Plot Lines

In the diagram on the left, we show how a horizontal or vertical line can be plotted exactly in a field of discrete points. However, a line at any other angle must be plotted as a series of steps. The line shown here joins the points (0,0) and ((2,100) by three equal vertical steps

Control Lines

The flowchart on the right shows Linesub's method of handling the four cases when the gradient is greater than one. The variables TOTAL and DECFLG are set for use by the routine in actually plotting the flowchart below. Plotting starts at the point (X1,Y1), and, since DX is kept positive, decrements or increments Y according to the state of DECFLG

yields a negative value. Bit 0 of this register (which we will call NEGREG) flags the fact that DY is negative; bit 1 flags DX as being negative. After these calculations, NEGREG can be tested to determine which of the four cases apply:

Case	a	b	c	d
Value of NEGREG	1	2	0	3
Binary Equivalent	01	10	00	11

Whichever case applies, we must eventually plot the line using a loop, starting at (X1,Y1), decrementing or incrementing Y as appropriate, and calculating the corresponding value of X before using Plotsub to plot the point. When Y reaches Y2, then the loop can be terminated.

To obtain an expression for calculating X from Y, we must rearrange our original expression once again:

$$(Y-Y1)/(X-X1) = G$$
$$1/(X-X1) = G/(Y-Y1)$$
$$(X-X1) = (Y-Y1)/G$$
$$X = X1 + (Y-Y1)/G$$

and thus, as (Y-Y1) equals one, the expression is: X = X1 + 1/G. As G = DY/DX, then this expression becomes X = X1 + DX/DY. However, if the gradient is greater than one, then DY is always greater than DX; hence, the result of the division DX/DY is always 0, remainder DX. If we keep a running total of the remainders while going through the plotting loop, we should only increment X each time the sum of the remainders exceeds DY. The running total will then be reset.

This may sound a little complex, but we can see the method in operation by considering the example given, where (X1, Y1)=(0,0) and (X2, Y2)=(2,100). The line is displayed as a series of three vertical bars. This is a very steep line; shallower lines would be made up of a greater number of shorter bars until, when the gradient was exactly one, each bar would be only one pixel long, giving the appearance of a perfect diagonal.