



---

School of Public Health

Department of Biostatistics

---

## PubH 7400 Fundamentals of Biostatistical Inference - *Fall* 2005

---

### Course Objectives

This course is part of a two-course sequence intended for Ph.D. students in the School of Public Health who need a rigorous approach to probability and statistics and statistical inference with applications to research in public health. [Course syllabus](#) (Word document).

---

### Material covered

- Tues., Sept. 6: Sections 1.4, 1.5. [Some notes](#). Sample spaces, experimental outcomes, events, probability.
- Thur., Sept. 8: Sections 1.6, 1.7. Finite sample spaces, simple sample spaces, counting.
- Tues., Sept. 13: Sections 1.8, 1.9. More combinatorics.
- Thur., Sept. 15: Sections 1.9, 1.10, 2.1. Multinomial coefficients, computing probabilities of unions of events. [A few solved homework 1 problems](#).
- Tues., Sept. 20: Sections 2.1, 2.2, 2.3. Conditional probability, independent events, Bayes' rule.
- Thur., Sept. 22: Sections 3.1, 3.2. Random variables, discrete r.v.'s.
- Tues., Sept. 26: Sections 3.2, 3.3. Continuous r.v.'s, the distribution function.
- Thur., Sept. 28: Sections 3.4, 3.5. Calculus review, bivariate distributions. [Handout](#).
- Tues., Oct. 4: Sections 3.5, 3.6. Marginal and conditional distributions obtained from jointly distributed random variables. [Some homework solutions](#).
- Thur., Oct. 6: Sections 3.6, 3.7. Multivariate distributions.
- Tues., Oct. 11: Sections 3.7, 3.8, 3.9: Multivariate distributions, random samples, functions of random variables. [Handout](#).
- Thur., Oct. 13: Sections 4.1, 4.2, 4.3:  $E\{g(X)\}$ ,  $E(X)$ ,  $\text{var}(X)$ .
- Tues., Oct. 18: Sections 4.3, 4.6, 5.2:  $\text{Cov}(X, Y)$ , Bernoulli distribution.
- Thur., Oct. 20: Sections 5.2, 5.4: binomial, Poisson distributions.
- Tues., Oct. 25: Review chapters 3 & 4. [Handout](#). Homework problems.

- Thur., Oct. 27: Section 5.6: normal distribution.
- Tues., Nov. 1: Sections 5.6, 5.7: normal quantiles, Central Limit Theorem. [Midterm](#) handed out.
- Thur., Nov. 3: Section 5.9 & notes: uniform, exponential, and gamma distributions. Midterm collected.
- Tues., Nov. 8: Section 6.5: Population, data, probability models, and inference. Maximum likelihood estimators.
- Thur., Nov. 10: Sections 6.5, 6.6. Properties of MLE's (invariance, large sample normality, example of situation where MLE exists but computing it is difficult).
- Tues., Nov. 15: The two-sample problem. Vectors and matrices.
- Thur., Nov. 17: Matrix addition, multiplication, and inverse. Data vector, design matrix. Two-sample problem revisited.
- Tues., Nov. 22: Simple linear regression: data, model, matrix formulation and MLE's. [Handout](#).
- Tues., Nov. 29: Introduction to logistic regression. Introduction to hypothesis testing and p-values. [Handout](#).
- Thur., Dec. 1: Hypothesis testing and confidence intervals for normal means. Student t distribution. Relationship between p-value and significance level.
- Tues., Dec. 6: Two sample problem: SAS and Minitab examples. More on one versus two-sided alternatives. [Handout 1](#) and [Handout 2](#). [Final exam](#). [Final data 1](#) and [Final data 2](#).
- Thur., Dec. 8: One-way ANOVA: model, F-test. Power and sample-size determination in one-sample normal model. [Handout 1](#) and [Handout 2](#).
- Tues., Dec. 13: Multiple comparisons in one-way ANOVA. Large sample properties of the MLE vector. Last [handout](#).

## Homework assignments

- Homework 1, due Sept. 15: (1.4) 2, 4, 6, 8 (1.5) 2, 4, 6, 8, 10 (1.6) 2, 4, 6, 8 (1.7) 2, 4, 6, 8.
- Homework 2, due Sept. 22: (1.8) 2, 4, 6, 8, 10, 12, 14, 18 (1.9) 2, 4 (1.10) 2, 4.
- Homework 3, due Sept. 29: (2.1) 2, 4, 6, 8 (2.2) 2, 4, 6, 8, 10, 12 (2.3) 2, 4, 8, 12 (3.1) 2, 6.
- Homework 4, due Oct. 6: (3.2) 2, 4, 6, 8 (3.3) 2, 4, 6, 12 (3.4) 2, 4, 8.
- Homework 5, due Oct. 13: (3.5) 2, 4, 6, 8 [extra credit] (3.6) 2, 4, 6, 8.
- [Homework 6](#), due Oct. 20.
- [Homework 7](#), due Oct. 27.
- Homework 8, due Nov. 10: (5.4) 2, 4, 6, 12, (5.6) 2, 4, 8, 10 (5.7): 2, 8
- Homework 9, due Nov. 17: (6.5) 2, 6 (6.6) 2
- Homework 10, due Dec. 6: [Part A](#) and Part B: page 496 problems 1 and 3. Do with any package or web-based applet, turn in output along with interpretation.