LOWESS SMOOTHING
Non-parametric regression fitting

**Lowess = Locally (weighted) regression scatter plot smoothing**

Create a curve capturing the “systematic” relationship between y and x (i.e. \( E(y \text{ at } x) \) as a function of x), without introducing a parametric model.

A method to create a “smooth” of the scatter plot of Y vs X, implemented in most statistical packages (including MINITAB).

To implement the procedure, need to specify:
- Fraction of data in each local neighborhood (smoothing parameter, \( q \))
- Degree of locally fitted polynomial (1=linear most common, but also 2=quadratic)
- Weight function for the least square fit
- Number of iterative weighted least square fits
Weighted least squares linear fit

$$\min_{\beta_0, \beta_1} \sum_{j \in N_i} w_j (y_j - (\beta_0 + \beta_1 x_j))^2$$

Weight function

$$w_i = \left( 1 - \left( \frac{d(x_j, x_i)}{\max_{\ell \in N_i} d(x_{\ell}, x_i)} \right)^3 \right)^3$$

For instance:
Smoothing param = 0.2
Degree = 1
# iterations = 2
For the chicken-human genome length example:
(first degree, q=0.2, # iterations = 2)
Fraction controls degree of smoothing: