NORMANDALE COMMUNITY COLLEGE
COURSE SYLLABUS

(1) **Identifying Information**
   (a) **Mathematics 2400**, **Probability and Statistics with Calculus**, 4 credits
   (b) Fall 2017 (August 21 – December 15)
   (c) Prerequisite: Math 1520 (Calculus II) with a grade of C or better or approved equivalent preparation.
   (d) Classroom: C3002
   (e) Class time: 10:00–10:50 M T W Th
   (f) Instructor: Dr. Mehdi Hakim Hashemi
   (g) Office: C3107
   (h) Office phone: 952-385-8491
   (i) e-mail: mehdi.hashemi@normandale.edu
   (j) Office hours: 11 – 11:50 M T W Th F

(2) **Course Objectives**: **Probability and Statistics with Calculus**: This is an introductory course in probability and statistics. In the first part elements of probability theory will be introduced. This includes discrete and continuous random variables, density and distribution functions, expectations, variance and the relations among them. In the second part we will do statistics. This includes Estimation, sampling distributions of estimation, testing hypothesis, regression, and an introduction to Bayesian methods. This course introduces the students to real life problems that can be modeled with random variables and measured by statistical instruments. The emphasis will be on problems and models with science and engineering flavor.

(3) **Course Material**
   (a) **Required Text:** *Probability and Statistics for Engineers and Scientists 9th Ed*, by R. E. Walpole, R. H. Myers, S. H. Myers, and K. Ye, Published by Prentice Hall (Pearson), 2012.
   (b) **Other Books:**
      - *The Drunkard's Walk: How Randomness Rules Our Lives*, by Leonard Mlodinow. This book, like our course, has two parts: Probability and Statistics. It discusses both in a beautiful way.
      - *How Not to Be Wrong: The Power of Mathematical Thinking*, by Jordan Ellenberg. This book is titled "Mathematical Thinking", but it is more "Probabilistic and Statistical" thinking.
      - *Thinking Fast and Slow*, by Daniel Kahneman. This is a "GEM". It is based on research done by the author and his collaborator Amos Tversky. They studied the question "Why people do not think statistically"? for a period of forty years, and the author has gathered the results in this book.
      - *The Invisible Gorilla*, by Christopher Chabris, and Daniel Simons. This is an amazingly entertaining book to read. Chapter 5, Jumping to Conclusions, is about "Illusion of Cause". It discusses how and why people confuse correlation with causality.
      - *The Improbability Principle: Why Coincidences, Miracles, and Rare Events Happen Every Day*, by David J. Hand. This book is written by an eminent professor (emeritus) of statistics and former president of the Royal Statistical Society. The title summarizes what the book is about.
      - *The Signal and the Noise: Why So Many Predictions Fail–but Some Don't*, by Nate Silver. Written by the master forecaster Nate Silver. He is the chief editor of "fivethirtyeight.com".
      - *Superforecasting: The Art and Science of Prediction*, by Phillip E. Tetlock, and Dan Gardner. The authors give some advice on how to make effective and sound forecasts.

(4) **Topics (Tentative)**
   (a) Introduction to Probability: Basic definitions, finite sample spaces, counting methods, combinatorial methods, the probability of a union of events.
   (b) Conditional Probability and Independence: Basic definitions, independent events, Bayes' theorem.
   (c) Random Variables and Distributions: Discrete and continuous distributions, the cumulative distribution function.
   (d) Expectation: Basic definitions, properties of expectations, variance.
   (e) Sampling Distributions: The Central Limit Theorem (CTL), t-distribution, F-distribution.
   (f) One- and Two-Sample Estimation Problems.
   (g) Test of Hypothesis.
   (h) Linear Regression and Correlation.
   (i) Analysis of Variance (ANOVA).
   (j) Introduction to Bayesian Statistics.

(5) **Calculators and R**
   (a) A calculator equivalent to TI-89 is recommended.
   (b) The programing language **R** is recommended. It is a free software.

(6) **Student Learning Outcomes:** Upon successful completion of this course, the student will be able to:
   (a) Compute mean, median, modes, standard deviation, z-scores and percentile ranks from data, and give simple common sense interpretations of these numerical measures.
   (b) Construct from raw data: frequency tables, histograms, pie charts, stem and leaf plots and estimate the common numerical measures from them.
   (c) Solve combinatorial problems involving permutations, combinations, and partitions.
   (d) Recognize underlying sample space structure in many applied situations and use this structure to compute probabilities of compound, complementary, and conditional events.
   (e) Compute expected values, variances, and probabilities for the more common discrete and continuous probability distributions including the binomial, multinomial, geometric, hypergeometric, negative binomial, Poisson, uniform, normal, gamma, and beta.
   (f) Model numerous applied situations with the probability distributions given in (e).
   (g) Determine expected values, variance and independence from a bivariate probability distribution.
   (h) Apply the central limit theorem to estimate probabilities of sample sums and means falling in a specified range of values.
   (i) Approximate binomial probabilities using the normal distribution.
   (j) Compute and interpret confidence intervals for means, proportions, and their differences, variance, and ratio of variance.
   (k) Carry out one sample hypothesis test (z or t) for population means, proportions, paired data, and variance, including the formation of null/alternative and interpretation of p-value.

(7) **Chapters Covered (Tentative)**
   (a) Chapter 1: Introduction to statistics and data analysis.
   (b) Chapter 2: Probability
   (c) Chapter 3: Random variables and probability distributions.
   (d) Chapter 4: Mathematical expectation.
   (e) Chapter 5: Discrete probability distributions.
   (f) Chapter 6: Some continuous probability distributions.
   (g) Chapter 8: Fundamental sampling distributions and data descriptions.
   (h) Chapter 9: One- and two-sample estimation problems.
   (i) Chapter 10: One and two-sample tests of hypothesis.
   (j) Chapter 11: Simple linear regression and correlation.
   (k) Chapter 13: One-factor experiments: General.
   (l) Chapter 18: Bayesian statistics.

(8) **Assignments, and Exam**:
   - Four hour-exams and a three-hour final exam.
   - Eight to nine quizzes.
   - Problem sets will be posted on d2l. The due dates will be announced in class (usually they are due on the exam days.)

(9) **Evaluation**
   - Problem sets 25%.
   - Quizzes 15%.
   - Each Midterm exam 10%, and the Final Exam 20%.

(10) **Exam Dates**

Exam 1	Thursday September 7	
Exam 2	Thursday October 5	
Exam 3	Thursday November 2	
Exam 4	Thursday November 30	
Final Exam	Friday December 15 at 8 AM	

(11) **Policies and Procedures**
   (a) Your **Normandale** email should be active. No information regarding your grades can be sent to any email other than your **Normandale** email.
   (b) Daily class attendance and / or communication with instructor are essential and expected.
   (c) No active cell phones or pagers are allowed in class at any time.
   (d) No make-ups will be allowed for work collected in class. All exams must be taken on scheduled day. Make-ups will be given only for extremely pressing circumstances, and the instructor should be notified in advance of the exam by phone or e-mail.

(12) **American Disability Act:** Normandale Community College is committed to equal access for students with disabilities through the services provided by the Office for Students with Disabilities (OSD). Please contact Debbie Tillman, the OSD Director, at 952-358-8623 or osd@normandale.edu to discuss how accommodations may be implemented in your Normandale courses, This syllabus is available in alternate formats by request.