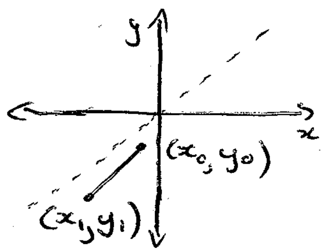
CS314 Summer 2005 HW3

(1) Same as octant 2 with points reversed.




```
x = x1
for (y=y1; y <= y0; y++) {
  draw (x, y);
  if (f(x+0.5, y+1) > 0) {
    x++;
  }
}
```

(2) Use point c.

$$I_c = I_a k_a + I_L k_d (N_c \cdot L_c) + I_L k_s (h \cdot N_c)^{n_{shiny}}$$

$$h = (L_c + V_c)/2$$

<u>NB</u>: light vector multiplication is <u>component-wise</u>.

$$\text{Ambient}_c = I_a k_a = \begin{bmatrix} .2 \\ .5 \\ .2 \end{bmatrix} \begin{bmatrix} .1 \\ .1 \\ .1 \end{bmatrix} = \begin{bmatrix} .02 \\ .05 \\ .02 \end{bmatrix}$$

$$\text{Diffuse}_c = I_L k_d (N_c \cdot L_c) \qquad L_c = L - C = \begin{bmatrix} -1 \\ -2 \\ 0 \end{bmatrix} / \sqrt{5}$$

$$= \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} .3 \\ .8 \\ .7 \end{bmatrix} 2/\sqrt{5} = \begin{bmatrix} .268 \\ .716 \\ .626 \end{bmatrix} \qquad N_c \cdot L_c = 2/\sqrt{5}$$

$$\text{Specular}_c = I_L k_s (h \cdot N_c)^{n_{shiny}} \qquad h_c = (L_c + V_c)/2 = \begin{bmatrix} -.224 \\ -.947 \\ 0 \end{bmatrix}$$

$$\text{normalise: } h_c = \begin{bmatrix} -.230 \\ -.973 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \begin{bmatrix} .8 \\ .8 \\ .8 \end{bmatrix} \times .578 = \begin{bmatrix} .462 \\ .462 \\ .462 \end{bmatrix} \qquad (h \cdot N_c)^{n_{shiny}} = (.973)^{20} = .578$$

$$\therefore I_c = \begin{bmatrix} .730 \\ 1 \\ 1 \end{bmatrix} \quad \text{(clamped at 1).}$$

3 A: $\text{ambient}_a = \begin{bmatrix} .02 \\ .05 \\ .02 \end{bmatrix}$

$L_A = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ $N_A = \begin{bmatrix} .447 \\ -.894 \\ 0 \end{bmatrix}$

$\text{diffuse}_a = \begin{bmatrix} .134 \\ .358 \\ .313 \end{bmatrix}$

$N_A \cdot L_A = .447$

$h_A = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

$\text{specular}_a = \begin{bmatrix} .8 \\ .8 \\ .8 \end{bmatrix} (.447)^{20}$

≈ 0

$\therefore I_A = \begin{bmatrix} .154 \\ .408 \\ .333 \end{bmatrix}$

c: I_c as in 2.

B: Interpolate normal

$N_B = \frac{3}{4} N_A + \frac{1}{4} N_c = \begin{bmatrix} .342 \\ -.940 \\ 0 \end{bmatrix}$

$\text{ambient}_c = \text{ambient}_a = \text{ambient}_b$

$\text{diffuse}_B = \begin{bmatrix} .3 \\ .8 \\ .7 \end{bmatrix} \left(\begin{bmatrix} .970 \\ -.243 \\ 0 \end{bmatrix} \cdot \begin{bmatrix} .342 \\ -.940 \\ 0 \end{bmatrix} \right) = \begin{bmatrix} .168 \\ .448 \\ .392 \end{bmatrix}$

$h_B = \begin{bmatrix} .928 \\ -0.219 \\ 0 \end{bmatrix}$ $(h_B \cdot N_B)^{20} \approx 0$

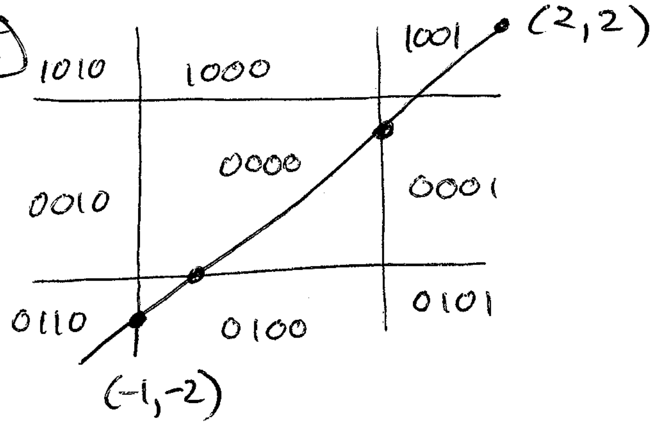
$\therefore \text{specular}_B = 0.$

$\therefore I_C = \begin{bmatrix} .170 \\ .453 \\ .394 \end{bmatrix}$

4 A and C unchanged.

$I_B = \frac{3}{4} I_A + \frac{1}{4} I_c = \begin{bmatrix} .298 \\ .556 \\ .500 \end{bmatrix}$

5



$m = 4/3$

$P1 = (-1,-2)$ $OC1 = 0100$

$P2 = (2,2)$ $OC2 = 1001$

$OC1 \neq 0$ and $OC2 \neq 0$

$\therefore$ no trivial accept

$(OC1 \& OC2) = 0$ $\therefore$ no trivial reject.

bottom: $P1' = (-.25, -1)$ $OC1' = 0000$

no trivial accept or reject.

top: $P2' = (1.25, 1)$ $OC2' = 0001$

no trivial accept / reject.

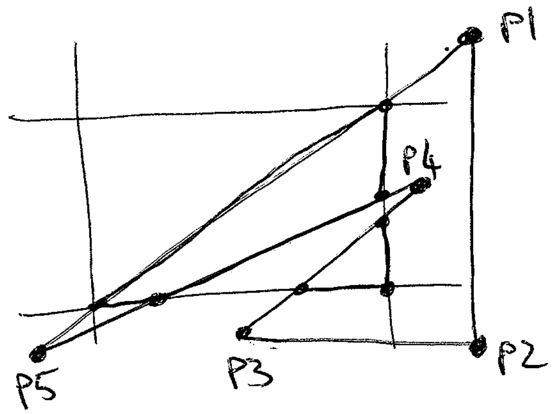
left: no intersection

right: $P2'' = (1, 2/3)$ $OC2'' = 0000$

$OC1' = OC2'' = 0$ $\therefore$ trivially accept.

new line $(-.25, -1)$, $(1, 2/3)$.

6



bottom	$\rightarrow$ top	$\rightarrow$ ...
P1	P1_(P1_P2)	
P1_P2	P1_P2	
P3_P4	P3_P4	
P4	P4	
P4_P5	P4_P5	
P5_P1	P5_P1	
	(P5_P1)_P1	

$\rightarrow$ left $\rightarrow$

P1_(P1_P2)
P1_P2
P3_P4
P4
P4_P5
(P4_P5)_(P5_P1)
(P5_P1)_((P5_P1)_P1)

right

(P1_P2)_(P3_P4)
P3_P4
(P3_P4)_P4
P4_(P4_P5)
P4_P5
(P4_P5)_(P5_P1)
(P5_P1)_((P5_P1)_P1)
((P5_P1)_P1)_(P1_(P1_P2))

7 $\alpha P_1 + \beta P_2 + \gamma P_3 = P$ 3 equations, 3 unknowns.

$\alpha + \beta + \gamma = 1$

$\therefore \alpha \begin{bmatrix} -2 \\ -1 \end{bmatrix} + \beta \begin{bmatrix} 2 \\ 1 \end{bmatrix} + \gamma \begin{bmatrix} 3 \\ 0 \end{bmatrix} = \begin{bmatrix} .5 \\ .5 \end{bmatrix}$

...

$\alpha = 1/3 \qquad \beta = 5/6 \qquad \gamma = -1/6$

$\therefore P_s = \alpha(.25) + \beta(.8) + \gamma(.6) = .65$

8 DELETED

9 Work in $(x, y, \underline{s})$ coordinate space.

$N = (P_1 - P_3) \times (P_1 - P_2) = \begin{bmatrix} -.15 \\ -1.35 \\ 6 \end{bmatrix} = \begin{bmatrix} A \\ B \\ C \end{bmatrix}$

Use P_3 to find $D = -3.15$
(or P_1 or P_2)

Substitute $P(0.5, 0.5, s)$ into
$Ax + By + Cs + D = 0$

$\Rightarrow s = .65$

10 Component-wise multiplication!

$\begin{bmatrix} 1 \\ .5 \\ 0 \end{bmatrix} \cdot \begin{bmatrix} .2 \\ .5 \\ 1 \end{bmatrix} = \begin{bmatrix} .2 \\ .25 \\ 0 \end{bmatrix}$

11 $\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} .3 & .59 & .11 \\ .6 & -.28 & -.32 \\ .21 & -.52 & .31 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$

$= \begin{bmatrix} .401 \\ .148 \\ .094 \end{bmatrix}$