7.2 Step Functions

Moving Beyond Linearity

The truth is almost never linear.

The linearity assumption may be good enough, but when it's not, we can use

- polynomials
- step functions
- splines
- local regression
- generalized additive models

which offer flexibility without losing the ease and interpretability of linear models.

A Note About 7.1

We discussed *polynomial regression* in some detail in Stat 140A.

This is just linear regression models where some of the input variables have been transformed using polynomials. E.g.,

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_1^2 + \hat{\beta}_3 x_1^3$$

Step Functions

- Using polynomial functions of the features in a linear model imposes a global structure on the non-linear function of X.
- Step functions allow us to impose more localized structure.

Step Functions

- These are just another way to create transformations of a variable.
- Here, we cut the variable into distinct regions
  $C_1(X) = I(X < 35), \quad C_2(X) = I(35 \leq X \leq 50)$, etc.