Week 7, Thursday - Topics for Exam 1

Office hours Tuesday of October break 11-12 or appt.

4 questions, multiple parts

2 questions, EMS

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Hypothesis test.

Layout & Model.

1. Hypotheses
2. test statistic (SNR)
3. p-value - measure of significance
4. Conclusion:
   reject H_0
   do not reject H_0

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t-test

Independent sample & paired data.

Type I error - $\alpha = P_r(\text{false}^+)$

Type II error - $\beta = P_r(\text{do not detect effect})$

Power = $1-\beta$

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One-way ANOVA (fixed effect model)

Randomization

Layout & Model

Hypothesis test

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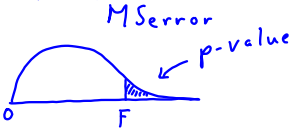
Hypothesis test

$H_0: \phi_T = 0$ ($H_0: \mu_i = \mu_j$ all ij)

$H_a: \phi_T > 0$ ($H_a: \mu_i \neq \mu_j$ some ij)

$F = \frac{MS_{Trt}}{MS_{error}}$



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Post F-test analysis.

If reject H_0, need to compare cell means.

Options:

1) No prior information, so compare all pairs of means.

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Range test for all means comparisons.

- Experimentwise procedure
  $\alpha = P_r$(make any Type I error)
- Comparisonwise
  $\alpha = P_r$(any one comp. gives Type I error)

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More powerful - Comparisonwise but more likely to make Type I error.

Bonferroni Ineq.

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2) Orthogonal Contrasts - Have prior information which suggests certain comparisons.

example 1: Control, Trt 1, Trt 2

Prior: Trt 1 & 2 should be same

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	C	T_1	T_2
	xx x	xx x	x x x
	0	-1	1
	1	-½	-½

0·1 + ½ - ½ = 0

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Common mistake.

	A	hi	hi	lo	lo
	B	hi	lo	hi	lo
Main A		-1	-1	1	1
Main B		-1	1	-1	1
AB		1	-1	-1	1

Pairwise!

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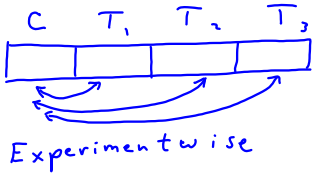
3) Dunnett's test - Have true control group. Compare all trt's to control



Experimentwise

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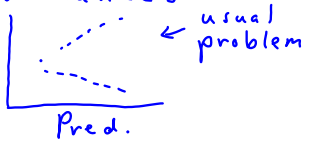
Diagnostics -
Equality of variances
- Plot



- Test
  Equal Variance
  Bartlett's
  Levene's

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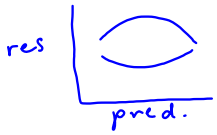
2nd most common problem, "ceiling" or "floor" effects.
Test, one group get's ~ 100%. another scores near 0.



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Normality
plot - Normal plot, q-q plot.
Test of normality -
Shapiro-Wilks test.

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If my assumption not satisfied, then we transform the data. Box-Cox transformation usually solves the problem.
redo ANOVA
means comparisons
diagnostics.

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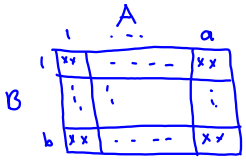
Two-way ANOVA
Layout & Model



$Y_{ijk} = \mu + A_i + B_j + AB_{ij} + \epsilon_{(ij)k}$

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Complete, balanced, factorial design
- Complete: all combinations of factors
- balanced: same # obs/cell
- factorial design: means factors crossed

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Three situations:

1) Fixed model, both factors fixed

2) Mixed model, one fixed one random

3) Random model, both factors random.

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Fixed model:

Test interaction, if significant do range test on cell means.

If not significant, test Main effects + do range test on signif. main effects.

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Mixed Model: A fixed, B random

Source	df	EMS
A_i		$\sigma_\epsilon^2 + n\sigma_{AB}^2 + nb\phi_A$
B_j		$\sigma_\epsilon^2 + na\sigma_B^2$
AB_{ij}		$\sigma_\epsilon^2 + n\sigma_{AB}^2$
error		σ_ϵ^2

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If A significant, do range test comparing levels of A.

If B or AB significant, estimate σ_B^2 or σ_{AB}^2.

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Random effects: Test all terms, estimate σ_A^2, σ_B^2 or σ_{AB}^2 if F-test was significant.

Do diagnostics always!

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Three-way ANOVA

Layout, model, EMS, correct F-tests.

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