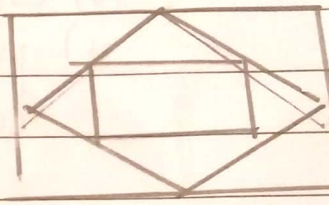
Expt No. A1

Assignment No. 1.

Title :- DDA Line & Bresenham's line drawing algorithm

Problem statement :- Write c++ program to draw the following pattern using Line drawing algorithms. Use Brsenham's line drawing algorithms for square & DDA line drawing algorithm for diamond.



Objective :- To learn & implement the DDA line & Bresenham's line drawing algorithm

Slw used :- Qt creator, C

Theory :-

- Digital diffrential analyzer (DDA) :-

In any 2-dimensional plane if we connect two poin (x_0, y_0) & (x_1, y_1) we get line segment. But in the case of computer graphics we can directly join two co-ordinate point for that we need to calculate interme co-ordinate

DDA is a simple line generation algorithm whic is explained step by step in algorithm.

algorithm :-

i) Get the i/p of two points.
ii) calculate diffrence betn two end points.
iii) Based on calculated difference in step -2, you need to identify the no. of steps to put pixel
if dx > dy then you need more steps in x-coordinate otherwise in y coordinate.
iv) Calculate the increment in x coordinate & y coordinate.
v) put the pixel by successfully incrementing x & y coordinates accordingly & complete drawing of the line.

Pseudo-code :-

Integer : integer function
i.e. Integer (-8.5) = -9
Sign : return -1, 0, 1 for argument
Step 1: Read end point (x1, y1) (x2, y2)
Step 2: Approximate the length of line
if (abs (x2-x1) >= abs (y2-y1)) then
length = (abs(x2-x1))
else
length = (abs(y2-y1))
Step 3: select raster unit
$\Delta x = (x2-x1) / length$
$\Delta y = (y2-y1) / length$

Step 4: Round the values
$x = x1 + 0.5 + \sin(\Delta x)$
$y = y1 + 0.5 + \sin(\Delta y)$

Step 5:)
Plot the pixel

```
i = 1
while ( i <= length)
    {
    setpixel (Integer(x), Integer(y))
        x = x + Δx
        y = y + Δy
        i = i + 1
    }
```

- Bresenham line drawing algorithm :

i) Initialize variable :

```
x = x1,   y = y1
Δx = abs (x2 - x1)
s1 = sign (x2 - x1)
Δy = abs (y2 - y1)
s2 = sign (y2 - y1)
```

ii) Interchange Δx & Δy depending upon slope.

```
if Δy > Δx then
    temp = Δx
    Δx = Δy
    Δy = temp
    interchange = 1
    else
    interchange = 0
end if
```

3) Initialize Δx term to compensate for non-zero intercept

$$\bar{e} = 2\Delta y - \Delta x$$

```
for (i = 1 to Δx)
    setpixel (x, y)
while (ē > 0)
    if interchange = 1 then
        x = x + s1
    else
        y = y + s2
    end if
ē = ē - 2Δx
end while

if interchange = 1 then
    y = y + s2
else
    x = x + s1
end if
ē = ē + 2Δy
next i
finish
```

It is line drawing algorithm that determines the points of dimensional raster that should be selected in order to form a close approximation of straight line betn points. It is one of the earliest algorithm developed in the fie of computer graphics.

- Advantage of Bresenham's over DDA

i) DDA uses float numbers & uses operators such as division and multiplication in its calculation.
ii) Due to only use of addition, substraction & bit shifting Bresenhams is faster than DDA in producing the line.

- Application :-

i) line drawing algorithms are useful & efficient in continuous drawing with some intensity.
ii) computer aided design.
iii) Animation.

- Conclusion :-

We have learn & implement DDA & Brexenham's line drawing algorithm & also understood the advantage of Brexenham's ~~line~~ algorithm over DDA