Economics 162A: Introduction to Probability and Statistics   Yale University

Professor Hanming Fang   Fall 2004

COURSE SYLLABUS

OFFICE: Room 35, 37 Hillhouse Avenue; E-mail: `hanming.fang@yale.edu`

TIME AND LOCATION: Tuesday and Thursday 9:00-10:15am at Becton 102

OFFICE HOURS: Mondays 3:00 - 4:30pm and by appointment

TEACHING ASSISTANT: Yoonseok Lee (E-Mail: `y.lee@yale.edu`)

REQUIRED TEXTBOOK (available at Yale Book Store, reserved at CCL)

- Robert Hogg and Elliot Tanis, *Probability and Statistical Inference*, 6th edition, Prentice-Hall. Irwin/McGraw-Hill, 2001.

Other texts (not required) that cover the same material include (reserved at CCL):

- Hogg, R. and A. Craig, *Introduction to Mathematical Statistics* [Also a good book at a higher level than Hogg and Tanis]

- Wonnacott, T. H. and R. J. Wonnacott, *Introductory Statistics for Business Economics* [Lower level than Hogg and Tanis]

COURSE DESCRIPTION:

- This course provides an introduction to probability and statistics for math econ/econ majors. It is followed by a course on econometrics, Econ 163b, in the Winter/Spring semester. Students are responsible for weekly reading and problem assignments (listed below). The problem sets will be discussed in the discussion section with the TA.

EVALUATION:

- The grade for the course will be based on the problem assignments (20%), a mid-term exam (30%), and a final exam (50%).

HOMEWORK AND EXAM POLICIES:

- You need to *personally* submit your homework *by the end* of the class on its due date. Otherwise, you will receive 0 points for that assignment. Exceptions are given only with a dean's excuse.

- Make-up exams are given only with a dean's excuse. Under no circumstances are early final exams given. The final exam may be postponed only under the conditions described in the Yale College Programs of Study, pages 54-55. Note that end of term travel plans are explicitly disallowed as valid excuses.

A WORD OF ADVICE:

- Do the reading and problem assignments diligently. The subject matter of this course will be learned better with as many exercises as possible.

- Half of the problems in the midterm and in the final will be directly taken from the assigned homework problems.

Tentative Weekly Reading and Problem Assignment

<u>Thursday, September 2:</u> Fundamentals of probability theory: set theory, probability axioms.

- Required Readings: §1.1, §A.1, §2.1

- Problem Set 1: §1.1: 2, 7; §2.1: 1, 2, 3, 9,12, 14, 15

- Due: Thursday, Sept. 9

<u>Week of September 7:</u> Methods of enumeration, conditional probability, independent events, Bayes' formula.

- Required Readings: §2.2-2.5

- Problem Set 2: §2.2: 2, 6, 8; §2.3: 2, 4, 5; §2.4: 3, 4, 11, 12; §2.5: 2, 6

- Due: Thursday, Sept. 16

- TA Session: Math Review: Appendix §A1 (algebra of sets).

<u>Week of September 14:</u> Discrete distributions: random variables, probability mass function, moment generating functions, expectation, mean, variance, standard deviation, Bernoulli distribution, binomial distribution, Poisson distribution

- Readings: §1.2, §1.7, §3.1-3.5

- Problem Set 3: §3.1: 3, 6, 8; §3.2: 4, 7, 8, 10; § 3.3: 3, 7, 9; §3.5: 8, 10

- Due: Thursday, Sept. 23

- TA Session: Problem Set 1; Math Review: §A5 (integration), §A6 (multivariate calculus).

<u>Week of September 21:</u> Continuous distributions: Random variables, density function, distribution function, moment generating functions, expectation, uniform distribution, exponential distribution, chi-square distribution, normal distribution, mixed discrete and continuous distributions

- Readings: §3.4, §4.1-4.4, §4.6

- Problem Set 4: §3.4: 2; §4.1: 2, 4, 10, 15; §4.2: 3, 6, 11; §4.3: 10, 11; §4.4: 2, 4, 7; §4.6: 2,4

- Due: Thursday, Sept 30

- TA Session: Problem Set 2; Math Review: Basics of linear algebra (matrix, determinant etc)

<u>Week of September 28:</u> multivariate distributions: correlation coefficient, conditional distributions, bivariate normal distribution, transformation of random variables

- Readings: §4.5, §5.1-5.6

- Problem Set 5: §4.5: 1, 2, 4, 6 §5.1: 1, 4, 8; §5.2: 1, 7, 10(a,b); §5.3: 1, 3, 10, 13; §5.5: 1, 2, 8, 13, 18; §5.6: 1, 3, 6

- Due: Thursday, Oct. 8

<u>Week of October 5:</u> Sample theory, sums of independent random variables, laws of large numbers.

- Readings: §1.2, §6.1-6.3

- Problem Set 6: §6.1: 2; §6.2: 2,4; §6.3: 3, 9, 12;

- Due: Thursday, Oct. 14

<u>Week of October 12:</u> Central limit theorem, Limiting Moment Generating Functions, Chebyshev's inequality.

- Readings: §6.4-5, §6.7, §6.8

- **Exercises: §6.4: 1, 4, 8; §6.5: 1, 3, 6, 10; §6.7: 3, 4, 5; §6.8: 1, 2 (Due to the upcoming midterm, you do not need to turn in this set of exercises).**

- Review for the midterm.

<u>Week of October 19:</u>

- **In-class Mid-term Exam, Tuesday October 19**

- October 22: Maximum likelihood estimators, properties of estimators

- Readings: §7.1

- Problem Set 7: §7.1: 2, 3, 5, 10, 12;

- Due: Thursday, October 29.

<u>Week of October 26:</u> Estimation of confidence intervals: confidence intervals for means, variances and proportions

- Readings: §7.2-7.5

- Problem Set 8: §7.2: 1, 2, 4, 6, 9, 12, 16, 19, 20, 21; §7.3: 3, 6, 7, 8, 10, 13; §7.4: 1, 2, 11; §7.5: 2, 4, 10, 12

- Due: Thursday, November 4.

<u>Week of November 2:</u> Hypothesis testing: Null and alternative hypothesis, type I error, type II error, significance level, power, p-value, tests of one mean and variance

- Readings: §8.1-8.3

- Problem Set 9: §8.1: 3, 8, 11, 18; §8.2: 4, 5, 9; §8.3: 2, 6, 12

- Due: Thursday, November 11.

<u>Week of November 9:</u> Hypothesis tesing (continued): test of equality of several means, Neyman-Pearson Lemma, uniformly most powerful tests, likelihood ratio tests

- Readings: §8.6, §9.1-9.4

- Problem Set 10: §8.6: 1, 5; §9.1: 2, 4; §9.2: 2, 4, 10; §9.3: 2, 4, 5; §9.4: 2, 4, 6

- Due: Thursday, November 18.

- TA session: Review of more linar algebra: inverse of a matrix, vector space, linear projection

<u>Week of November 16:</u> Linear Regression Models: Single variable linear regression, preview of Economics 163

- Readings: §7.8-7.9,

- Problem Set: §7.8: 2, 4

- Due: **Tuesday**, November 30.

<u>Week of November 23:</u> Happy Thanksgiving!

- Readings: None

- Problems: None

<u>Week of November 30:</u> Review of the course.

Final Exam: Thursday, December 16th, Thursday 2pm

Happy Holidays!