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Formulas for correlation and regression

- Least-squares regression line
- Inference for correlation and regression
- Sample correlation coefficient

Least-squares regression line $\hat{y} = b_0 + b_1 x$

$$b_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} = \frac{\sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x^2}$$

$$b_0 = \bar{y} - b_1 \bar{x}$$

Sample correlation coefficient

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} = \frac{\sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y}$$

Inference for correlation and regression

$$r\sqrt{\frac{n-2}{1-r^2}}$$

$$\frac{b_1}{SE_{b_1}}$$

$$\left(b_0 + b_1 x_0\right) \pm t_{\alpha/2}\ s\ \sqrt{D}$$

$$\text{where} \quad D = \frac{1}{n} + \frac{\left(x_0 - \bar{x}\right)^2}{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}$$

$$\left(b_0 + b_1 x_0\right) \pm t_{\alpha/2}\ s\ \sqrt{1 + D}$$

$$\text{where} \quad D = \frac{1}{n} + \frac{\left(x_0 - \bar{x}\right)^2}{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}$$