Summary Statistics

five number summary: minimum, $Q_1$, median, $Q_3$, maximum

InterQuartile Range: $Q_3 - Q_1$

Range: maximum − minimum

$$
\overline{Y} = \frac{\sum Y}{n} \quad s^2 = \frac{\sum(Y - \overline{Y})^2}{(n-1)} \quad s = \sqrt{s^2}
$$

One Sample Problem

$$
df = n - 1 \quad \overline{Y} \pm t^* \left( \frac{s}{\sqrt{n}} \right) \quad t = \frac{\overline{Y} - \mu_0}{\left( \frac{s}{\sqrt{n}} \right)}
$$

Simple Linear Regression

$$
\hat{\beta}_1 = \frac{\sum(X - \overline{X})(Y - \overline{Y})}{\sum(X - \overline{X})^2} \quad \hat{\beta}_o = \overline{Y} - \hat{\beta}_1 \overline{X}
$$

$$
\hat{Y} = \hat{\beta}_o + \hat{\beta}_1 X = \hat{\mu}_{Y|X}
$$

$$
S_{Y|X} = \sqrt{\frac{\sum(Y - \hat{Y})^2}{n - 2}}
$$

$$
df = n - 2 \quad \hat{\beta}_1 \pm t^* \left( \frac{S_{Y|X}}{S_X \sqrt{n - 1}} \right) \quad t = \frac{\hat{\beta}_1}{\left( \frac{S_{Y|X}}{S_X \sqrt{n - 1}} \right)}
$$

$$
\hat{\mu}_{Y|X} \pm t^* S_{Y|X} \sqrt{\left( \frac{1 + \frac{1}{n} + \frac{(X_o - \overline{X})^2}{\sum(X - \overline{X})^2}}{\frac{1}{n} + \frac{(X_o - \overline{X})^2}{\sum(X - \overline{X})^2}} \right)}
$$

$$
\hat{Y} \pm t^* S_{Y|X} \sqrt{\left( 1 + \frac{1}{n} + \frac{(X_o - \overline{X})^2}{\sum(X - \overline{X})^2} \right)}
$$

Correlation

$$
r = \frac{\sum(X - \overline{X})(Y - \overline{Y})}{\sqrt{\sum(X - \overline{X})^2 \sum(Y - \overline{Y})^2}} = \frac{\sum(X - \overline{X})(Y - \overline{Y})}{(n-1)s_X s_Y}
$$

$$
r = \hat{\beta}_1 \left( \frac{s_X}{s_Y} \right) \quad r = \pm \sqrt{r^2} \quad df = n - 2 \quad t = \frac{r \sqrt{n - 2}}{\sqrt{1 - r^2}}
$$