

EDUCATION 257 Winter-Spring 2005

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note: NWK chapter cites to fourth ed.; corresponding ver5 added alongside

I. Design and Analysis of Comparative Studies (Experiments)

A. Introduction and review. Factorial Designs

1. Comparing group outcomes on a single classification: One-way analysis of variance
2. Multiple comparisons in one-way anova
3. Two-way fixed effects anova and interactions

NWK readings for intro factorial designs

one-way anova NWK 16.1-16.9 ver 4; 16.1-16.6 ver5

post hoc pairwise comparisons NWK 17.4-17.5 ver4 and ver5;

factorial designs: two-way fixed effects NWK 19.1-19.6, 20.2,20.3 ver4; 19.1-19.6, 19.9 ver5

B. More Factorial Designs

1. Random and mixed anova models (multiple comparisons, variance component estimation)
2. Unbalanced designs
3. k-way classifications
4. Design--Sample size and power
5. Randomized block designs (including Latin Squares)

NWK readings for more factorial designs

mixed and random 2-way NWK 24.2-24.4 ver4; 25.2-25.4 ver5

one observation per cell NWK 21.1-21.2 ver4 and ver5

Unbalanced two-way designs NWK 22.1, 22.2, 22.6 24.6 ver 4; 23.1, 23.2, 23.6 23.6 ver5;

three-way factorial designs NWK 23.1-23.6, 24.5 ver4; 24.1-24.5, 25.6 ver5

planned (orthogonal) comparisons NWK 17.3 ver4 and ver5

design and sample size NWK 26.1-26.5 ver4; 16.10,16.11, 19.11, 24.7 ver5

randomized block designs NWK 27.1-27.7, 30.1-30.2 ver4; 21.1-21.9, ver5

C. Nested and Repeated Measures Experimental Designs

1. Nested designs
2. Repeated measures designs

NWK readings for nested and repeated measures designs

nested and crossed-nested NWK 28.1-28.5, 28.9 ver4; 26.1-26.5, 26.9 ver5

repeated measures designs NWK 29.1-29.4 ver4; 27.1-27.4 ver5

II. Analysis of Association: Correlation and Regression

Review

Correlation and Straight-line regression

A. Basic Regression Models

1. Multiple regression
2. Polynomial regression
3. Model violations and transformations

Note: readings for introductory regression lectures Part A

Review: Straight-line regression NWK Ch 1-4 ver4,5

Multiple Linear Regression

Basic fit: Inference for params & fit Ch.6 ver4,5

R-sq, adj R-sq pp230-1 ver 4; 226-7 ver 5

Adjusted Variable Interpretation (partial regr) sec 9.1 ver 4; sec 10.1 ver5 (added-variable plots)

Testing composite Hypoth sec 7.1-7.3 ver4,5

partial part correl sec 7.4 ver4,5

standardized coeff sec 7.5 ver4,5

polynomial regr sec 7.7 ver4; sec 8.1 ver5

Inference for correlations sec 15.4 640-643 ver 4; sec 2.11 ver5

Problems

heteroskedascity sec 10.1 ver 4; 11,1 ver 5; autocorrelation ch12.1-12.4 ver4,5;

multicollinearity sec 7.6 ver4,5, VIF sec 9.5, 10.2 ver 4; sec 10.5 ver5

outliers, residuals sec 9.2 ver4; sec10.2 ver5

B. Regression Models with Categorical Variables

1. Reformulation of anova models

2. Analysis of covariance & alternatives

Note: readings for regression lectures Part B: categorical predictor vars,

Qualitative predictors: NWK Ch 11 ver 4, Chap 8 ver5 ;

Ancova (via anova models)NWK Ch 25 ver4, Ch 22 ver 5

Qualitative predictors:

0,1 dummy vars, reg params sec 11.1 p456- ver4; 8.3 p.313- ver5

non-parallel regressions sec 11.2 ver4, sec8.4,8.5 ver5

regr approach to ancova, more than 2 groups sec 11.3 ver4 , sec8.6 ver5

anova one-way sec 16.11, 2-way sec 19.7 p.832 ver 4

sec 16.8 ver5

Ancova

reduction of error var sec 25.1 ver4, 22.1 ver5

single factor sec 25.2, crackers ex sec25.3 ver 4, 22.2,3 ver5

C. Building Regression Models

1. Variable Selection and Model Construction:

Statistical algorithms, stepwise regression, best subsets

Composites and variable reduction (including principal components)

2. Model building by "theory", Intro Path Analysis and LISREL (see ed260 page, Rogosa "casual models")

3. Regression models with hierarchical data

Note: readings for regression lectures Part C: Model Building,

stepwise, best subsets, "automatic" NWK 8.1-8.5 ver 4, 9.1-9.5 ver 5

cross-validation NWK 10.5-10.7 ver 4, 9.6 ver 5

advanced topics: path analysis, hierarchical data see ed260 page

III. Analysis of Categorical Data

A. Proportion and Count Outcomes:

Intro and Review: Bernoulli, Binomial, Multinomial, and Poisson distributions; inferences for proportion and count data;

Univariate Categorical Data; Logit and odds transformations;

Generalized Linear Models: Logistic and Poisson Regression

Readings for IIIA

NWK Ch.14, ver4, ver5 Logistic regression, Poisson Regression

Agresti Ch.1 (proportions and counts); 4, 5, 8 (logistic, poisson regression); 10 (history)

B. Statistical Modelling, Estimation, and Inference for Multivariate Categorical Data

Review: Basic contingency Tables

Odds-ratios, conditional and marginal independence, Simpsons Paradox,
Cochran-Mantel-Haenszel for metanalysis,
Log-linear models for Multi-way Contingency Tables,
Associations among ordinal variables
Agresti Ch. 2, 3, 6, 7, 9.

Additional Readings

Bringing Evidence-Driven Progress To Education:

[main report November 2002](#)

[US DOE press release](#)

[December 2003 confab, "what](#)

[works"](#)

Rogosa, D. R. (1980). [Comparing nonparallel regression lines](#).
Psychological Bulletin, 88, 307-321.

Rogosa, D. R. (1987). Casual models do not support scientific
conclusions: A comment in support of Freedman.
Journal of Educational Statistics, 12, 185-195.

Guest books

- Miller, R.G. (1986). Beyond Anova, Basics of applied statistics. New York: Wiley.
- Box, G.E.P., Hunter, W.G., & Hunter, J.S. (1978). Statistics for Experimenters. New York: Wiley.
- Winer, B.J. (1971) Statistical Principles in Experimental Design McGraw-Hill
- Mosteller, F., & Tukey, J.W. (1977). Data Analysis and Regression. Reading: Addison-Wesley.
- Agresti, A. (1990). Categorical Data Analysis. New York: Wiley.
- Bryk, A.S. & Raudenbush, S. W.(1992). Hierarchical linear models: Applications and data analysis methods. Sage Publications:CA: