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CGM

Assignment - 1

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Class - 3C7

Course - B.Tech CSE

Ques1. Consider a raster system with resolution 640 * 480. What size frame buffer is needed to store 12 bits per pixel. How much storage is required if 24 bits per pixel are to be used?

Ans a) Frame buffer size with 12 bits per pixel for 640 x 480

$$\text{Size} = \frac{640 * 480 * 12}{8}$$

$$= 460800 \text{ bytes}$$

b) Storage required if 24 bits per pixel is to be store.

$$\text{size} = \frac{(640 \times 480 \times 24)}{8}$$

$$= 921,600 \text{ bytes}$$

Ques2. Compute the size of a 640 x 480 image at 240 pixels per inch.

Ans Dividing each pixel dimension by the ppi setting of 240

Horizontal

$$640/240 = 8/3 = 2\frac{2}{3} \text{ inches}$$

Vertical

$$480/240 = 2/1 = 2 \text{ inches}$$

2 2/3 inches wide and 2 inches tall.

Ques 3. Compute the resolution of a 2" * 2" image that has 512 * 512 pixels.

Ans resolution = 512 * 512.
= 262144 pixels

512 pixels in 2 inches
⇒ 256 pixels in 1 inch
∴ Resolution = 256 dpi.

Ques 4. If we use direct coding of RGB values for primary colour, how many possible colours do we have?

Ans $2^3 = 8$ possible colours

Ques 5. Using direct coding of RGB value with 10 bits per primary colour, how many possible colours do we have for each pixel.

Ans $2^{10} = 1024$ possible colors for each channel (R for Example) Then 2^{30} for a pixel. This makes 1024^3 = 1073741824 possible different colors for a pixel.

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Ques6. Using 5 bits for red and 6 bits for green, blue, how many possible colours do we have for each pixel.

Ans $2^5 * 2^5 * 2^6 = 2^{5+5+6}$

$2^{16} = 65536$

Ques7. If we use 12-bit pixel value in a look up table representation how many entries does the lookup table have?

Ans $2^{12} = 4096$

Ques 8. If 2 bytes pixel value are used in a 24 bit lookup table occupy?

Ans $2^{16} \times \frac{24}{8} = 65,536 \times 3$

$= 196,608$ Ans

Ques 9. Find the decision variable and other parameters as found in Bresenham's line drawing algorithm when the line is having slope greater than 1.

Ans Decission Parameter.

$$p_{k+1} = p_k + 2dx - 2dy \quad (x_{k+1} - x_k)$$

The first decision parameter p_0 is evaluated at (x_0, y_0).

$$p_0 = 2dx - dy$$

Ques 10. Plot a circle using Mid-point circle algorithm with center (2,4) r=7,

Ans 10. Let the center of circle $(h, k) = (2, 4)$

$d = 1 - r$ (decision parameter)

Starting point $= (0, r) = (0, 7)$

$d \geq 0$	$d < 0$
$d = d + 2*(x-y)+5$ $x++$, $y--$	$d = d + 2*x + 3$ $x++$

To stop condition

x or $y \approx r/\text{sqrt}(2) = 4.94$

	d	x	y	coordinate $(x+h, y+k)$
1.	$1-r = -6$	0	7	(2, 11)
2.	-3	1	7	(3, 11)
3.	2	2	7	(4, 11)
4.	1	3	6	(5, 10)
5.	4	4	5	(6, 9)

Terminates as $y = 5 \approx 4.94$

No. of points using eight way symmetry

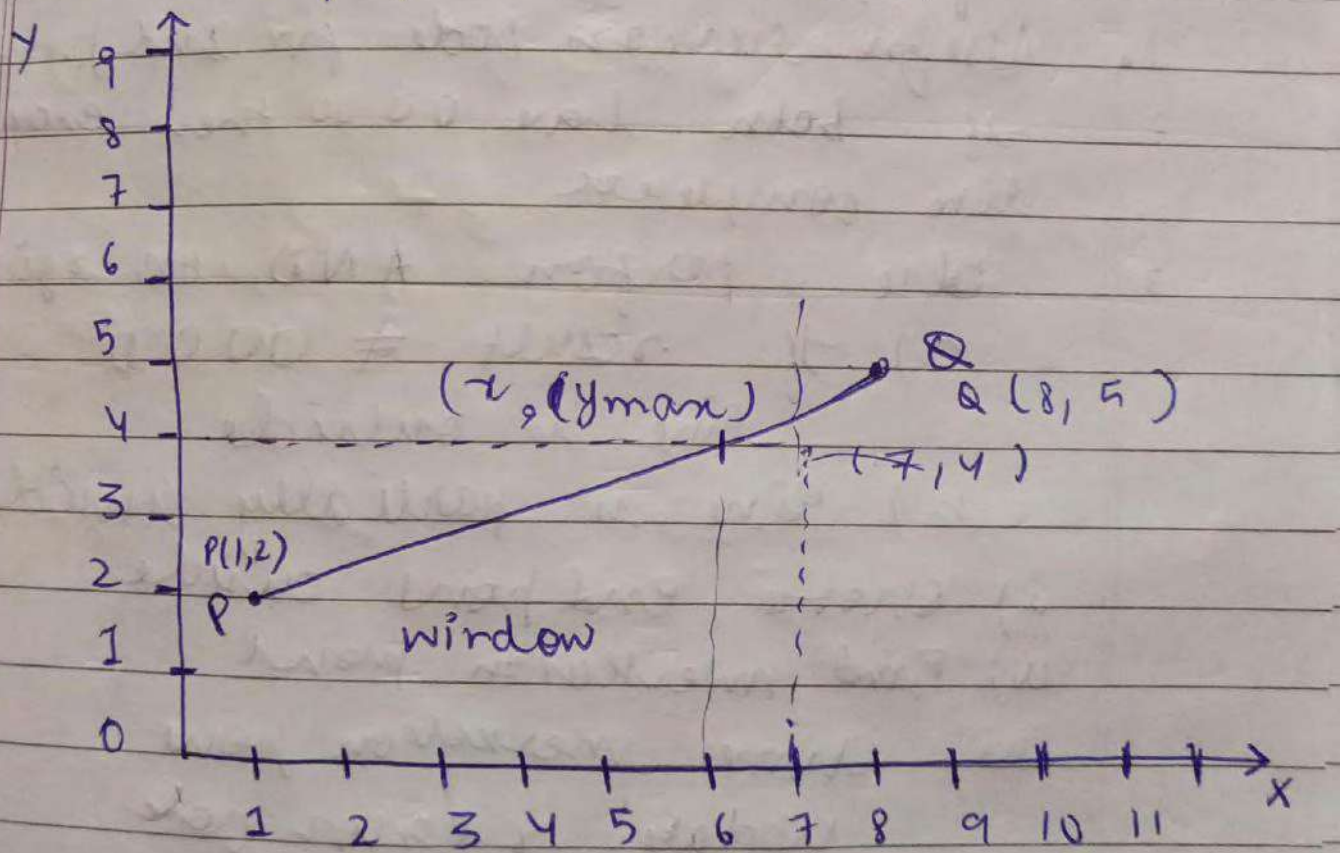
Octant - 1 points	Octant - 2 Points
(2, 11)	(9, 6)
(3, 11)	(10, 5)
(4, 11)	(11, 4)
(5, 10)	(11, 3)
(6, 9)	(11, 2)

Quadrant - 1 points

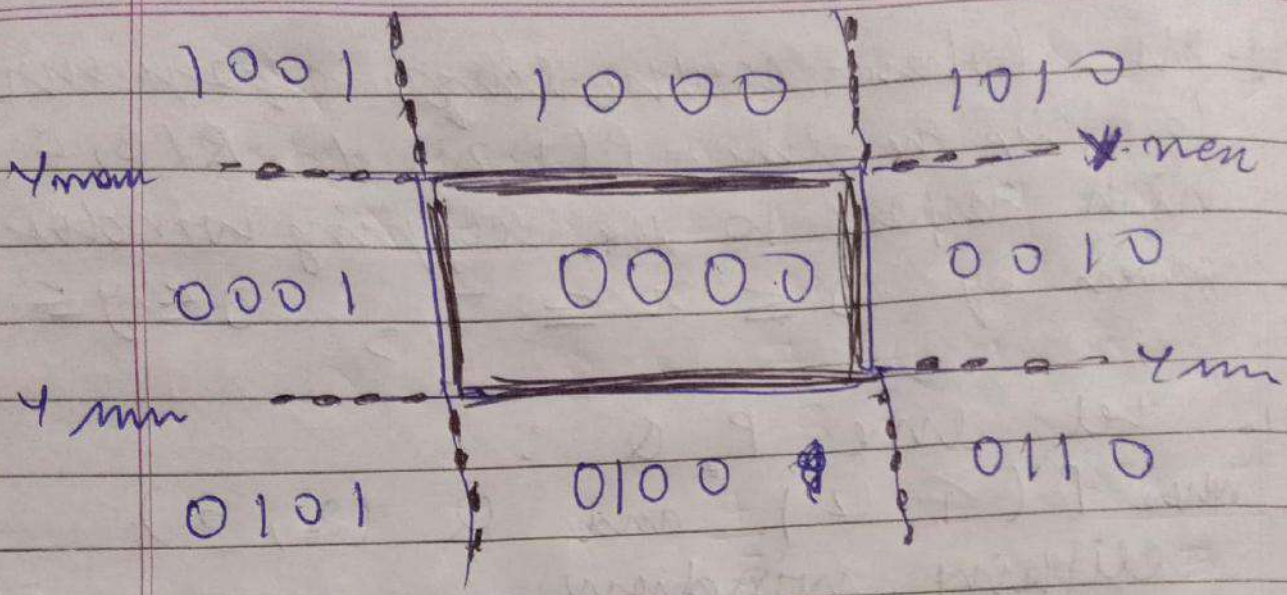
	Quadrant 1 (x,y)	Quadrant 2 (-x,y)	Quadrant 3 (-x,-y)	Quadrant 4 (x,-y)
1.	(2, 11)	(-2, 11)	(-2, -11)	(2, -11)
2.	(3, 11)	(-3, 11)	(-3, -11)	(3, -11)
3.	(4, 11)	(-4, 11)	(-4, -11)	(4, -11)
4.	(5, 10)	(-5, 10)	(-5, -10)	(5, -10)
5.	(6, 9)	(-6, 9)	(-6, -9)	(6, -9)
6.	(9, 6)	(-9, 6)	(-9, -6)	(9, -6)
7.	(10, 5)	(-10, 5)	(-10, -5)	(10, -5)
8.	(11, 4)	(-11, 4)	(-11, -4)	(11, -4)
9.	(11, 3)	(-11, 3)	(-11, -3)	(11, -3)
10.	(11, 2)	(-11, 2)	(-11, -2)	(11, -2)

Ans 11. Use Cohen - Sutherland algorithm to clip the line P(1,2) to Q(8,5) with respect to the clipping window given by $0 \leq x \leq 7$, $0 \leq y \leq 4$

Ans 11. Let line P, Q :
where P(1, 2) and Q (8, 5)
clipping window
$(x_{min}, y_{min}) = (x_L, y_B) = (0, 0)$
$(x_{max}, y_{max}) = (7, 4)$



TBRL (Region code) → 4 bit code
(Top, Bottom, Right, left)



TBRL

1. Assign region code for 2nd points
2. If both have 0000 then except line completely
3. Else perform AND on region code
   a) If result ≠ 0000
      Line is outside
   b) Line is partially inside
      i) Choose end point outside
      ii) Find intersection point
      iii) Choose intersection point
      Update region code
      iv) Repeat step 2 until line is trivially accepted
4. Repeat step 1 for other lines.

Intersection formulas

If line crossed x_{min} or x_{max}

then $y = y_1 + m(x - x_1)$

else $x = x_1 + \frac{1}{m}(y - y_1)$

→ Slope of line PQ

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-2}{8-1}$$

$$= \frac{3}{7} = 0.43$$

This is a partially inside line

region code for P 0000

region code for Q 1010

performing AND

$$\begin{array}{r} 0000 \\ 1010 \\ \hline 0000 \end{array}$$

Partially inside line

changing Q

Q coordinates

$$y = 5 + \frac{3}{7}(8 - 8)$$

$$x = 8 + \frac{7}{3}\left(4 - \frac{5}{0.43}\right) \quad y = 8 = 5.66$$

$$= 5 + \frac{3}{7} \times 15 = 11.42$$

Q (x', y max) = Q (x', 4)

Calculating x'

$$x' = x_1 + \frac{1}{m}(y - y_1)$$

$$x' = 8 + \frac{7}{3}(4 - 5)$$

$$= 8 - \frac{7}{3} = \frac{24 - 7}{3}$$

$$= \frac{17}{3} = 5.67$$

i (x, y max) = (5.67, y max)

Q (5.67, 4)

≈ Q (5, 4) (pixels can't be represented as points)

Hence the visible line is P(1, 2) to Q (5, 4)