BIOSTATISTICS 660 (FALL 2017)

Probability and Statistical Inference I

Instructor:	Anastasia Ivanova, Associate Professor of Biostatistics Office Location: 3103C McGavran-Greenberg Hall Office Hours: by appointment Office Phone Number: 843-8086 E-mail: aivanova@bios.unc.edu
Lectures:	Tuesday and Thursday, 12:30 PM to 1:45 PM, Rosenau 228 Please be aware of the UNC policy that food and drink of any kind are prohibited in all General Purpose Classrooms.
Assessment:	1) MIDTERM EXAM 1 help on Sep 17 (worth 20% of final grade); 2) MIDTERM EXAM 2 held on Oct 27 (worth 20% of final grade); 3) FINAL EXAM (worth 35% of final grade); UNC assigned time for Final Exam is Fri Dec 8 noon-3 pm, location Rosenau 228. You are allowed to bring a 1-page cheat-sheet to Midterm 1, a 2-page cheat-sheet to Midterm 2, and a 3-page cheat-sheet to the Final Exam. You can also bring the table with probability distributions from Casella and Berger (Casella and Berger is the table approved for MS qualifying exams). 4) HOMEWORK (worth 25% of final grade); the homework assignments are due **by 12:30 PM).** HW can be submitted by e-mail (e-mail to BOTH course assistants) or bring the paper copy of your HW to class to submit before the beginning of class. You are permitted to work together on homework assignments, but all work submitted must be your own. Copying or simply dividing up assignments among collaborating students is not allowed. Questions concerning the homework assignments can be addressed to the course instructor or the course assistant. Questions concerning grading of homeworks should be addressed to the course assistant.
Help sessions:	Weekly help session (optional) Mon 2:20 PM - 3:15 PM, location TBD.
Course assistants:	Phoebe (Xiaotong) Jiang <xiaotong@live.unc.edu> , Chao Huang chaoh@email.unc.edu. The course assistants will be grading the homework assignments
Primary text:	*A first course in probability* by Sheldon Ross, 8th (or other) edition. **ISBN-10:** 013603313X, **ISBN-13:** 978-0136033134
Lecture notes:	https://sakai.unc.edu/portal/site/bios660
Other useful texts:	*Statistical Inference* by Casella and Berger (Ch 1-5) http://www.math.umass.edu/~lavine/Book/book.html http://www.math.dartmouth.edu/~prob/prob/prob.pdf
Course prerequisite:	A working knowledge of multivariate calculus (e.g., MATH 33 at UNC)
Course evaluations:	All students are expected to complete course evaluations during the two week time window at the end of the course as listed on the UNC Academic Calendar.

List of Lectures

8/22 L 1. Introduction. A sample of statistical problems. Basic principles of counting.
8/24 L 2. Combinations and permutations. Set theory.
8/29 L 3. Definition of probability. Conditional probability.
8/31 L 4. The multiplication rule. Bayes' Theorem. Case-control design.
9/5 L 5. Independence.
9/7 L 6. Random variables. Density function. Cumulative distribution function. Discrete probability distributions. Expected value of a random variable. Variance.
9/12 L 7. Bernoulli, Binomial, Poisson.
9/14 L 8. Geometric, Negative Binomial, Hypergeometric.
9/19 L 9. Derivation of the Poisson distribution.
9/21 L 10. Midterm 1.

9/26 L 11. Continuous random variables. Uniform.
9/28 L 12. Normal. Normal approximation to the Binomial. Exponential.
10/3 L 13. Hazard rate. Gamma. Weibull. Cauchy. Beta.
10/5 L 14. Distribution of a function of a random variable. Mixtures of distributions. Truncated distributions.

10/10 L 15. Bivariate discrete distributions. Marginal and conditional distributions.
10/12 L 16. Bivariate continuous distributions. Mutually independent random variables. Sum of random variables.
10/17 L 17. Joint distribution of functions of random variables. Order statistics.
10/24 L 18. Hierarchical distributions. Covariance and correlation.
10/26 L 19. Bivariate Normal. Bivariate Bernoulli. Multinomial.
10/31 L 20. Midterm 2

11/2 L 21. Expectation theory for multivariate distributions.
11/7 L 22. Conditional expectation. Chain rule.
11/9 L 23. Chain rule: conditional variance.
11/14 L 24. Conditional expectation and prediction.
11/16 L 25. Moment generating functions.
11/21 L 26. Multivariate moment generating functions. Multivariate Normal distribution.
11/28 L 27. Sampling from populations. Infinite and finite populations.
11/30 L 28. Statistical inequalities: Markoff's inequality. Tchebysheff's Theorem.
12/5 L 29. Method of statistical differentials (delta method).
12/8 Final exam.

Tentative HW Schedule

	Date given	Date due
HW 1	Aug 24	Aug 31
HW 2	Aug 31	Sep 7
HW 3	Sep 7	Sep 14
HW 4	Sep 26	Oct 5
HW 5	Oct 5	Oct 12
HW 6	Oct 12	Oct 24
HW 7	Nov 2	Nov 14
HW 8	Nov 14	Nov 28
HW 9	Nov 28	Dec 5