$\lambda(x, y)$ A has phenotype x

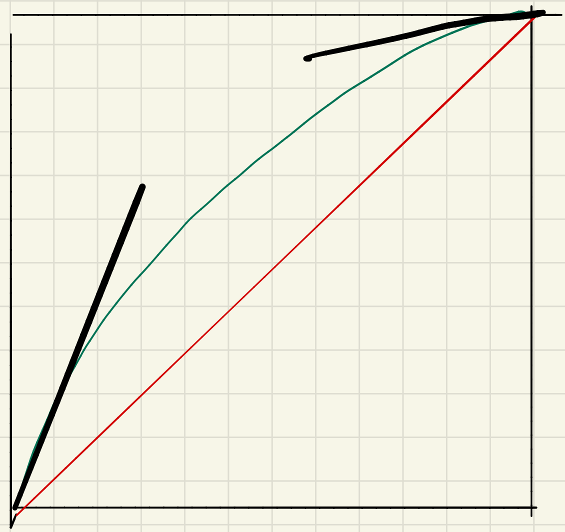
a " " y

$$p_{t+1} = \frac{p_t \cdot w(x)}{p_t \cdot w(x) + q_t w(y)}$$

$w(x) > w(y)$

$\lambda(x, y) > 1$

p_{t+1}



p_t

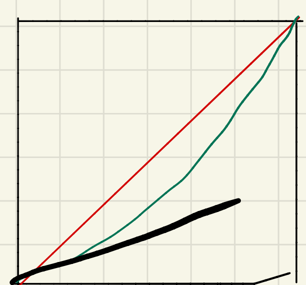
$\lambda(y, x)$ A has phenotype y

a " " " x

$w(x) > w(y)$

$\lambda(y, x) < 1$

p_{t+1}



p_t

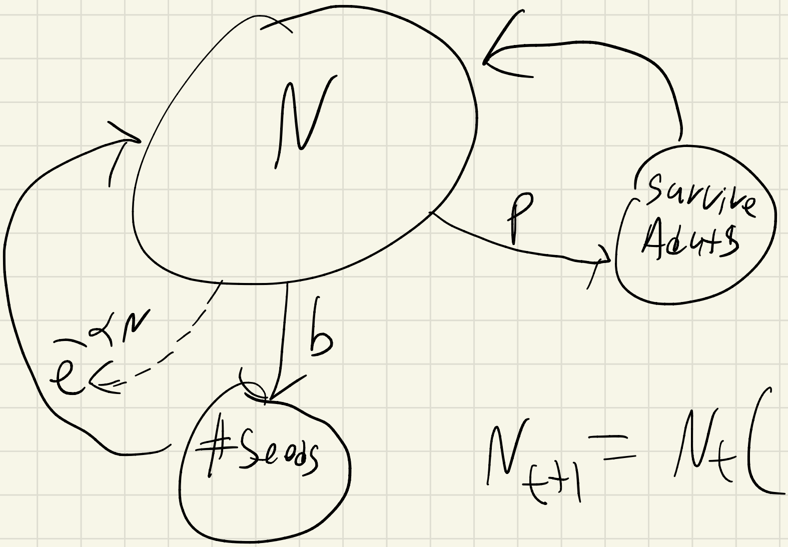
$N \equiv$ # Adults

$p \equiv$ Prob Adult Survives

$b \equiv$ # of Seeds produced/Adult

Survivorship of Seeds $= e^{-\alpha N}$

$\alpha \equiv$ density dependence

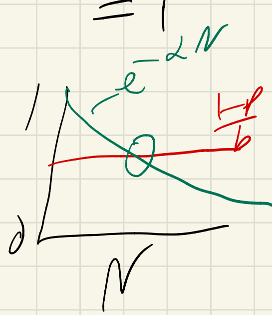


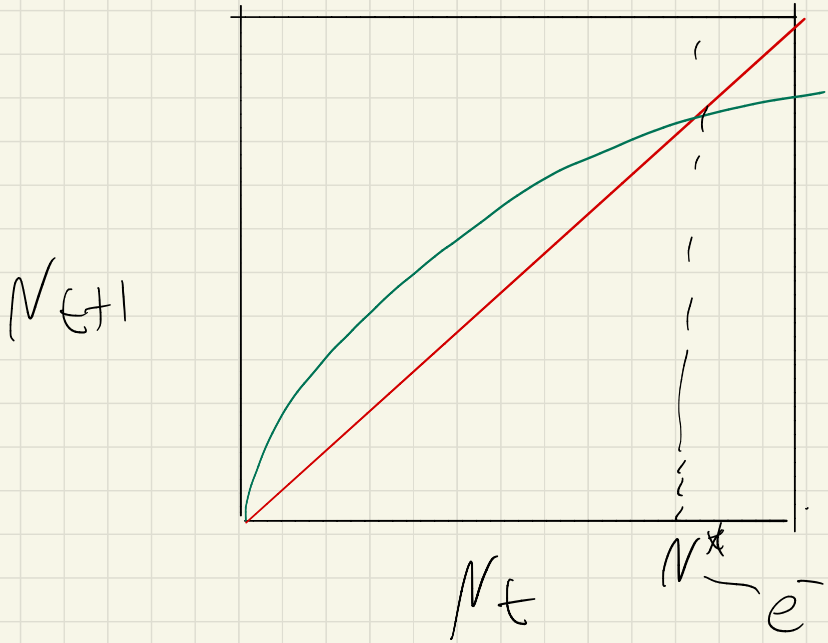
$$N_{t+1} = N_t\left(p + b e^{-\alpha N_t}\right)$$

$$N^* = N^*\left(p + b e^{-\alpha N^*}\right)$$

$\boxed{\text{eq 1 is } N^* = 0}$ or $p + b e^{-\alpha N^*} = 1$

$$e^{-\alpha N^*} = \frac{1-p}{b}$$





$$e^{-\alpha N^*} = \frac{1-p}{b}$$

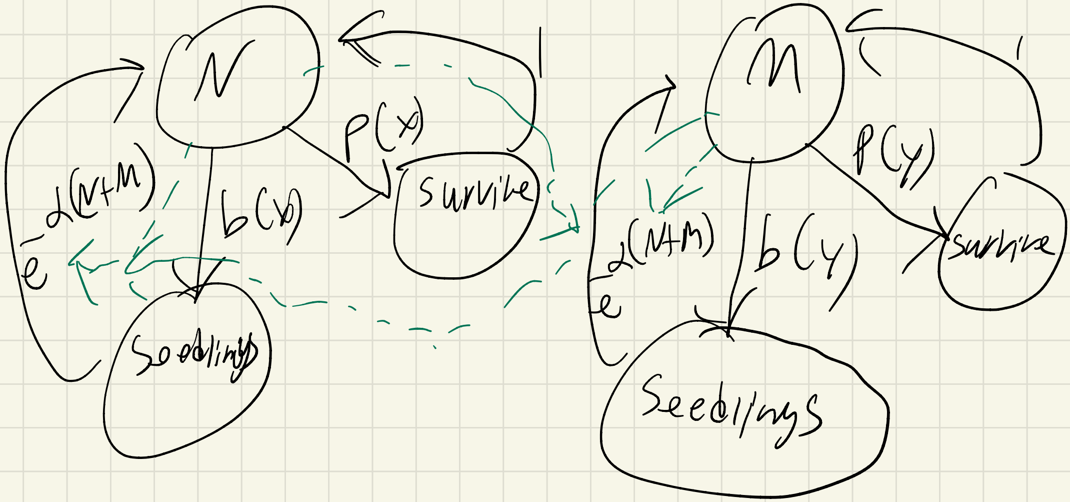
$$p + b e^{-\alpha N^*} > 1 \,?$$

if $N^* = 0 \Rightarrow e^{-\alpha N^*} = 1$

$$p + b > 1 \Rightarrow b > 1 - p$$

Wt genotype $b(x), p(x) \Rightarrow N = \#\,wt$

mutant genotype $b(y), p(y) \Rightarrow M = \#\,m$



$$M_{t+1} = M_t\left(p(y) + b(y)e^{-\alpha(N_t+M_t)}\right)$$

assume $N_t = N^*$

$$M_{t+1} = M_t\left(p(y) + b(y)e^{-\alpha(N^*+0)}\right)$$

$$M_{t+1} = M_t\left(p(y) + b(y)e^{-\alpha N^*}\right)$$

$$\lambda(y, x) = p(y) + b(y)e^{-\alpha N^*}$$

$$\lambda(y,x) > 1 \,?$$

$$\lambda(y,x) = p(y) + b(y)e^{-\alpha N^*} > 1 \,?$$

$$\boxed{N^* \Longrightarrow e^{-\alpha N^*} = \frac{1-p(x)}{b(x)}}$$

$$p(y) + b(y)\left(\frac{1-p(x)}{b(x)}\right) > 1$$

$$\frac{1-p(x)}{b(x)} > \frac{1-p(y)}{b(y)}$$

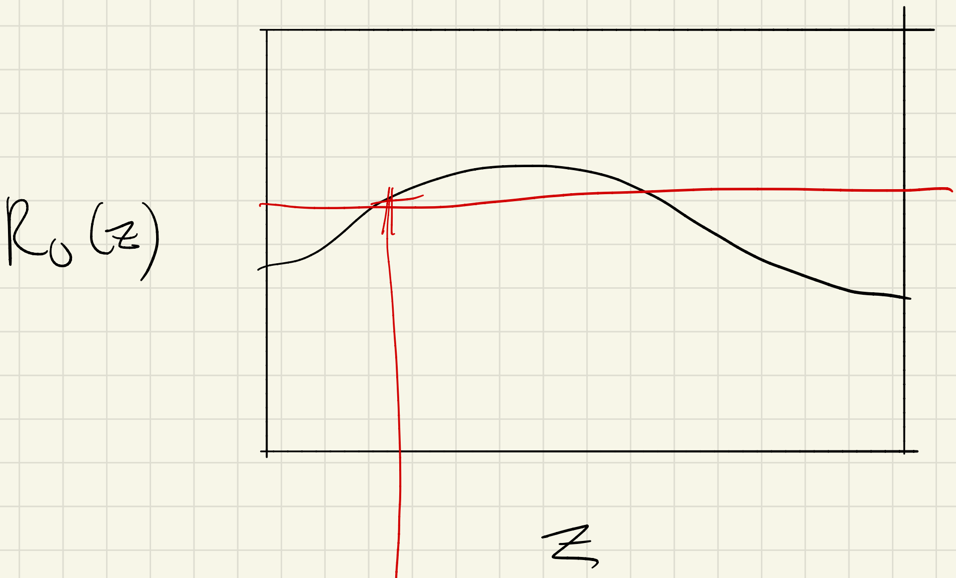
$$\boxed{R_0(x) = \frac{b(x)}{1-p(x)}}$$

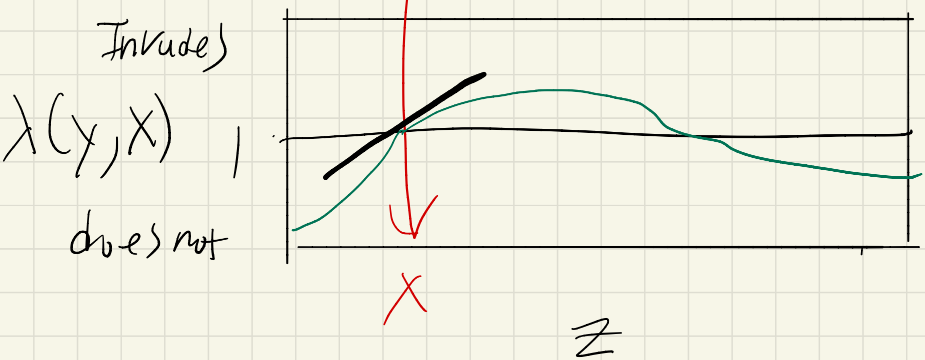
$$\frac{b(y)}{1-p(y)} > \frac{b(x)}{1-p(x)}$$

$$b(z) = e^{z}$$

$$p(z) = p_0 - z^2$$

$$R_0(z) = \frac{b(z)}{1-p(z)} = \frac{e^{z}}{1-p_0+z^2}$$





$$\left.\frac{d\lambda(y,x)}{dy}\right|_{y=x}$$