Department of Statistics Courses

Note on Course Numbers

Each Carnegie Mellon course number begins with a two-digit prefix which designates the department offering the course (76-xxx courses are offered by the Department of English, etc.). Although each department maintains its own course numbering practices, typically the first digit after the prefix indicates the class level: xx-1xx courses are freshmen-level, xx-2xx courses are sophomore level, etc. xx-6xx courses may be either undergraduate senior-level or graduate-level, depending on the department. xx-7xx courses and higher are graduate-level. Please consult the Schedule of Classes (https://enr-apps.as.cmu.edu/open/SOC/SOCServlet) each semester for course offerings and for any necessary pre-requisites or co-requisites.

36-149 Freshman Seminar: Genomics in the Era of Personalized Medicine
Intermittent: 9 units
TBD.

36-201 Statistical Reasoning and Practice
All Semesters: 9 units
This course will introduce students to the basic concepts, logic, and issues involved in statistical reasoning, as well as basic statistical methods used to analyze data and evaluate studies. The major topics to be covered include methods for exploratory data analysis, an introduction to research methods, elementary probability, and methods for statistical inference. The objectives of this course are to help students develop a critical approach to the evaluation of study designs, data and results, and to develop skills in the application of basic statistical methods in empirical research. An important feature of the course will be the use of the computer to facilitate the understanding of important statistical ideas and for the implementation of data analysis. In addition to three lectures a week, students will attend a computer lab once a week. Examples will be drawn from areas of applications of particular interest to H&SS students. Not open to students who have received credit for 36-201; 36-207/70-207, 36-220, 36-225, 36-625, or 36-247.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-202 Statistical Methods
Spring: 9 units
This course builds on the principles and methods of statistical reasoning developed in 36-201 (or its equivalents). The course covers simple and multiple regression, analysis of variance methods and logistic regression. Other topics may include non-parametric methods and probability models, as time permits. The objectives of this course is to develop the skills of applying the basic principles and methods that underlie statistical practice and empirical research. In addition to three lectures a week, students attend a computer lab once a week for “hands-on” practice of the material covered in lectures. Not open to students who have received credit for: 36-208/70-208, 36-209. Students who have completed 36-401 prior to 36-202 will not receive credit for 36-202.
Prerequisites: 36-201 or 36-207 or 36-220 or 36-247 or 70-207.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-207 Probability and Statistics for Business Applications
Fall: 9 units
This is the first half of a year long sequence in basic statistical methods that are used in business and management. Topics include exploratory and descriptive techniques, probability theory, statistical inference in simple settings, basic categorical analysis, and statistical methods for quality control. Not open to students who have received credit for 36-201, 36-220, 36-625, or 36-247. Crosslisted as 70-207.
Prerequisites: 21-112 or 21-120 or 21-121.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-217 Probability Theory and Random Processes
All Semesters: 9 units
This course provides an introduction to probability theory. It is designed for students in electrical and computer engineering. Topics include elementary probability theory, conditional probability and independence, random variables, distribution functions, joint and conditional distributions, limit theorems, and an introduction to random processes. Some elementary ideas in spectral analysis and information theory will be given. A grade of C or better is required in order to use this course as a pre-requisite for 36-226 and 36-410. Not open to students who have received credit for 36-225, or 36-625.
Prerequisites: 21-112 or 21-122 or 21-123 or 21-256 or 21-257.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-220 Engineering Statistics and Quality Control
All Semesters: 9 units
This is a course in introductory statistics for engineers with emphasis on modern product improvement techniques. Besides exploratory data analysis, basic probability, distribution theory and statistical inference, special topics include experimental design, regression, control charts and acceptance sampling. Not open to students who have received credit for 36-201, 36-207/70-207, 36-226, 36-626, or 36-247, except when AP credit is awarded for 36-201.
Prerequisites: 21-112 or 21-120 or 21-121.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-225 Introduction to Probability Theory
Fall: 9 units
This course is the first half of a year long course which provides an introduction to probability and mathematical statistics for students in economics, mathematics and statistics. The use of probability theory is illustrated with examples drawn from engineering, the sciences, and management. Topics include elementary probability theory, conditional probability and independence, random variables, distribution functions, joint and conditional distributions, law of large numbers, and the central limit theorem. A grade of C or better is required in order to advance to 36-226 and 36-410. Not open to students who have received credit for 36-217 or 36-625.
Prerequisites: 21-256 and 21-257 and 21-268.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-226 Introduction to Statistical Inference
Spring: 9 units
This course is the second half of a year long course in probability and mathematical statistics. Topics include maximum likelihood estimation, confidence intervals, and hypothesis testing. If time permits there will also be a discussion of linear regression and the analysis of variance. A grade of C or better is required in order to advance to 36-401, 36-402 or any 36-46x course. Not open to students who have received credit for 36-626.
Prerequisites: 15-539 or 21-325 or 36-217 or 36-225.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-247 Statistics for Lab Sciences
Spring: 9 units
This course is a single-semester comprehensive introduction to statistical analysis of data for students in biology and chemistry. Topics include exploratory data analysis, elements of computer programming for statistics, basic concepts of probability, statistical inference, and curve fitting. In addition to two lectures, students attend a computer lab each week. Not open to students who have received credit for 36-201, 36-207/70-207, 36-220, or 36-246.
Prerequisites: 21-112 or 21-120 or 21-121.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-303 Sampling, Survey and Society
Spring: 9 units
This course will revolve around the role of sampling and sample surveys in the context of U.S. society and its institutions. We will examine the evolution of survey taking in the United States in the context of its economic, social and political uses. This will eventually lead to discussions about the accuracy and relevance of survey responses, especially in light of various kinds of nonsampling error. Students will be required to design, implement and analyze a survey sample.
Prerequisites: 36-202 or 36-208 or 36-226 or 36-309 or 36-625 or 70-208 or 73-261 or 88-250.
Course Website: http://www.stat.cmu.edu/academics/courselist
36-309 Experimental Design for Behavioral and Social Sciences
Fall: 9 units
Statistical aspects of the design and analysis of planned experiments are studied in this course. A clear statement of the experimental factors will be emphasized. The design aspect will concentrate on choice of models, sample size and order of experimentation. The analysis phase will cover data collection and computation, especially analysis of variance and will stress the interpretation of results. In addition to a weekly lecture, students will attend a computer lab once a week.
Prerequisites: 36-201 or 36-207 or 36-217 or 36-220 or 36-247.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-315 Statistical Graphics and Visualization
Spring: 9 units
Graphical displays of quantitative information take on many forms as they help us understand both data and models. This course will serve to introduce the student to the most common forms of graphical displays and their uses and misuses. Students will learn both how to create these displays and how to understand them. As time permits the course will consider some more advanced graphical methods such as computer-generated animations. Each student will be required to engage in a project using graphical methods to analyze and display data collected from a real scientific or engineering experiment. In addition to two weekly lectures there will be lab sessions where the students learn to use software to aid in the production of appropriate graphical displays.
Prerequisites: 36-202 or 36-208 or 36-226 or 36-303 or 36-309 or 36-625 or 70-208 or 88-250.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-326 Mathematical Statistics (Honors)
Spring: 9 units
This course is a rigorous introduction to the mathematical theory of statistics. A good working knowledge of calculus and probability theory is required. Topics include maximum likelihood estimation, confidence intervals, hypothesis testing, Bayesian methods, and regression. A grade of C or better is required in order to advance to 36-401, 36-402 or any 36-46x course. Not open to students who have received credit for 36-625.
Prerequisites: 15-359 or 21-325 or 36-217 or 36-225 with a grade of A and advisor approval.
Prerequisite: 36-325.

36-350 Statistical Computing
Fall: 9 units
Statistical Computing: An introduction to computing targeted at statistics majors with minimal programming knowledge. The main topics are core ideas of programming (functions, objects, data structures, flow control, input and output, debugging, logical design and abstraction), illustrated through key statistical topics (exploratory data analysis, basic optimization, linear models, graphics, and simulation). The class will be taught in the R language. No previous programming experience required. Pre-requisites: (36-202 or 36-208), plus (“computing at Carnegie Mellon” or consent of instructor) and 36-225 corequisite.
Prerequisites: 36-202 or 36-208 or 70-208
Corequisite: 36-225.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-401 Modern Regression
Fall: 9 units
This course is an introduction to the real world of statistics and data analysis. We will explore real data sets, examine various models for the data, assess the validity of their assumptions, and determine which conclusions we can make (if any). Data analysis is a bit of an art; there may be several valid approaches. We will strongly emphasize the importance of critical thinking about the data and the question of interest. Our overall goal is to use a basic set of modeling tools to explore and analyze data and to present the results in a scientific report. A minimum grade of C in any one of the pre-requisites is required. A grade of C is required to move on to 36-402 or any 36-46x course.
Prerequisites: (36-226 or 36-326 or 36-625) and (21-240 or 21-241).
Course Website: http://www.stat.cmu.edu/academics/courselist

36-402 Advanced Methods for Data Analysis
Spring: 9 units
This course introduces modern methods of data analysis, building on the theory and application of linear models from 36-401. Topics include nonlinear regression, nonparametric smoothing, density estimation, generalized linear and generalized additive models, simulation and predictive model-checking, cross-validation, bootstrap uncertainty estimation, multivariate methods including factor analysis and mixture models, and graphical models and causal inference. Students will analyze real-world data from a range of fields, coding small programs and writing reports. Prerequisites: 36-401
Prerequisite: 36-401.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-410 Introduction to Probability Modeling
Spring: 9 units
An introductory-level course in stochastic processes. Topics typically include Poisson processes, Markov chains, birth and death processes, random walks, recurrent events, and renewal theory. Examples are drawn from reliability theory, queuing theory, inventory theory, and various applications in the social and physical sciences.
Prerequisites: 21-325 or 36-217 or 36-225 or 36-625.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-461 Special Topics
Intermittent: 9 units
TBD
Prerequisite: 36-401.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-462 Special Topics: Data Mining
Intermittent: 9 units
Data mining is the science of discovering patterns and learning structure in large data sets. Covered topics include information retrieval, clustering, dimension reduction, regression, classification, and decision trees.
Prerequisites: 36-401 (C or better).
Prerequisite: 36-401.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-463 Special Topics: Multilevel and Hierarchical Models
Intermittent: 9 units
Multilevel and hierarchical models are among the most broadly applied “sophisticated” statistical models, especially in the social and biological sciences. They apply to situations in which the data “cluster” naturally into groups of units that are more related to each other than they are the rest of the data. In the first part of the course we will learn about Bayesian statistical methods. In the second part we will relate multilevel and hierarchical models to other areas of statistics, and in the third part of the course we will build and apply these models using a variety of data sets and examples. Prerequisites: 36-401 (C or better).
Prerequisite: 36-401.
Course Website: http://www.stat.cmu.edu/academics/courselist

36-464 Special Topics: Applied Multivariate Methods
Intermittent: 9 units
This course is an introduction to applied multivariate methods. Topics include a discussion of the multivariate normal distribution, the multivariate linear model, repeated measures designs and analysis, principle component and factor analysis. Emphasis is on the application and interpretation of these methods in practice. Students will use at least one statistical package.
Prerequisites: 36-401 (C or better).
Course Website: http://www.stat.cmu.edu/academics/courselist

36-490 Undergraduate Research
Spring: 9 units
This course is designed to give undergraduate students experience using statistics in real research problems. Small groups of students will be matched with clients and do supervised research for a semester. Students will gain skills in approaching a research problem, critical thinking, statistical analysis, scientific writing, and conveying and defending their results to an audience. Eligible students will receive information about the application processes for this course early in the fall.
Prerequisite: 36-401
Corequisite: 36-402.
Course Website: http://www.stat.cmu.edu/academics/courselist
mostly we’ll focus on the downfall of Enron as our overarching case study.

How do the topics change over time? The Enron Corporation was an energy, commodities, and services company in Houston, Texas that went spectacularly bankrupt in 2001 after it was revealed that it was engaging in systematic, planned accounting fraud. At its peak, it employed over 20,000 people with revenues over $100 billion. Its downfall was related to deregulation of California’s energy commodity trading and a series of rolling power blackouts over months. For example, Enron traders encouraged the removal of power during the energy crisis by suggesting plant shutdowns. The resulting increase in the price for power made them a fortune. After Enron’s collapse, journalists used the Freedom of Information Act to release the emails sent/received by the employees of Enron. Subsequently, the emails were analyzed to see who knew what and when. Every news article, email, letter, blog, tweet, etc can be thought of as an observation. We characterize these documents by their length, what words they use and how often, and possibly extra information like the time, the recipient, etc. Topic detection and document clustering methods are statistical and machine learning tools that extract and identify related documents, possibly over time. These methods need to be flexible enough to handle both very small and very large clusters of documents, topics that change in importance, and topics that appear and disappear. This class will emphasize application of methods and real-world data analysis. Class time will be split into lecture and "lab". (Bring your laptop.) Occasional homeworks and final project, but mostly we’ll focus on the downfall of Enron as our overarching case study.