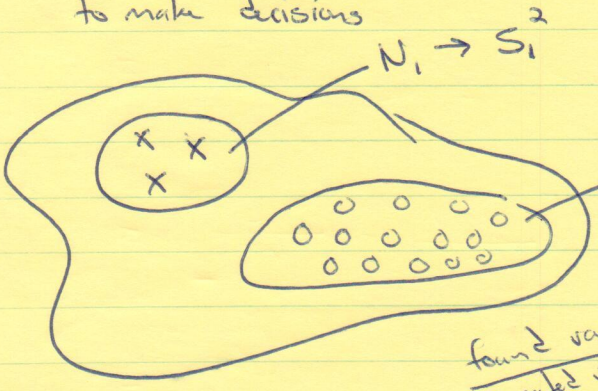
Factorial Experiment Design - Part II

From last activity
- When do our results have statistical meaning?
- Use ANOVA to answer this question
"Analysis of Variance"

Uses the F distribution - difference in error to make decisions

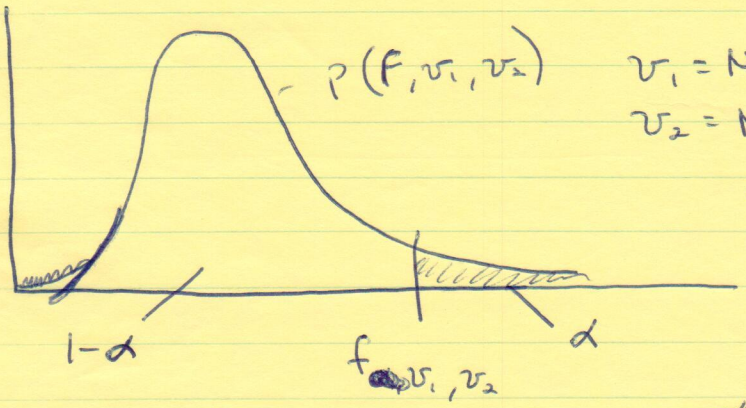


$$F = \frac{S_1^2}{S_2^2} \quad \begin{matrix} \rightarrow \text{factor of interest} \\ \rightarrow \text{noise} \end{matrix}$$

found variation of group averages / expected variation of group averages

S_1^2 & S_2^2 could be very different because amount of data is different

PDF
Prob. Dens. Fn



$\upsilon_1 = N_1 - 1$
$\upsilon_2 = N_2 - 1$

N = # data points

↖ Degrees of Freedom

$$1-\alpha = \int_0^{f(\alpha \upsilon_1, \upsilon_2)} P(f) \qquad \alpha = \int_{f(\alpha \upsilon_1, \upsilon_2)}^{\infty} P(f)$$

$$Pr\{F > F_{\alpha(\upsilon_1, \upsilon_2)}\} = \alpha \times 100\%$$

measure ↑ table

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$Pr\{F > F(\alpha, v_1, v_2)\} = \alpha \cdot 100\%$

Probability that variance is greater than "noise" is $\alpha\%$

Want to find α where F is barely > than "noise".

example

Single experiment $N_1 + N_2$

$N_1 = 7$ $N_2 = 4$

$S_1^2 = 20$ $S_2^2 = 8$

not much variance compared to norm variance

$F = \frac{20}{8} = 2.5$

Choose $\alpha = 0.25$ $F(0.25, 6, 3) = 2.42$

$Pr\{F > 2.42\} = 25\%$

true - chance that stat. fluke has occured is less than 25%

Choose $\alpha = 0.05$ $F(0.05, 6, 3) = 8.94$

$Pr\{F > 8.94\} = 5\%$

not true - due to statistical fluctuation only

Choose $\alpha = 0.01$ $F(0.01, 6, 3) = 27.91$

$Pr\{F > 27.91\} = 1\%$

not true

Suppose $S_1^2 = 90$ + $S_2^2 = 3$ $F = 30$

"found variation is much greater than expected noise"

$Pr\{F > 27.91\} = 1\% \rightarrow$ true

Probability that statistical fluke has occured is less than 1%

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Go to ANOVA notes handout

- How to get F?

$$F_A = \frac{MS_A}{MS_E}$$

MS_A – mean square A — Variance in A

MS_E – mean square error — Expected variance

Using Example data from text

Meet in Room GJ237