

Math 204 Winter 2026
Recap

Background knowledge: Hypothesis testing

- Consider H_0 and H_a .
- Test statistic, T .
- Find the (null) distribution of T .
- Compute T_{obs} .
- Complete the test: to reject H_0
 - ▶ T_{obs} in the rejection region ?
 - ▶ Small p-value ?

Background knowledge: Confidence Intervals

For a two group comparison, a 95 % CI for $\mu_A - \mu_B$

$$(\bar{x}_A - \bar{x}_B) \pm t_{0.025, n_A + n_B - 2} s_P \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}$$

where $t_{a, \nu}$ is the upper a point of the t_ν -distribution.

General rule of thumb: for large sample 95% CI is

$$\text{Estimate} \pm 2 \times \text{e.s.e}(\text{Estimate})$$

as $t_{0.025, \nu} \simeq 2$ when ν is large, and

$$\text{e.s.e}(\text{Estimate})$$

is the **estimated standard error**.

Chapter 1

The Analysis of Variance

Designed Experiments

- Terminology
- Designs
 - ▶ CRD
 - ▶ RBD
 - ▶ FD

and when they would be used.

- Sums of Squares Decompositions
- ANOVA & ANOVA Tables
- Assumptions & Balanced Complete Design
- Post hoc tests and multiple comparisons

Designed Experiments

- Interactions
 - ▶ interpretation
 - ▶ impact on sums of squares decompositions
- Models, Parameterizations and Estimation
- Relaxing the assumptions: Permutation and Randomization procedures

Chapter 2

Linear Regression

Linear Regression

- Probability Models & Least-Squares Fitting
- Model Assumptions
- Simple Linear Regression
 - ▶ Parameter Estimation and Testing
 - ▶ ANOVA in Regression
 - ▶ Goodness of Fit (R-squared statistics)
 - ▶ The Correlation Coefficient
 - ▶ Prediction

Linear Regression

- The Linear Model & Multiple Regression
 - ▶ Polynomial Regression
 - ▶ Multiple Regression Models
 - ▶ Factor Predictors and Dummy Variables
 - ▶ Parameterization

Linear Regression

- ANOVA for finding the best model
 - ▶ Model Building and Checking
 - ▶ Comparing Nested Models
 - ▶ Stepwise Model Selection
- Residual Analysis & Checking
- Pitfalls of Regression Modelling

Chapter 3

Non-Parametric Statistics

Non-parametric hypothesis tests

- Distribution-Free Tests: why and how
- Tests for tables of counts (contingency tables)
 - ▶ Chi-squared tests
 - ▶ Tests for 2×2 tables
 - ▶ Exact tests
- Tests based on ranks
- Single population tests
 - ▶ Sign/Binomial test

Non-parametric hypothesis tests

- Comparing two populations: independent samples
 - ▶ Mann-Whitney and Wilcoxon Tests
 - ▶ Small sample and large sample versions
- Comparing Two Populations: Dependent Samples
 - ▶ Wilcoxon Signed Rank Test
 - ▶ Small sample and large sample versions
- Rank Correlation

Exam Format

- Same as Practice Final
- Five questions, each out of 20 = 100 total
- I reserve the right to rescale out of a smaller total
 - eg 97, 95
- Many of the questions are computations
- Some of the questions involve short written answers

Exam Format

Formula sheet:

- contains the key formulae
- contains some methods, but not all
- in general does not contain definitions

Core principles and techniques

- Terminology/definitions
- Hypothesis Testing Procedures
- p -values
- Significance Levels (α)
- Parameter estimates
- Types of experimental design and statistical model
- Use of statistical tables
 - ▶ F, Chi-squared, t/Normal, Non-parametric tables

Core principles and techniques

- Know how to complete a statistical analysis; for example
 - ▶ manipulate ANOVA tables
 - ▶ perform ANOVA-F tests for nested models
 - ▶ identify significant coefficients
 - ▶ combine parameter estimates to get predictions