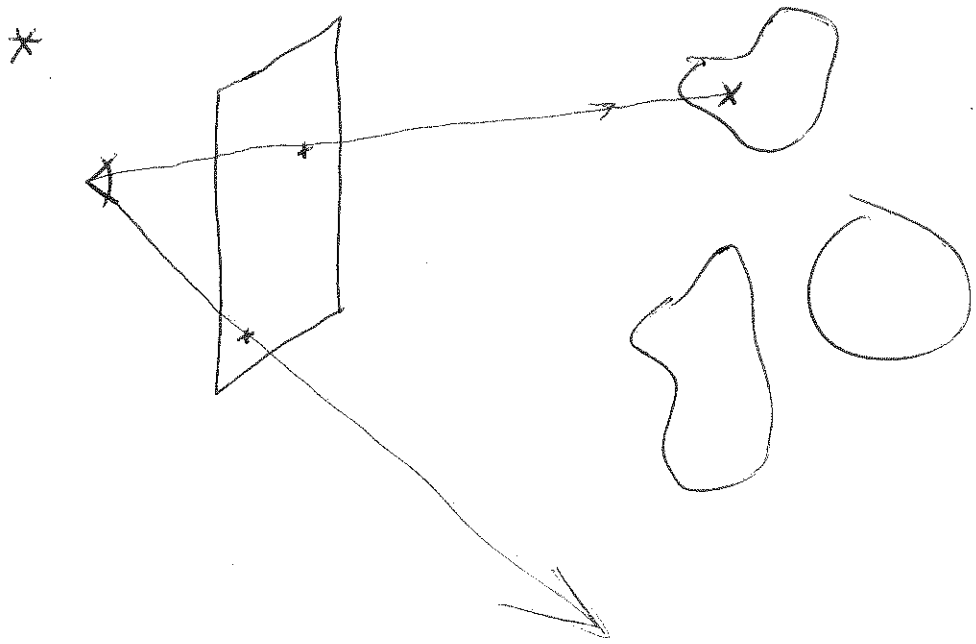


---

shade ray (r) → color

intersect ray (r) → (obj, t) ←

if no intersection

return background shader (r) ← shader

n = normal (obj, x) ←

c = shade (obj, x, n) ← later

for each pixel

compute ray r

c = shade ray (r)

store c in image pixel

intersect ray (r)

$\hat{t} = \infty$

$\hat{o} = \emptyset$

for each object $\bar{o}$

if intersects $(\bar{o}, r)$ at distance t ←

if $t < \hat{t}$

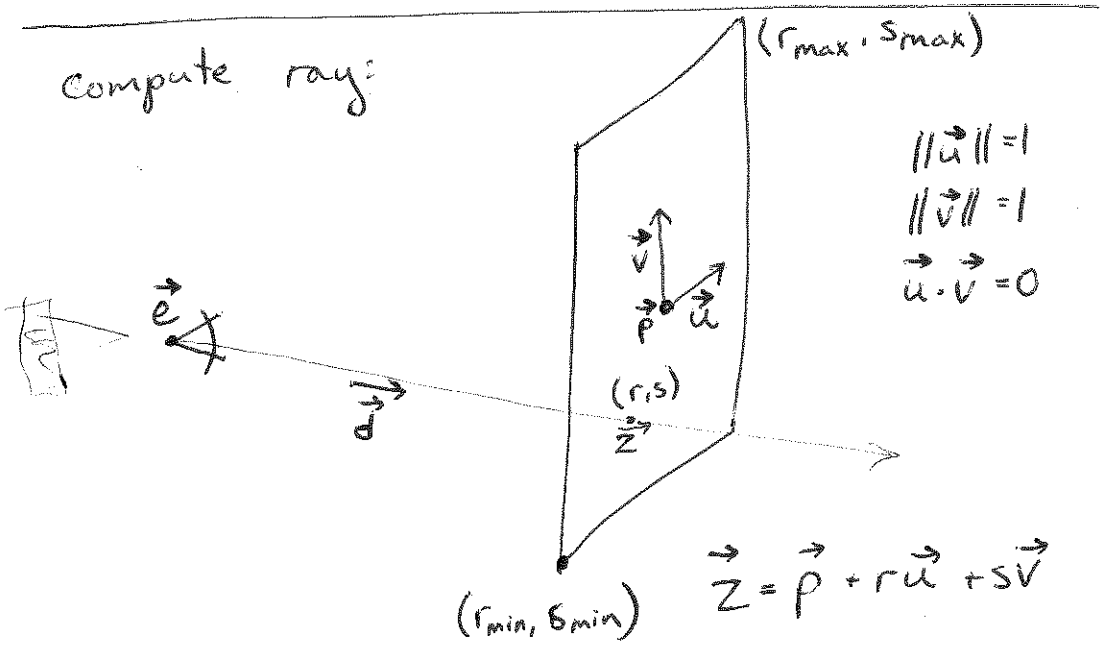
$\hat{o} = \bar{o}$

$\hat{t} = t$

return $(\hat{o}, \hat{t})$

---

compute ray:



$\|\vec{u}\| = 1$

$\|\vec{v}\| = 1$

$\vec{u} \cdot \vec{v} = 0$

$\vec{z} = \vec{p} + r\vec{u} + s\vec{v}$

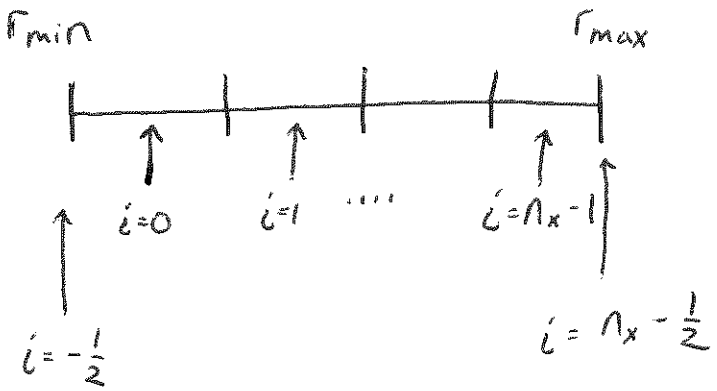
dimensions of image: $(r_{max} - r_{min}) \times (s_{max} - s_{min})$

number of pixels: n_x, n_y

given (i,j) pixel

$0 \le i < n_x$

$0 \le j < n_y$



$$r = ai + b$$

$$r_{min} = a\left(-\tfrac{1}{2}\right) + b$$

$$r_{max} = a\left(n_x - \tfrac{1}{2}\right) + b$$

$$r_{max} - r_{min} = a n_x$$

$$a = \frac{r_{max} - r_{min}}{n_x}$$

$$b = r_{min} + \frac{a}{2}$$

$$r = ai + \frac{a}{2} + r_{min}$$

$$= a\left(i + \tfrac{1}{2}\right) + r_{min}$$

$$= \frac{r_{max} - r_{min}}{n_x}\left(i + \tfrac{1}{2}\right) + r_{min}$$

$j \to s$ is similar

ray:

endpoint $= \vec{e}$

direction $\vec{d} = \dfrac{\vec{z} - \vec{e}}{\|\vec{z} - \vec{e}\|}$

$$f(t) = \vec{e} + t\vec{d}$$

$$t \geq 0$$