Computer Graphics
Assignment 1

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Q1. Extend Bresenham's line drawing algorithm to generate lines with any slope, taking symmetry between quadrants into account. Implement a function polyline as a routine that displays the set of straight lines connecting n points. For n=1, the routine displays a single point.

Ans- First part

```
void lineBres (int xa, int ya, int xb, int yb)
{
    int dx = abs(xa-xb) , dy = abs(ya-yb);
    int p = 2*dy - dx;
    int twoDy = 2*dy, twoDx = 2*dx, twoDyMinusDx =2*(dy-dx);
    bool NEGSLOPE = (xb<xa) ^ ( yb<ya) ;
    bool SLOPEGT1  = dy >=dx;
    int x = xa, y = ya;
    setPixel(x,y);
    int incr=1;
    if(NEGSLOPE) incr =-1; // if -ve slope, y-increment = -1
    while (x!=xb && y!=yb){ //while either endpoint is not reached
        if (!(SLOPEGT1) ){  // if slope <1
            x++;
            if(p<0)
                p+=twoDy;
            else{
                y+= incr;
                p += twoDyMinusDx;
            }
        }
    }
```

```
else {                          // if slope >= 1
    y++=incr;
    if (p<0)
        p+= twoDx;
    else {
        x++;
        p-= twoDyMinusDx;
    }
}
setPixel(x,y);
}
```

Second part

```
void polyline( int points[N][2]) {
    if(N==1) {
        setPixel( points[0][0], points[0][1]);
        return;
    }
    for (int i =0; i<N-1; i++)
        lineBres(points[i][0],points[i][1],points[i+1][0],points[i+1][1]);
}
```

Q2. Differentiate DDA and Bresenham's line drawing algorithms w.r.t the following parameters - Arithmetic, Operation, Speed, Accuracy & Efficiency, Round off etc.

Ans -

Parameters	DDA algorithm	Bresenham's algorithm
Arithmetic	DDA algorithm uses floating points.	Bresenham's algorithm uses fixed points.
Operations	DDA algorithm uses multiplication and division in its operation	Bresenham's algorithm uses only addition and subtraction in its operation.

Speed	DDA algorithm is slower than Bresenham's because it uses real arithmetic	Bresenham's algorithm is much faster due to simpler calculations.
Accuracy & efficiency	DDA is not as accurate and efficient as Bresenham's algorithm.	Bresenham's algorithm is more efficient and much more accurate.
Round off	DDA algo rounds off the coordinates to integer that is nearest to the line.	Bresenham's algo does not round off but takes the incremental values in its operation.
Expensive	DDA algo uses enormous number of floating point operations, hence expensive	Bresenham's algo is less expensive than DDA