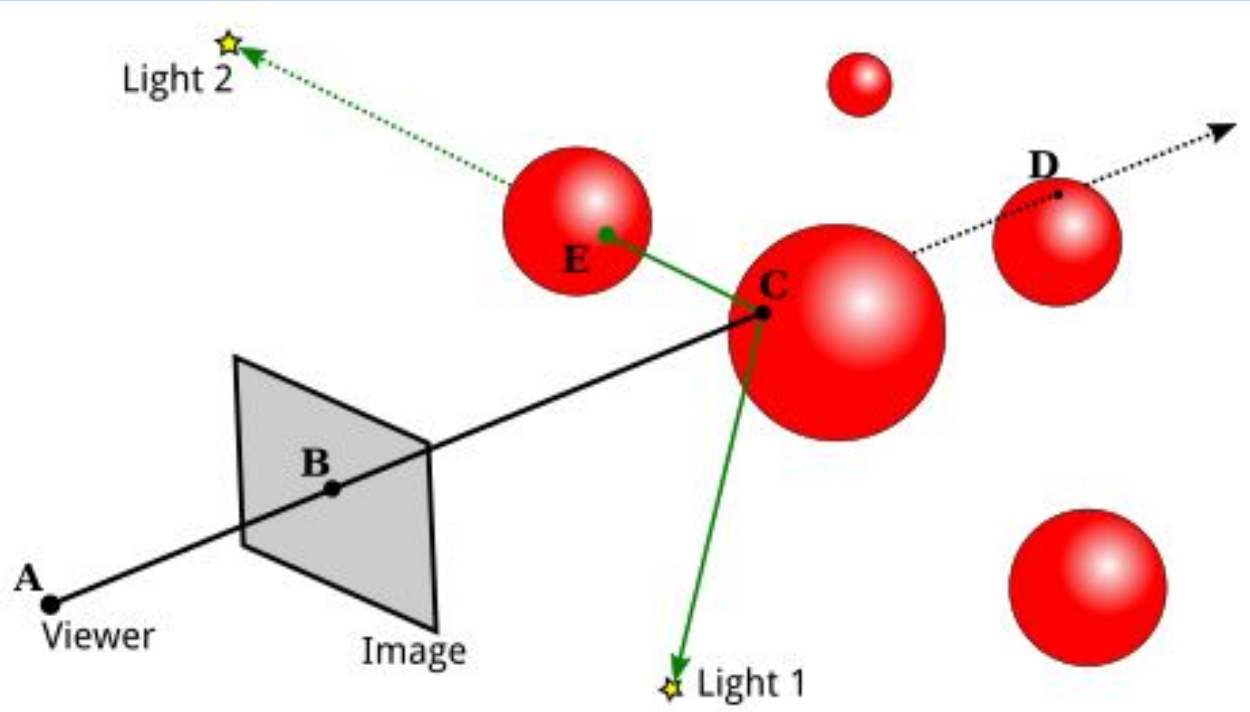

Intersection points
Computer Graphics(CSI 413)

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Intersection points

Intersection points with a clipping boundary can be calculated using the slop-intercept form of the line equation. For a line with endpoint coordinates(x1, y1) and (x2, y2), the y coordinate of the intersection point with a vertical boundary can be obtained with the calculation.

$$y = y1 + m(x - x1)$$

Intersection points

Where the x value is set either to x_{min} or to x_{max}, and the slop of the line is calculated as-

$$m = (y2 - y1) / (x2 - x1)$$

Similarly, if we are looking for the intersection with a horizontal boundary, the x coordinate can be calculated as-

$$x = x1 + (y - y1) / m$$

Intersection points

If the boundary line is vertical then

$X=x_{min}$ if the line is left

$X=x_{max}$ if the line is right

$$y = y1 + m(x - x1)$$

If the boundary line is horizontal then

$Y=y_{min}$ if the line is bottom

$Y=y_{max}$ if the line is top

$$x = x1 + (y - y1) / m$$

Example 1:

Apply the Cohen Sutherland line clipping algorithm to clip the line segment with coordinates (30,60) and (60,25) against the window with (X_{min}, Y_{min})= (10,10) and (X_{max}, Y_{max})= (50,50).

Solution:

Example 1:

First ,Find the slop of line AB from the equation:

m = (y2 – y1) / (x2 – x1)

m=(25-60)/(60-30)

=-35/30

=-1.16

Then ,We fined the coordinate of intersection point from line A A^{-}.

The boundary line A A^{-} is horizontal ,so Y_{max}=y=50 and calculate x value from this :

Example 1:

$$\mathbf{x = x1 + (y - y1) / m}$$

$$= 30+(50-60)/-1.16$$

$$=30+-10/-1.16$$

$$= 30+8.6$$

$$=38.6$$

the coordinate of intersection point is **A(38.6,50)**.

Example 1:

We fined the coordinate of intersection point form line BB^{-}.

The boundary line BB^{-} is vertical ,so $x_{max}=x=50$ and calculate y value from this:

$$\mathbf{y = y1 + m(x - x1)}$$

$$=25+(-1.16)(50-60)$$

$$= 25+11.6$$

$$=36.6$$

The coordinate of intersection point is $\mathbf{B^{-}(50,36.6)}$.

Example 2:

Window is defined A(20,20),B(90,20),C(90,70),D(20,70)

Find visible portion of

line1 :P1(10,30),P2(80,90)

Line2: Q1(20,10) , Q2(70,60)

using Cohen Sutherland line clipping algorithm.

Example 2:

First find the slop of line P1P2 from the equation:

m = (y2 – y1) / (x2 – x1)

=(90-30)/(80-10)

=60/70

=0.8

Example 2:

Then fined the coordinate of intersection point from line P1P1¯.

The boundary line P1P1¯ is vertical ,so X_{min}=x=20 and calculate y value from this :

$$y = y1 + m(x - x1)$$

$$=30+0.8(20-10)$$

$$=30+8=38$$

the coordinate of intersection point **P1¯(20,38).**

Then fined the coordinate of intersection point from line P2P2¯ .

Example 2:

The boundary line P1P1^{-} is horizontal ,so y_{max}=y=70 and find x from this equation:

x = x1 + (y – y1) / m

=80+(70-90)/0.8

=80+(-20)/0.8

=80+(-25)=55

the coordinate of intersection point **P2^{-}(55,70).**

Example 2:

Fined the slop of second line Q1Q2

m = (y2 – y1) / (x2 – x1)

=(60-10)/(70-20)=50/50=1

Then fined the coordinate of intersection point from line $Q1Q1^{-}$

The boundary line $Q1Q1^{-}$ is horizontal ,so $y_{min}=y=20$ and calculate x value from this :

x = x1 + (y – y1) / m

=20+(20-10)/1

=20+10=30

The coordinate of intersection point is $Q1^{-}$ **(30,20)**

Example 3:

Rectangular area of interest (defined by below four values which are coordinates of bottom left and top right)

$X_{min}=4, y_{min}=4, x_{max}=10, y_{max}=8$

A set of lines(defined by two corner coordinates)

Line 1: A(5,5), B(7,7)

Line 2: C(7,9), D(11,4)

Line 3: E(1,5), F(3,2)

Apply the Cohen Sutherland line clipping algorithm to clip the line segment.

Example 3:

Find slop for line CD as follow:

m = (y2 – y1) / (x2 – x1)

=(4-9)/(11-7)

=-5/4=-1.25

We fined the coordinate of intersection point from line CC^-,

The boundary line CC^- is horizontal ,so $Y_{max}=y=8$ and find x as follow:

x = x1 + (y – y1) / m

= 7+(8-9)/-1.25

=7+-1/-1.25

7+0.8=7.8

The coordinate of intersection point is **C^-(7.8,8)**.

Example 3:

We fined the coordinate of intersection point form line DD^-,

the boundary line DD^- is vertical ,so $x_{max}=x=10$ and find y as follow:

$$\mathbf{y = y1 + m(x - x1)}$$

$$=4+(-1.25)(10-11)$$

$$=4+1.25$$

$$=5.25$$

The coordinate of intersection point is $\mathbf{D^-(10,5.25)}$.

Example 3:

We fined the coordinate of intersection point form line DD^-,

the boundary line DD^- is vertical ,so $x_{max}=x=10$ and find y as follow:

$$\mathbf{y = y1 + m(x - x1)}$$

$$=4+(-1.25)(10-11)$$

$$=4+1.25$$

$$=5.25$$

The coordinate of intersection point is $\mathbf{D^-(10,5.25)}$.

Example 3:

We fined the coordinate of intersection point form line DD^-,

the boundary line DD^- is vertical ,so $x_{max}=x=10$ and find y as follow:

$$\mathbf{y = y1 + m(x - x1)}$$

$$=4+(-1.25)(10-11)$$

$$=4+1.25$$

$$=5.25$$

The coordinate of intersection point is $\mathbf{D^-(10,5.25)}$.

Example 4:

Window is defined A(10,20),B(20,20),C(20,10),D(10,10) Find visible portion of line P(15,15),Q(5,5) using Cohen Sutherland line clipping algorithm.

Example 4:

We fined the coordinate of intersection point from line PP ˙,

The boundary line PP˙ is horizontal ,so Y_{min}=y=10 and find x as follow:

x = x1 + (y – y1) / m

=15+(10-15)/1

=15-5

= 10

the coordinate of intersection point is **P˙(10,10).**

Thank you very much