CSE-301 Computer Graphics

Final Exam

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NAME WASEEM KHAN

Id NO 14306

DEPARTMENT (BS CS 5TH)

SUBJECT CG

SUBMITTETED TO MAM SANA JAHAN

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Question #1 (15 Marks)

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a. What is 'Eight Way Symmetry' of a circle?

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ANS

The most important thing in drawing a cirde is learning how the circle is draw using 8 way symmetry . it is based on mirror reflection .
if we see right hand in the mirror we will see left hand , simmlary if we see pixel (x,y) in mirror we will see (x , y) , so point p1 (x , y) will become p2 (x , y) after reflection .

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b. Write the 8 coordinates for representing 8-way symmetry in terms of (x, y).

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ANS B

Any circle following 8-way symmetry . this mean that for even point (x , y) 8 point can be plotted .

these (x , y) , (y,x) ,(- y , x) , (- x , y) (-x , - y) , (y , -x) , (x , -y)

for any point (x + a , y + b) , points (x -+ a , y -+ b) and (y +-a , x +- b) also lie on the same circle . so it is sufficient to computer only 1/8 of a circle , and all the other

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c. How does it help minimize the calculations?

ANS

$X_1 = 1$ $x_2 - 3$

$Y_1 = 1$ $y_2 = 3$

$\hat{}x = 4$

$\hat{}y = 2$

The initial dection parameter and the minum calculation has the value .

Pk = 2 ^ y - ^ x

= 4- 4 = 0

Question #2 (10 Mark

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a. What happens if Refresh Rate of a display is too slow? Explain.

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ANS .A

Typically a refresh rate of less than 60Hz will produce noticeable flicker , meaning you can tell the being redrawn instead of seeing a constant image .

if the refresh rate is too show , this flicker can be hard on your eyes and may cause them to tire quickly.

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b. What happens if Refresh Rate of a display is too fast? Explain.

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ANS . B

If you specify a refresh rate that is too high for your monitser . your screen may become unsable and your hardware may be damage ,
also note , some monitors shiver at higher rates and some of the higher resolutions and color depdth may be unavabile at the higher frequancies .
in my older moniter . it displayed resoulation from 60hz to 200 Hz .

Question #3 (10 Marks)

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For plotting a line between two points, we can use algorithms such as

ANS

➢ Incremental Line Algorithm

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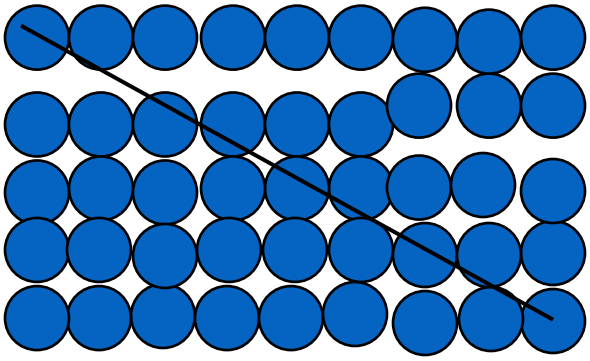
learning algorithms inherently support incremental learning.
Other algorithms can be adapted to facilitate incremental learning.
Examples of incremental algorithms

- have got a pixel on the line (Current Pixel).
- How do I get the next pixel on the line?
- Compute one point based on the previous point:
- (x_0, y_0).....(x_k, y_k) ---------== (x_{k+1}, y_{k+1}) .....



Next pixel on next column
(when slope is small)

- Next pixel on next row
- (when slope is large

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➢ Incremental Line Algorithm

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- This algorithm exploits simple line equation
- $y = m x + b$
- where $m = dy / dx$
- and $b = y - m x$
- Now if $|m| < 1$

- Then $x = x + 1$
- Whereas $y = m x + b$
- why to check $|m|$
- Suppose a line has points
- p1 (10, 10) – p2 (20, 18)
- dy = y2 – y1 = 18 – 10 = 8
- dx = x2 – x1 = 20 – 10 = 10
- This means that there will be 10 pixels on the line in which for x-axis there will be distance of 1 between each pixel and for y-axis the distance will be 0.8.
- Now consider the reverse case
- Suppose a line has points
- p1 (10, 10) , p2 (16, 20)
- dy = y2 – y1 = 20 – 10 = 10
- dx = x2 – x1 = 16 – 10 = 6
- This means that there will be 10 pixels on the line in which for x-axis there will be distance of 0.6 between each pixel and for y-axis the distance will be

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- Incrementing along x

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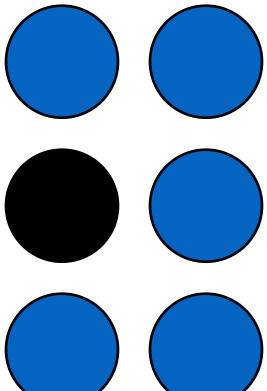
Current
Pixel
(x_k, y_k) 
(5,2)

(6,3)



6,2)

(6,1

➢ DDA Algorithm

- ## Digital differential analyzer (graphics **algorithm**)

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In its simplest implementation for linear cases such as lines, the DDA algorithm interpolates values in interval by computing for each xi the equations
DDA may refer to: Dda (DNA-dependent ATPase), a DNA helicase Delhi Development Authority, the planning agency for Delhi, India Demand deposit account

DDA abbreviated for digital differential analyzer has a very simple technique.

Find difference, dx and dy as:

dy = y2 – y1

dx = x2 – x1

if |dx| > |dy| then

step = |dx|

else

step = |dy|

Now very simple to say that step is the total number of pixels required for a line.

Next step is to find xIncrement and yIncrement:

xIncrement = dx/step

yIncrement = dy/step

Next a loop is required that will run 'step' times.

In the loop drawPixel and add xIncrement to x1 and yIncrement to y1.

Now sum-up all above in the algorithm:

```
DDA_Line (Point p1, Point p2)
    dx = p2.x – p1. x
    dy = p2.y – p1. y
    x1=p1.x
    y1=p1.y
    if |dx| > |dy| then          step = |dx|
    else
        step = |dy|
    xIncrement = dx/step
    yIncrement = dy/step
    for counter = 1 to step
        drawPixel (x1, y1)
        x1 = x1 + xIncrement
        y1 = y1 + yIncrement
```

➢ Midpoint Algorithm

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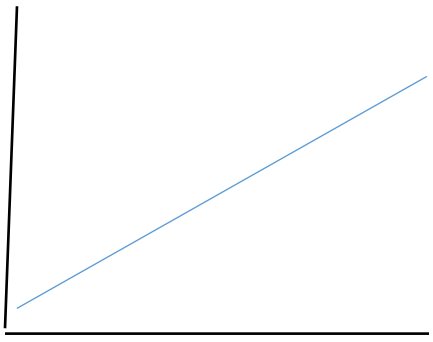

$f(x, y) = 0$

Midpoint below line

Midpoint circle algorithm

midpoint circle algorithm is an algorithm used to determine the points needed for rasterizing a
circle. Bresenham's circle algorithm is derived from the

- Bresenham's Algorithm

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- The Bresenham algorithm is another incremental scan conversion algorithm
- The big advantage of this algorithm is that it uses only integer calculations

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Bresenham Line Drawing Algorithm

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Bresenham's algorithm finds the closest integer coordinates to the actual line, using only integer math. Assuming that the slope is positive and less than 1, moving 1 step in the x direction, y either stays the same, or increases by 1. A decision function is required to resolve this choice

. List of **algorithms**

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imaginary line over the image Warnock algorithm Line Drawing: graphical algorithm for approximating a line segment on discrete graphical media. Bresenham's line

Timeline of **algorithms**

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Ford–Fulkerson algorithm developed by L. R. Ford, Jr. and D. R. Fulkerson 1962 – Bresenham's line algorithm developed by Jack E. Bresenham 1962 – Gale–Shapley

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Question3 Ans (A)

(1) Bresenham line drawing algorithm

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Bresenham algorithm finds the closet integer coordinates to the actual line , using only integer math . assuming that the slope is positive ans less than 1 , moving 1 step in the x direction , y either staye the same or incrases by 1 . a decsiosion function is requrid to resolved this choice .

Move across the x axis in unit intervals ad at each step choose between two different y coordibates .

For example from the position (2 , 3) we have to choose between (3 , 3) and (3 , 4) we have would like the point that us closer to the original line at sample position xk + 1 the vertical mathematical line are labeled dupper and dlower

The y coordinater on the mathematical line at xk + 1 is
Y =M (xk + 1) +b
1 . input the two line and point , storing the left end point in (x1.y1) and plot this point .

2 calculat the constants x dx and y dy 2dy and 2 dx get the first vaule for the decision parmater as e = 2^y- ^x

It produce all the sequence a line goes through pixle . the long measurement is among for every peixel . and with the fragmehter incline is collected .

Question 3 (b)

Drawback of bresnham line drawing algortam these are the drawbacks of icrecmental line algoritm . though it improves the accuary of generated point s but but still the resulted line is not smooth .

Drawbacked of DDA algoritam

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the disadatvantage of DDA algorithm are thre is an extra overhead of using round off () function . using round off () function incrasses time complexty of the alogritm

resulted line are not smooth because of round off () function .

the point generated by this aligrotam are not accurate .

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Question #4 (15 Marks)

When plotting a circle, the convention is to draw the arc of first quadrant and then impose the same values in all the other 7 quadrants. To plot the arc in first quadrant, we just need the radius of the circle.

a. Draw the first arc of the circle centered at (0, 0) and radius r = 13. (10 Marks)

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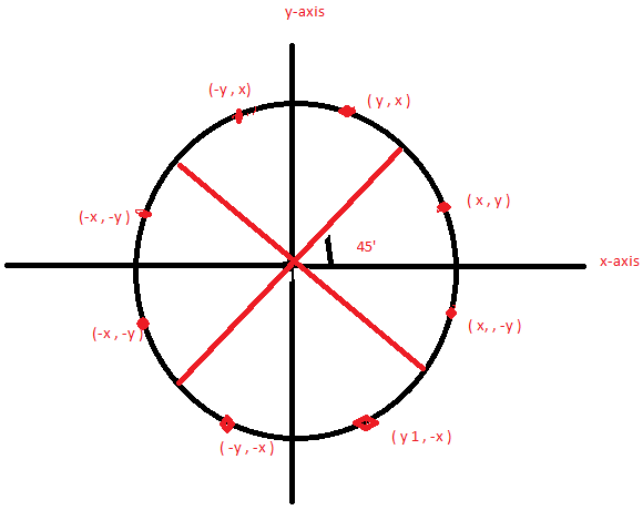
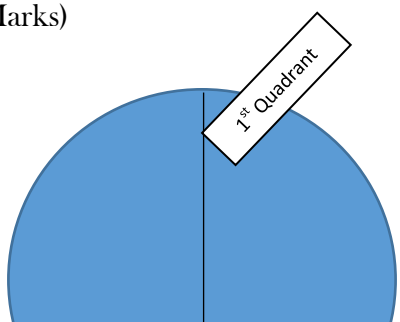
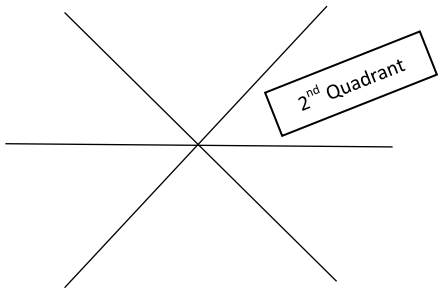
ANS . A

The first are of the circle centered at (0 , 0) and radius r = 13.



b. Convert the (x, y) values determined in part 'a' to the second quadrant. (5 Marks)




2nd Quadrant

Q No 4 Part = B

Convert (x, y) values determined in Part 'a' to The Second quadrnt.

Ans: r = 8 , (x, y) = (0, 0)

If $d > 0$ Then $(x+1, y-1)$
else $(x+1, y)$

Initally $(x, y) = (0, 13)$

where $d = 3 - (2 \times 6)$ and
$x = 0$ $y = r = 13$

$d = 3 - (2(13)$
$= 3 - 26$
$d = -23 < 0$

So $(x+1, y) = (1, 13)$

Now
$x < y$ $1 < 13$ So repeat above step.

$d = -32 < 0$ So
$d = d + (4 \times x) + 6$
$= -23 + (4 * 1) + 6$

$d = -13 < 0$

So $(x+1, y) = (2, 13)$ Here $x < y$

$d = -13 + (4 \times 2) + 6$

$= -13 + 8 + 6$

$= 1 > 0$

$(x+1, y) = (3, 13)$

$x < y$ and $d > 0$ So

$d = d + 4 \times (x - y) + 10$

$= 1 + 4 \times (3 - 13) + 10$

$d = -29 < 0$

and $(x, y-1) = (2, 12)$

$(x < y)$ and $(d < 0)$ There fore

$d = -29 + (4 \times 3) + 6 = -11 < 0$

$(x+1, y) = (4, 12)$

$x < y$ and $d < 0$ Ther fore

$d = -11 + (4 \times 4) + 6 = 11$

$(x+1, y-1) = (5, 11)$

$x < y$ and $d > 0$ Ther fore

$d = 11 + 4 (5 - 11) + 10$

$d = 19$

So

$(x+1, y-1) = (6,10)$

$x < y$ and $d > 0$ Therfore

$d = 10 + 4 \times (6-10) + 10$

$d = 4 > 0$

So

$(x+1, y-1) = (7-9$

$x < y$ and $d > 0$ Therfore

$d = 4 + 4 \times (7-9) + 10$

$d = 6 > 0$

So $(x+1, y-1) = 8,8)$

Here $x = y$ So exit The

pregram.