitor or a television screen, emits a slightly different shade and intensity of red, green and blue light.

In the RGB system, each colour component of a pixel (picture element) is measured by a number ranging from 0 to 255, for a total of 256 (as "0" is a valid number).

The next model is the CMY model. It refers to cyan, magenta and yellow colors.

This model is a subtractive colour model that complements the RGB additive model.

THE END

