Recall Lec 05
Generalized logistic function

Note If you set
$L=0$, $K=1$, $\theta=1$, $r=1$
$doy_{ip}=0$

$$\frac{1}{1+\exp(-doy)} = \hat{p}$$

$\hat{p}$ this is function used in logistic regression.

$\hat{\beta}_0 + \hat{\beta}_1 x$

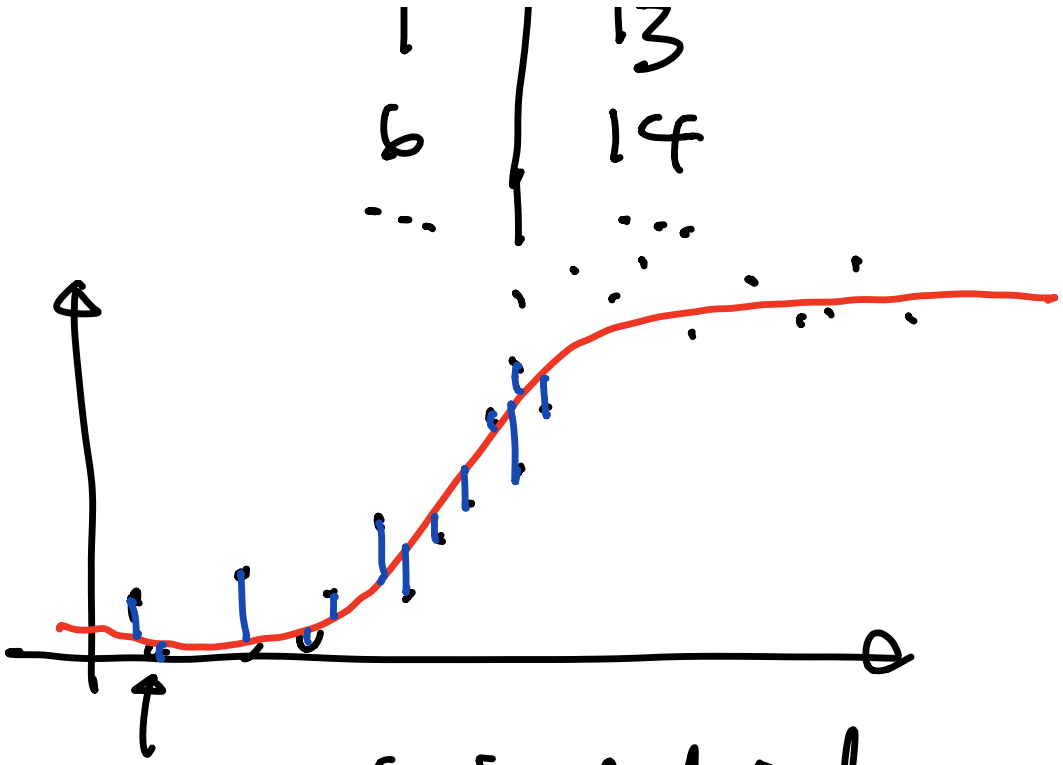
$$Y = f(x) + \varepsilon$$

$$dbh = f(doy \mid K, L, \theta, r, doy_{ip}) + \varepsilon$$

given

data

doy	dbh



Goal: want to find red curve that "best fits" the points

Goal: want to find "optimal" $K^*, L^*, \theta^*, r^*, \text{day:p}^*$ that "best fits" the points

To do this Need

1. Criteria for "best fit"
2. Method to find optimal

five parameter values

① Most people would guess "sum of squared residuals"

Rather we use criterion of "maximizing the (log) likelihood function"

MTH 320 Math Stats

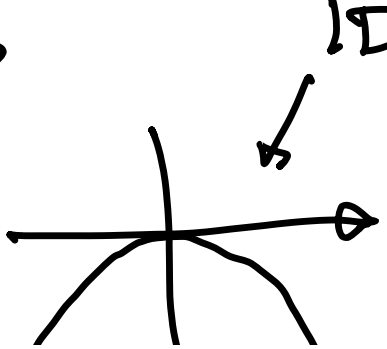
Likelihood function

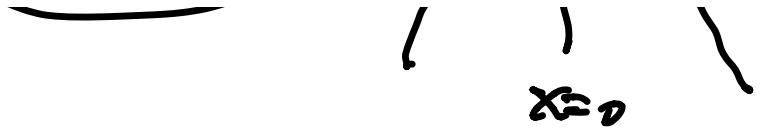
$f(\text{day} \mid K, L, \Theta, r, \text{days in})$ =

$L(K, L, \Theta, r, \text{days in} \mid \text{day})$

Side note How do we find maxima?

Ex $f(x) = -x^2$





Solve for $f'(x)=0$

$$-2x=0$$

$$\boxed{x=0}$$

We are not going to do this by hand, rather we use numerical optimization

Algorithm

(1) Make initial guess of optimal β parameters.

(2) feed ~~data~~ in initial guess & data into optim( ) function in R

(3) Output: a guess of

optimal parameter values $K^*, L^*, \theta^*, r^*, \text{dayin}^*$

④ take these values & plot them in red using generalized form logistic function.

take home Message

Method of maximum likelihood estimation

Method of MLE

Ex: To find optimal $\hat{b}_0, \hat{b}_1$, (intercept, slope) for any kind of regression