POP	SAMPLE
Errors: u_i	Residuals: $\hat{u}_i$
	$(\hat{u}_i = Y_i - (\hat{\beta}_0 + \hat{\beta}_1 X_{1,i} + \hat{\beta}_2 X_{2,i}))$

How do we get $\hat{\beta}_k$?

$$(\hat{\beta}_0, \hat{\beta}_1, \ldots) = \underset{(\beta_0, \beta_1, \ldots)}{\operatorname{argmin}} \sum_{i=1}^{n} \Big(\underbrace{Y_i - (\beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i} \ldots)}_{\text{"} \hat{u}_i \text{"}}\Big)^2$$

We find these by taking the first derivative of this objective function <u>for each beta</u>, and solving the system of equations, where each FD is set to $= 0$.

$$\min_{(\beta_0, \beta_1)} (Y_i - \beta_0 - \beta_1 X_i)^2$$

First Deriv. with respect to β_0 set to 0:

$$\sum_{i=1}^{n} 2(Y_i - \hat{\beta}_0 - \hat{\beta}_1 X_i)(-1) = 0 \qquad (1)$$

" " " β_1 "

$$\sum_{i=1}^{n} 2(Y_i - \hat{\beta}_0 - \hat{\beta}_1 X_i)(-X_i) = 0 \qquad (2)$$

Solving this system gives you $\hat{\beta}_0, \hat{\beta}_1, \ldots$ that we call OLS estimators.