DEPARTMENT OF STATISTICS

PROFESSORS

AKKAYA (DENER), Ayşen: B.S., M.S., Ph.D., METU.
AYHAN, H. Öztaş ***(Chairperson)***: B.S., Istanbul University; M.S., University of Aberdeen; Ph.D., University of Wales.

ASSOCIATE PROFESSORS

BATMAZ, İnci: B.S., METU; M.S., Ph. D., Ege University.
SÜRÜCÜ, Barış: B.S., M.S., Ph.D., METU.

ASSISTANT PROFESSOR

KALAYLIOGLU, I. Zeynep, B.S., METU; M.S., Ph.D., North Carolina State University.
ERKAN BAŞBUĞ, B. Burçak: B.S., METU; M.S., University of Warwick; Ph.D., London School of Economics.
İLK, Özlem: B.S., METU; M.S., Ph.D, Iowa State University.
PURUTCUOĞLU, Vilda: B.S., M.S., METU; Ph.D., Lancaster University.
YOZGATLIGİL (TALU), Ceylan ***(Associate Chairperson)***: B.S., M.S., METU; Ph.D., Temple University.

GENERAL INFORMATION: The Department of Statistics offers courses leading to the degree of Bachelor of Science, Master of Science and Doctor of Philosophy.

The purpose of the programs is to train students and researchers to carry out research based on extensive observations and experimentations; collection and analysis of data in laboratories and social, economic and public systems and organizations and to derive inferences about the behavior of such systems. The students who complete the statistics education in the Department will be able to make their skills available in the science of inductive inference for research, industrial and social organizations by playing an important part in solving problems of science and practical life. Graduates are expected to take part in research and development activities in such institutions as the State Planning Organizations, State Institute of Statistics, Ministries, State Economic Enterprises and other public and private. To this end, the Department emphasizes both the theory and the applications of statistics with special emphasis on computational statistics in its undergraduate and graduate programs.

LABORATORIES AND EQUIPMENT: The department has its own computer facilities. A laboratory is open to the use of the students of the department. A large number of statistical and graphical package programs are available in the PC's of the laboratory.

MAJOR RESEARCH INTERESTS OF THE STAFF: The major graduate level research areas are, optimal design of experiments, statistical reliability, time series data, survival analyses, actuarial risk and data analyses, disaster management, extremes of random functions and applications, stochastic modeling of engineering systems, computational statistics, response surface methodology, simulation, survey methods research, categorical data analysis, robust statistical methods, biostatistics,, data mining, scientometrics, bibliometrics and informetrics.

UNDERGRADUATE PROGRAM: The required courses for the Bachelor of Science (B.S.) degree in Statistics are listed in the following pages. All students are required to develop working knowledge and skills in the computers, scientific and statistical computing.

GRADUATE PROGRAMS:

Degrees

The Department of Statistics offers M.S. and Ph.D. degrees in Statistics. The programs enable students to acquire a sound understanding of the theoretical basis of statistics and emphasize the formation of research capability in applied research work.

In addition to the relevant regulations of the Graduate School for granting the M.S. and Ph.D. degrees, the following are required by the Department,

a) For the M.S. degree: The completion of at least seven credit courses.
b) For the Ph.D. degree: The completion of at least eight credit courses.

The main objective of the master's program is to train students in applied statistics by imparting knowledge of the theory and practice of statistics. This program will furnish its graduates with abilities to take part in studies involving extensive observations and experimentations; collection and analysis of data in laboratories, social, economic and public systems, organizations and to derive inferences about the behavior of underlying systems. On the other hand, the Ph.D. program is structured with the objective of preparing students for careers in university teaching and research and for industrial and government positions that involve consulting and research in new statistical methods.

CAREER OPPORTUNITIES: The graduate programs are designed to train students for positions in industry, government and academic institutions. The graduates of the programs will be able to make their skills available in the science of inductive inference to research, industrial and social organizations by playing important part in solving problems of science and practical life. The interdisciplinary nature of the programs brings together faculty and students interested in statistical applications in engineering, science, social sciences, management and planning, as well as statistical theory, and this nature enriches the career opportunities for graduates. Some career opportunities for the graduates are:

Teaching and academic positions which involve research in the universities; Industrial and government positions involving consulting and research in existing and new statistical methods; Programmer and analyst in statistical software development centers.

STATISTICAL COMPUTING: All graduate students are required to develop working knowledge and skills in the computers and scientific computing.

UNDERGRADUATE CURRICULUM

FIRST YEAR

First Semester

STAT	153	Probability I	(3-2)4
STAT	155	Principles of Statistics	(3-2)4
MATH	119	Calculus with Analytic Geometry	(4-2)5
ENG	101	English for Academic Purposes I	(4-0)4
IS	100	Introduction to Information Technologies and Application	NC

Second Semester

STAT	154	Probability II	(3-2)4
STAT	156	Statistical Methods	(3-2)4
MATH	120	Calculus for Functions of Several Variables	(4-2)5
ENG	102	English for Academic Purposes II	(4-0)4
CENG	230	Introduction to C Programming	(2-2)3

SECOND YEAR

Third Semester

STAT	271	Mathematical Statistics I	(3-2)4
STAT	291	Statistical Computing I	(3-2)4
MATH	219	Intro. to Differential Eqns.	(4-0)4
MATH	260	Basic Linear Algebra	(3-0)3
HIST	2201	Principles of Kemal Atatürk I	NC

Fourth Semester

STAT	272	Mathematical Statistics II	(3-2)4
Non Departmental Elective			(3-0)3
STAT	292	Statistical Computing II	(3-2)4
MATH	250	Advanced Calculus in Statistics	(4-2)5
ENG	211	Academic Oral Presentation Skills	(3-0)3
HIST	2202	Principles of Kemal Atatürk II	NC

THIRD YEAR

Fifth Semester

STAT	361	Computational Statistics	(3-2)4
STAT	363	Linear Models I	(3-2)4
STAT	365	Survey Sampling Techniques	(3-2)4
STAT	391	Probability Theory	(2-2)3
ENG	311	Advanced Communication Skills	(3-0)3
TURK	303	Turkish I	NC

Sixth Semester

STAT	356	Statistical Data Analysis	(3-2)4
STAT	364	Linear Models II	(3-2)4
STAT	366	Survey Research Methods	(3-0)3
STAT	376	Stochastic Processes	(3-2)4
TURK	304	Turkish II	NC

FOURTH YEAR

Seventh Semester

STAT	457	Statistical Design of Experiments	(3-2)4
STAT	465	Multivariate Analysis I	(3-0)3
STAT	499	Undergraduate Research	
or			
Departmental Elective			(1-4)3
Non Departmental Elective			(3-0)3

Eighth Semester

STAT	460	Nonparametric Statistics	(3-0)3
STAT	466	Multivariate Analysis II	(3-2)4
Departmental Elective			(2-2)3
Non Departmental Elective			(3-0)3

MINOR PROGRAM IN STATISTICS

This program is designed for students of non-statistical background.

Preliminary courses required for admission:
MATH 119 Calculus I or equivalent
MATH 120 Calculus II or equivalent

Compulsory Courses

STAT 153 Probability I
STAT 154 Probability II
STAT 271 Mathematical Statistics I
STAT 272 Mathematical Statistics II
STAT 363 Linear Models I

Plus one elective course offered by the Department of Statistics.

DESCRIPTION OF UNDERGRADUATE COURSES

STAT 153 Probability I (3-2)4
Sample space, events. Basic combinatorial probability, conditional probability. Bayes' theorem, independence, random variables, distributions, expectation.

STAT 154 Probability II (3-2)4
Transformations of random variables, generating functions, conditional expectation. Limit theorems, central limit theorem, limiting distributions.
Prerequisites: STAT 153, MATH 119

STAT 155 Principles of Statistics (3-2)4
Brief history of statistics. Basic definitions and types of data, descriptive statistics. Elementary probability, random variables, probability distributions and their properties. Introduction to use of computer solving tools.

STAT 156 Statistical Methods (3-2)4
Sampling distributions, estimation, confidence intervals, hypothesis testing, power of test, analysis of variance for one or two factor designs, linear regression, basic nonparametric procedures. Elementary time series analysis, trends, seasonality, forecasting.
Prerequisite: STAT 155 or Consent of Department.

STAT 201 Introduction to Probability and Statistics I (3-0)3
Experiments and events. Set theory. Axioms and basic theorems of probability. Finite sample spaces and counting techniques. Independent events. Conditional probability. Random variables and distributions. Expectation, variance, covariance and correlation. Some special distributions.

STAT 202 Introduction to Probability and Statistics II (3-0)3
Random samples. Sample mean and variance. Chebychev's inequality. Law of large numbers. Central limit theorem. Estimation. Maximum likelihood, unbiased, minimum variance unbiased, consistent and efficient estimators. Sufficiency. Confidence intervals. Hypothesis testing. Introduction to nonparametric methods. Regression and analysis of variance.
Prerequisite: STAT 201

STAT 221 Statistics for Engineers I (3-0)3
Introduction to probability. Finite sample spaces. Conditional probability and independence. Discrete and continuous random variables. Random sample and statistics. Statistical inference, estimation and tests of hypotheses. Simple linear regression.
Prerequisite: MATH 120

STAT 256 Numerical Methods (3-2)4
Accuracy in numerical computations. Numerical solution of linear and nonlinear algebraic equations. Finding eigen-values and eigenvectors. Finite difference calculus. Interpolation and extrapolation. Numerical differentiation and integration. Numerical approximation methods.
Prerequisites: STAT 291 or STAT 292, MATH 260

STAT 271 Mathematical Statistics I (3-2)4
Common theoretical distributions. Sampling distributions. Principles of point estimation. Techniques of estimation .Properties of point estimators. Optimality criteria in estimation. Selected topics from robust inference. Bayesian inference.
Prerequisites: STAT 154 or consent of the department and MATH 120.

STAT 272 Mathematical Statistics II (3-2)4
Region (interval) estimation. Hypothesis testing. Optimality properties for hypothesis testing. Likelihood ratio tests. Sequential tests.
Prerequisite: STAT 271

STAT 291 Statistical Computing I (3-2)4
Introduction to statistical techniques in statistical software. Managing and analyzing data using statistical database packages. Introduction to MATLAB with applications to matrix algebra.
Prerequisites: CENG 230, STAT 156

STAT 292 Statistical Computing II (3-2)4
Introduction to programming and computation. Introduction to computer organization and basic data structures. An advanced programming language with applications to statistical procedures.
Prerequisite: CENG 230

STAT 356 Statistical Data Analysis (3-2)4
Types of data. Graphical and tabular represantation of data. Approaches to finding the unexpected in data. Exploratory data analysis for large and high-dimensional data. Analysis of categorical data. Elements of robust estimation. Handling missing data. Smoothing methods. Data mining.
Prerequisites: STAT 156, STAT 291

STAT 361 Computational Statistics (3-2)4
Random number generation. Generating from other distributions. Monte Carlo methods for inferential statistics. Resampling. Data partitioning. Cross-validation. Bootstraping. Jackknifing. Tools for exploratory and graphical data analysis. Nonparametric probability density estimation.
Prerequisite: STAT 291

STAT 363 Linear Models I (3-2)4
Simple and Multiple Linear Regression Models. Estimation, interval estimation and test of hypothesis on the parameters of the models. Model Adequecy Checking. Multicollinearity. Transformation.
Prerequisites: MATH 260, STAT 156

STAT 364 Linear Models II (3-2)4
Simple nonlinear models, Less than full rank models : One-way , Two-way ANOVA models, Multiple comparison tests, Analysis of Covariance (ANCOVA) Models, Introduction to generalized linear models (GLM), Poisson regression, Logistic regression.
Prerequisite: STAT 363

STAT 365 Survey Sampling Techniques (3-2)4
Introduction to survey sampling. Probability sampling techniques. Simple random sampling. Stratified element sampling. Systematic sampling. Equal sized cluster sampling. Unequal sized cluster sampling. PPS selection techniques. Sampling errors.
Prerequisite: STAT 156 or equivalent for non-statistics majors.

STAT 366 Survey Research Methods (3-0)3
Introduction to survey research. Survey research methods. Planning of sample surveys. Survey designs. Methods of data collection. Questionnaire design techniques. Fieldwork organization methods. Survey designs over time. Multiplicity survey designs. Establishment survey designs. Components of total survey error. Survey research project.
Prerequisite: STAT 365 or consent of department for non-statistics majors.

STAT 376 Stochastic Processes (3-2)4
Random walk. Markov chains, martingales. Discrete and continuous parameter Markov processes. Branching processes. Birth and death processes. Renewal processes. Queuing processes. Applications.
Prerequisite: STAT 391

STAT 391 Probability Theory (2-2)3
Sigma-algebra of events. Probability measure. Axioms of probability. Conditional probability and independence. Combinatorial problems. Random variables and their distributions. Functions of random variables. Distribution functions. Expectation. Conditional expectation. Moments and characteristic functions. Convergence of random variables. Central limit theorem. Laws of large numbers.
Prerequisite: STAT 154 or Consent of the department

STAT 444 Advanced Statistical Computing (3-0)3
Reading raw data files and Statistical Analysis Software (SAS) data sets, and writing the results to SAS data sets; subsetting data; combining multiple SAS files; creating SAS variables and recoding data values; creating listing and summary reports
Prerequisite: STAT 156 or consent of the department.

STAT 457 Statistical Design of Experiments (3-2)4
Strategies for experimentation, Randomized complete and balanced incomplete block designs, Latin squares. General, two-level and fractional factorials. Blocking and confounding in two-level factorials. Three and mixed level factorial and fractional factorials. Introduction to response surface methodology. Second-order experimental designs. Nonnormal responses. Unbalanced data in factorials. Split-plot designs, Nested designs, Random effect models. Repeated measures.
Prerequisite: STAT 363 or consent of the department.

STAT 460 Nonparametric Statistics (3-0)3
Review of basic statistics. Distribution-free statistics, ranking statistics, U statistics. Large sample theory for U statistics. Tests based on runs. Asymptotic relative efficiency of tests. Hypothesis testing, point and interval estimation. Goodness of fit, rank-order (for location and scale), contingency table analysis and relevant models. Measures of association, analysis of variance.
Prerequisite: Consent of Department

STAT 461 System Simulation (3-2)4
Introduction to discrete-event system simulation and simulation software. Statistical models in simulation. Queuing models. Input data modeling. Variance reduction techniques. Verification and validation of simulation models. Output analysis for a single model. Comparison and evaluation of alternative system design.
Prerequisite: STAT 156 and STAT 292

STAT 462 Biostatistics (3-2)4
Populations and samples. Types of biological data. Data transformations. Survival data analysis. Life tables. Sample size determination in clinical trials. Measures of association. The odds ratio and some properties. Application of generalized linear models and logistic regression to biological data. Analysis of data from matched samples.
Prerequisite: STAT 156

STAT 463 Reliability (3-0)3
Reliability studies. Statistical failure models. Censoring and truncation and their types. Useful limit theorems in reliability. Inference procedures for lifetime distributions. System reliability. Bayesian methods. Accelerated life testing.
Prerequisite: STAT 272

STAT 464 Operations Research (2-2)3
Basic operations research methodology. Basic models such as network flow models, project scheduling, dynamic programming, and production and inventory control. LP and game theory. Two person zero-sum games and mixed strategies.
Prerequisite: MATH 260

STAT 465 Multivariate Analysis I (3-0)3
Vectoral representation of multivariate data. Sample mean vector and sample covariance matrix. Multivariate distributions, multivariate normal distribution, some other multivariate distributions. Parametric estimation. Hypothesis testing. Reduction of dimensionality.
Prerequisites: MATH 260, STAT 156

STAT 466 Multivariate Analysis II (3-2)4
MANOVA. Principal components, factor analysis. Multivariate classification and clustering. Canonical correlation.
Prerequisite: STAT 465

STAT 472 Statistical Decision Analysis (3-2)4
Introduction to decision making and types of decision situations. Bayes theorem and Bayesian decision theory. Prior, posterior and conjugate prior distributions. Loss functions. Empirical Bayesian approach. Utility theory for decision making. Value of information. Sequential decision procedures. Multidecision problems.
Prerequisite: STAT 154

STAT 477 Statistical Quality Control (2-2)3
Introduction to concepts of quality and total quality management. Basic principles of teamwork and learning. Probability in Quality Control. Methods and Philosophy of Statistical Process. Control Charts for variables and attributes. Cumulative-Sum and Exponentially Weighted Moving-Average Control Charts. Process Capability Analysis. Introduction to Experimental Design and Factorial Experiments. Taguchi Method, Lot-by-Lot Acceptance Sampling for attributes and by variables.
Prerequisite: STAT 156

STAT 479 Linear Programming (2-2)3
Introduction to Linear Programming (LP). The simplex method. Transportation, assignment and transshipment problems. Sensitivity testing, duality theory and its applications. Advanced methods in LP and revised simplex algorithm.
Prerequisite: MATH 260

STAT 480 Application of Statistical Techniques in Socio-Economic Research (3-2)4
Prinicipals of empirical socio-economic research. Formulation of research problems, determination of research design, application of sampling design. Strategies of field work, collection of data, improving data quality, selecting appropriate statistical methods. Evaluation of test of hypothesis and interpretation of findings. Preparation and presentation of a research proposal and report.
Prerequisite: STAT 356

STAT 482 Categorical Data Analysis (3-2)4
Probability distributions and measures of association for count data. Inferences for two-way contingency tables. Generalized linear models, logistic regression and loglinear models. Models with fixed and random effects for categorical data. Model selection and diagnostics when response is categorical. Classification trees.
Prerequisite: STAT 272

STAT 487 Insurance and Actuarial Analysis (3-0)3
Basic definition of insurance. Historical background. Insurance applications in government and private sector, regulations and legislation in insurance. Fundamentals of insurance. Types of insurance, disaster insurance and risk menagement applications around the world. Turkish catastrophe insurance pool. Definition of risk, probability aspect of risk. Utility theory, claim processes, distribution of claim processes.
Prerequisite: Consent of the department.

STAT 493 New Horizons in Statistics (3-0)3
New advances in the field of statistics.
Prerequisite: Consent of Department

STAT 495 Applications in Statistics (2-2)3
Applications of different statistical methods in various disciplines such as medicine, science, engineering and social sciences. Presentation of projects involving these applications as group studies.
Prerequisite: STAT 156

STAT 497 Applied Time Series Analysis (3-2)4
Time series as a stochastic process. Means, covariances, correlations, stationarity. Moving averages and smoothing. Stationary and nonstationary parametric models. Model specification. Estimation and testing. Seasonality. Some forecasting procedures. Elementary spectral domain analysis. Exponential smoothing methods. Unit root tests.
Prerequisite: STAT 272

STAT 499 Undergraduate Research (1-4)3
This course is intended to improve the research capabilities of graduating students. Each student will be given a project and an academic advisor; lectures will be given on research design, data evaluation and report writing. A final report and/or seminar is required at the end of the semester.
Prerequisite: Consent of the department.