12.1b Confidence Intervals for the slope of a LSRL

a estimates α

b estimates β

b ← point estimate for β

S estimates σ ← st. dev. of residuals (how far from the LSRL will our points be, on average)

Method: t interval for the slope

Statistic ± (crit. val)(st. dev. of statistic)

(st. dev. of statistic) = standard error

(crit. val)(st. dev. of statistic) = margin of error

$$b \pm t^* \cdot SE_b$$

t^* = inv T(all area below, df), df = n − 2

SE_b = from computer output

interpret SE_b: in repeated sampling the slope of the sample regression line would typically vary by about SE_b from the slope of the true regression line for predicting y from x.

example: flowers

Step 1

β is the slope of the true regression line for predicting hours of freshness (y) from amount of sugar (x).

C-level: 99%

Step 2 Use a t interval for the slope

Conditions:

Linear — the scatterplot shows a linear pattern and the residual plot shows no pattern

Independent — knowing the freshness of one flower doesn't tell me info on the freshness of another

Normal — The histogram of the residuals is not strongly skewed and there are no outliers.

Equal Variance — there is no obvious increase or decrease in variance on the residual plot

Random — 12 carnations randomly selected and treatments were randomly assigned.

Step 3

$b \pm t^* SE_b$ $\quad df = 12-2 = 10$

$15.2 \pm (3.169)(1.943)$

$(9.042, 21.36)$

Step 4 We are 99% confident that the interval (9.04, 21.35) captures the true slope of the regression line relating the amount of sugar to hours of freshness of the flowers.