**Course # and Title: EPI204A Foundation of Statistical Methods**

**Quarter and Time**: Winter 2013, M & W 10AM-12PM

**Room**: 2011 Valley Hall

**Instructor and Contact information**: Heejung Bang ([hbang@ucdavis.edu](mailto:hbang@ucdavis.edu)), MS1C Room 146

**Office hours**: M, W 12-1PM, or by appointment

**Grader and Contact information**: Amit Kharb [akharb@ucdavis.edu](mailto:akharb@ucdavis.edu)

**Prerequisite(s)**: STA130A, 131A, EPI228 or Basic Calculus are recommended. Some statistical programming skill (e.g., in SAS) or EPI298 is desirable.

**Textbook**: Hogg and Tanis. Probability and Statistical Inferences (8th Edition). Section 5.5-5.7; Chapter 6, Chapter 7, Section 10.2-10.4 and 10.7; Mainly, estimation and Inference and Some theories will be covered.

(Optional reference: Bang and Davidian. Chapter 1: Experimental Statistics for Biological Sciences. PDF is downloadable from publisher’s website at: <http://www.springer.com/life+sciences/systems+biology+and+bioinformatics/book/978-1-60761-578-1>)

**Course Description**:

This is a core graduate course for the PhD program in Epidemiology. This course will provide the theoretical basis for fundamental elements that are commonly used in epidemiologic and other experimental studies, and emphasize real applications and implications on practice so that the learning materials would be well suited for applied scientists (i.e., non-statisticians). As heavy users of statistics and statistical methods and software, it is highly ideal that epidemiologists understand what is going on inside statistical software when they use it in daily life. This course will also help students use specific methods correctly with proper understanding of underlying theory and assumptions entailed. Specifically, this course will focus on statistical estimation and inference, including regression, ANOVA and hypothesis testing. If time permits, we will go over additional important topics and widely adopted methods such as sample size and power calculation, resampling and some recent developments and discussions in modern statistics.

**Grading**: Attendance and participation (10%), Homework (45%), Final exam (45%).

**Homework**: There will be approximately 1 homework per week, along with reading assignments. **Two weeks** will be given for completion unless announced differently. Most reading assignments are optional but highly recommended – contemporary, didactic and rigorous articles have been selected.

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| **Lecture # - Date** | **Section # and Topics** | **Brief outline or Remarks** |
| 1 – Jan 7 | Sec 5.5. Random functions associated with normal distributions | Basically we will review what you learned from previous stat courses. |
| 2 – Jan 9 | Sec 5.6. and 5.7. The Central Limit Theorem (CLT) | Basically we will review what you learned from previous stat courses. |
| 3 – Jan 14  4 – Jan 16 | Sec 6.1. Point estimation  Sec 10.7. Asymptotic distributions of  MLE. | Introduction to point estimation, e.g., MLE, MME. Discussion on interpretations of statistics. |
| No class – Jan 21 (Martin Luther King day) | | |
| 5 – Jan 23 | Sec 6.2. Confidence intervals (CIs) for means | Introduction to interval estimation |
| 6 – Jan 28 | Sec 6.3. CIs for the difference of two means |  |
| 7 – Jan 30 | Sec 6.4. CIs for variances |  |
| 8 – Feb 4 | Sec 6.5. CIs for proportions |  |
| 9 – Feb 6 | Sec 6.6. Sample size (N)  (More N/power to be covered in Ch 7. Hypothesis Testing, and Sec 10.2. Power of a statistical test) | N can be determined in the estimation as well as hypothesis testing contexts. Various sample size formulae are provided. |
| 10 – Feb 11 | Sec 6.7. Simple linear regression | Along with brief introduction to association and causation |
| 11 – Feb 13 | Sec 6.8. More regression  (Use of vectors and matrices) | Estimation vs. Prediction, multiple regression. |
| No class – Feb 18 (President day) | | |
| 12 – Feb 20 | Introduction to Hypothesis Tests |  |
| 13 – Feb 25  14 – Feb 27 | Sec 7.1. Tests about proportions  Sec 7.2-3. Tests about means  Sec 7.4. Tests for variances | Connecting CI and hypothesis testing. More discussion on interpretations of statistics.  We will learn Student t-test (again). |
| 15 – March 4 | Sec 10.2.-10.4. Additional topics and theory in Hypothesis testing. | Chi-square test and Likelihood ratio  Test. How to evaluate tests. |
| 16 – Mar 6 | Sec 7.5. One-factor Analysis of Variance (ANOVA) | Multiple comparisons to be covered as well. |
| 17 – Mar 11 | Sec 7.6. Two-factor ANOVA | Introduction to interaction |
| 18 – Mar 13 | Sec 7.7. Tests concerning regression and correlation | Relationship between regression and correlation |
| 19 – Mar 18 | Additional topics in Regression | Various issues in regression, gentle introduction to Logistic regression |
| 20 – Mar 20 | Final exam | In-class exam |