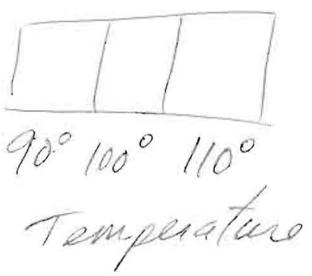
## Polynomial Contrasts (4.4 OCRT)

Dose-Response experiment.

- Equally spaced doses, equal sample sizes.
- Instead re-fitting the ANOVA model as a polynomial (treating "dose" as a quantitative variable), we can use polynomial contrasts to get the regression analysis information.

example: Drying temperature vs. germination of barley

$a=3$




$n=4$
$N=12$

ANOVA table

| Source | df |
|---|---|
| Temp | 2 |
| error | 9 |
| C. total | 11 |

← Can partition $SS_{Temp}$ into 2 orthogonal contrasts.

2/23/09 

$\underset{\sim}{\mu}' = (\mu_1, \mu_2, \mu_3)$

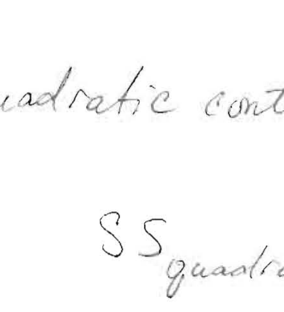
Linear contrast: $(-1, 0, +1)$ $\Rightarrow H_0: \mu_1 = \mu_3$

$$SS_{\text{Linear contrast}} = \frac{(\hat{\mu}_3 - \hat{\mu}_1)^2}{2/4} = 2(\hat{\mu}_3 - \hat{\mu}_1)$$

Quadratic contrast: $(1, -2, 1)$ $\Rightarrow H_0: \mu_2 = \frac{1}{2}(\mu_1 + \mu_3)$

$$SS_{\text{quadratic contrast}} = \frac{(\hat{\mu}_1 - 2\hat{\mu}_2 + \hat{\mu}_3)^2}{6/4} = \frac{2}{3}(\hat{\mu}_1 - 2\hat{\mu}_2 + \hat{\mu}_3)$$

1) If the relationship is linear...



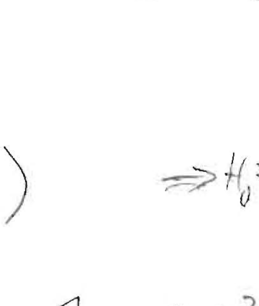
$SS_{\text{quad contrast}} \approx 0$

($\mu_2$ is at midpoint of $\mu_1$ & $\mu_3$)

$SS_{\text{Temp}} \approx SS_{\text{Linear contrast}}$

Linear contrast significant.
quad contrast not significant.

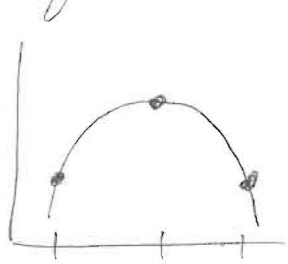
2) If the relationship is quadratic as...



Both contrasts may be significant.

The quadratic component measures additional improvement over the linear fit.

3) If the relationship is quadratic as...



$SS_{\text{linear}} \approx 0$

linear not significant
quad significant.

(See Appendix Table D.6 for higher order polynomials.)