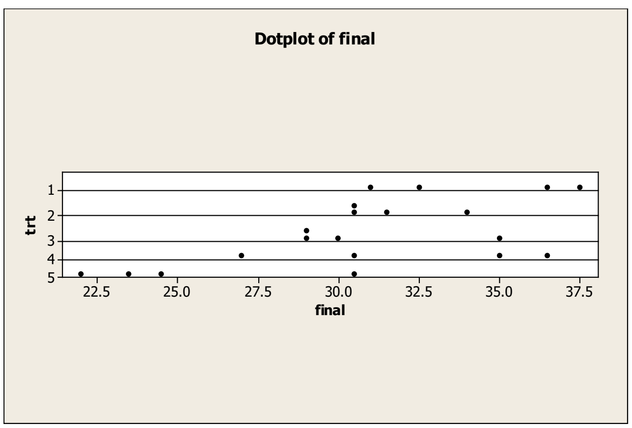
illustrating the basic features of analysis of covariance

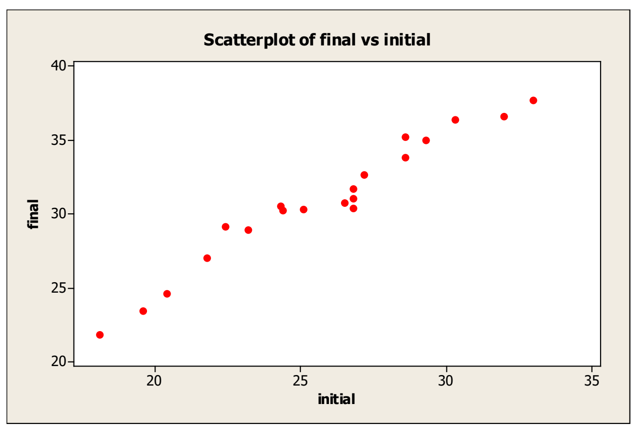
growth of oysters = response

oysters randomly placed at each of five locations in the cooling water canal of a power generating plant … initial weight and final weight recorded …

trt 1 = intake-bottom trt 2 = intake-surface trt 3 = discharge-bottom trt 4 = discharge-surface trt 5 = bay

Row	trt	initial	final
1	1	27.2	32.6
2	1	32.0	36.6
3	1	33.0	37.7
4	1	26.8	31.0
5	2	28.6	33.8
6	2	26.8	31.7
7	2	26.5	30.7
8	2	26.8	30.4
9	3	28.6	35.2
10	3	22.4	29.1
11	3	23.2	28.9
12	3	24.4	30.2
13	4	29.3	35.0
14	4	21.8	27.0
15	4	30.3	36.4
16	4	24.3	30.5
17	5	20.4	24.6
18	5	19.6	23.4
19	5	25.1	30.3
20	5	18.1	21.8





One-way ANOVA: final versus trt

Source	DF	SS	MS	F	P
trt	4	198.4	49.6	4.64	0.012
Error	15	160.3	10.7		
Total	19	358.7			

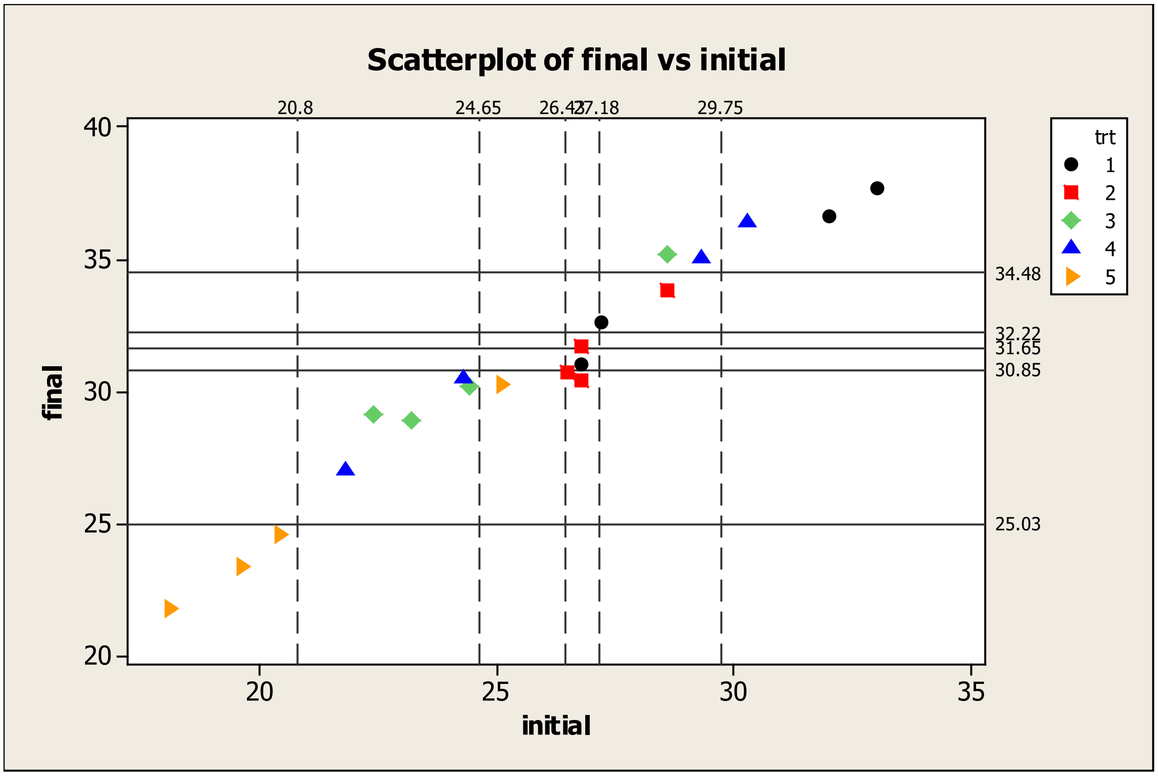
S = 3.269   R-Sq = 55.32%   R-Sq(adj) = 43.40%

Regression Analysis: final versus initial

The regression equation is
final = 3.76 + 1.05 initial

Predictor	Coef	SE Coef	T	P
Constant	3.765	1.409	2.67	0.016
initial	1.05125	0.05409	19.44	0.000

S = 0.951948   R-Sq = 95.5%   R-Sq(adj) = 95.2%



Variable	trt	Mean	Variable	trt	Mean
initial	1	29.75	final	1	34.48
	2	27.175		2	31.650
	3	24.65		3	30.85
	4	26.43		4	32.22
	5	20.80		5	25.03

Major conditions imposed on the model in analysis of covariance …

- The relationship between the response and covariate is linear.
- The regression (slope) coefficient is the same for all *t* treatments.
- The treatments do not affect the covariate, x_{ij}.

- $Y_{i,j} = \mu_i + \beta_1(X_{i,j} - \bar{X}_{..}) + \epsilon_{i,j}$
- As usual the $\epsilon_{i,j}$ are iid $N(0, \sigma^2)$.
- $Y_{i,j} \sim N(\mu_i + \beta(X_{i,j} - \bar{X}_{..}), \sigma^2)$ independent
- For each i, we have a simple linear regression in which *the slopes are the same*, but the intercepts may differ (i.e. different means once covariate has been "adjusted" out).