Appendix 1: Current Graduate-level Statistics Courses

Courses listed alphabetically by department.

ANS 513. Statistical Genetics for Quantitative Measures. (3 units)
Description: This course is intended to develop skills for the analysis of genetic data including information on molecular markers and phenotypes for the purpose of localizing putative genes of interest on chromosomes and to properly analyze microarray data. It is assumed you are comfortable with regression theory, covariance, and correlation.

ANS 553. Statistics for Applied Biological Experiments. (3 units)
Description: This course is intended for graduate students in the biological sciences. Topics covered will include parameter estimation, hypothesis testing, regression and ANOVA, graphical exploration of data, Bayesian statistics and resampling methods, and experimental design. Principles of statistical practice will be highlighted and practical experience gained through laboratory homework exercises. The statistical language R will be used for analysis, however other software such as SAS could be used.

AREC 517 -- Introductory Mathematical Statistics for Economists (3 units)
Description: This course covers the basic mathematical statistics topics necessary for a deep understanding of applied econometrics. Topics include random variables probability theory, probability and density functions, sampling hypothesis.

AREC 549 -- Applied Econometric Analysis (3 units)
Description: Econometric model-building, estimation, forecasting and simulation for problems in agricultural and resource economics. Applications with actual data and models emphasized.

AREC 559 -- Advanced Applied Econometrics (4 units)
Description: Emphasis in the course is on econometric model specification, estimation, inference, forecasting, and simulation. Applications with actual data and modeling techniques are emphasized.

CPH 576A (EPI 576A) -- Biostatistics in Public Health (3 units)
Description: This course introduces biostatistical methods and applications, and will cover descriptive statistics, probability theory, and a wide variety of inferential statistical techniques that can be used to make practical conclusions about empirical data. Students will also be learning to use a statistical software package (STATA).

CPH 576B (EPI 576B) -- Biostatistics for Research (3 units)
Description: Descriptive statistics and statistical inference relevant to biomedical research, including data analysis, regression and correlation analysis, analysis of variance, survival analysis, biological assay, statistical methods for epidemiology and statistical evaluation of clinical literature.
CPI 576C (EPI 576C) -- Applied Biostatistics Analysis (3 units)
Description: Integrate methods in biostatistics (EPI 576A, B) and Epidemiology (EPI 572A, B) to develop analytical skills in an epidemiological project setting.

CPI 576D (EPI 576D) -- Data Management and the SAS Programming Language (3 units)
Description: This course will introduce students to the fundamentals of data management using the SAS programming language. Emphasis will be placed on data manipulation, including reading, processing, recoding, and reformatting data. The approach will be to teach by example, with an emphasis on hands-on learning.

CPI 676 (EPI 676) -- Advanced Topics in Biostatistics (3 units)
Description: An advanced course intended to broaden and deepen student knowledge of statistics by providing an overview of nonparametric, semiparametric, and robust statistical methodology and additional experiences using regression models to analyze categorical and time-to-event data, e.g., analyzing data using logistic regression and Cox proportional hazards models. The course will consist of three modules: 1) Nonparametric, semiparametric and robust techniques 2) categorical data analysis 3) time-to-event (survival) analysis.

CPI 684 (EPI 684) -- General Linear and Mixed Effects Models (3 units)
Description: This course introduces basic concepts of linear algebra that are essential for understanding more advanced statistical modeling methodology. This knowledge is used to understand the General Linear Model (GLM) which includes ordinary linear regression, ANOVA, and other special applications and modern methods for the analysis of repeated measures, correlated outcomes and longitudinal data, including the unbalanced and incomplete data sets characteristic of biomedical research. Topics include an introduction to matrices for statistics, general linear models, analysis of correlated data, random effects models, and generalized linear mixed models.

ECOL 581 -- Advanced Topics in Biological Statistics (3 units)
Description: Advanced topics in statistical methodology relevant to Biology, Genetics and Ecology. Maximum likelihood, General Linear Models, randomization methods, power, distribution theory.

ECON 517 -- Introductory Mathematical Statistics for Economists (3 units)
Description: This course covers the basic mathematical statistics topics necessary for a deep understanding of applied econometrics. Topics include random variables, probability theory, probability and density functions, sampling, hypothesis testing, and point and interval estimation.

GEOS 502A -- Statistical Analysis of Geologic Data (3 units)
Description: Application of statistical methods to the analysis of and description of geologic data. Geologic similarity, estimation, classification of geologic objects, and
structure of data on multiple features. Examples and case studies from major subdisciplines of geoscience. Graduate-level requirements include an additional term project on an approved topic.

GEOS 502B - Statistical Analysis of Geologic Data (3 units)
Description: An advanced treatment of the topic: covering important additional techniques in dealing with multivariate geologic problems. Graduate-level requirements include an additional term project on an approved topic.

GEOS 502B - Statistical Analysis of Geologic Data (3 units)
Description: An advanced treatment of the topic: covering important additional techniques in dealing with multivariate geologic problems. Graduate-level requirements include an additional term project on an approved topic.

HWR 545 - Statistical Hydrology (3 units)
Description: Application of statistics and probability to uncertainty in the description, measurement, and analysis of hydrologic variables and processes, including extreme events, error models, simulation, sampling. Graduate-level requirements include an in-depth simulation project.

HWR 645 - Stochastic Methods in Subsurface Hydrology (3 units)
Description: Application of the theory of stochastic processes and random fields to natural variability in subsurface hydrology.

HWR 655 - Stochastic Hydrology (3 units)
Description: Topical applications will vary with instructor. Advanced application of statistics and probability to hydrology, time series analysis and synthesis, and artificial neural network methods, as applied in the modeling of hydro-climatic sequences or Bayesian and other analyses in the decision making process of water resources. A combination of theory and application to the fields of hydrology, environmental and water resources engineering, climatic modeling, and other related natural resource modeling.

MATH 500C - Statistics for Research (3 units)
Description: Statistical concepts and methods applied to research in other scientific disciplines. Principles of estimation and hypothesis testing for standard one- and two-sample procedures. Correlation, linear regression. Contingency tables and analysis of variance.

MATH 561 - Regression and Multivariate Analysis (3 units)
square distribution. Principal components. Students will be expected to utilize standard statistical software packages for computational purposes.

**MATH 562 -- Time Series Analysis (3 units)**
**Description:** Methods for analysis of time series data. Time domain techniques. ARIMA models. Estimation of process mean and autocovariance. Model fitting. Forecasting methods. Missing data. Students will be expected to utilize standard statistical software packages for computational purposes.

**MATH 563A -- Probability Theory (3 units)**
**Description:** [Taught alternate years 2004-2005] Introduction to measure theory, strong law of large numbers, characteristic functions, the central limit theorem, conditional expectations, and discrete parameter martingales.

**MATH 563B -- Probability Theory (3 units)**
**Description:** [Taught alternate years 2004-2005] A selection of topics in stochastic processes from Markov chains, Brownian motion, the functional central limit theorem, diffusions and stochastic differential equations, martingales.

**MATH 564 -- Theory of Probability (3 units)**
**Description:** Probability spaces, random variables, weak law of large numbers, central limit theorem, various discrete and continuous probability distributions. Graduate-level requirements include more extensive problem sets or advanced projects.

**MATH 565A -- Stochastic Processes (3 units)**
**Description:** [Taught alternate years 2003-2004] Stationary processes, jump processes, diffusions, applications to problems in science and engineering.

**MATH 565B -- Stochastic Processes (3 units)**
**Description:** [Taught alternate years 2003-2004] Stationary processes, jump processes, diffusions, applications to problems in science and engineering.

**MATH 566 -- Theory of Statistics (3 units)**
**Description:** Sampling theory. Point estimation. Limiting distributions. Testing hypotheses. Confidence intervals. Large sample methods. Graduate-level requirements include more extensive problem sets or advanced projects.

**MATH 567A -- Theoretical Statistics (3 units)**
MATH 567R -- Theoretical Statistics (3 units)

MATH 568 -- Applied Stochastic Processes (3 units)
Description: Applications of Gaussian and Markov processes and renewal theory, Wiener and Poisson processes, queues. Graduate-level requirements include more extensive problem sets of advanced projects.

MATH 570 -- Categorical Data Analysis (3 units)

MATH 571 -- Design of Experiments (3 units)
Description: Principles of designing experiments. Randomization, block designs, factorial experiments, response surface designs, repeated measures, analysis of contrasts, multiple comparisons, analysis of variance and covariance, variance components analysis.

MATH 572 -- Statistical Consulting (3 units)
Description: Course provides instruction and experience in all aspects of statistical consulting. The class is organized as a small consulting lab with instructor acting as director. Students interact with actual clients from university and local business communities.

MATH 574 -- Introduction to Geostatistics (3 units)
Description: Exploratory spatial data analysis, random function models for spatial data, estimation and modeling of variograms and covariances, ordinary and universal kriging estimators and equations, regularization of variograms, estimation of spatial averages, non-linear estimators, includes use of geostatistical software. Application of hydrology, soil science, ecology, geography and related fields.

PSYC 577A -- Statistical Methods in Psychological Research (3 units)
Description: Statistical research design, methods and metascience. Variance and extensions of the general linear model including bivariate and multiple regressions, analysis of variance and covariance, planned orthogonal contrasts and multiple comparisons, simultaneous and sequential canonical correlation analysis, discriminant function analysis and multivariate analysis of variance.
PSYC 507B -- Statistical Methods in Psychological Research (3 units)
Description: Statistical research design, methods and metascience. Application of the structural equation modeling to manifest variable (path analysis) and latent variable (multivariate) causal analysis, confirmatory and exploratory factor analysis, and hierarchical (variance component) linear models, including generalizability theory, meta-analytic, and growth curve parameter models.

PSYC 507C -- Research Design & Analysis of Variance (3 units)
Description: This course provides an overview of research design and statistical analysis with a special focus on Analysis of Variance. Various designs including between subjects, repeated measures, mixed, hierarchical and Latin Square designs are covered. Other topics addressed are contrasts among means and trends analysis.

PSYC 597C -- Advanced Statistical Methods (3 units)
Description: The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles.

BNR 613 (ENT 613) -- Applied Biostatistics (4 units)
Description: Introductory and advanced statistical methods and their applications in ecology. Focuses on how research design dictates choice of statistical models; explores principles and pitfalls of hypothesis testing.

SIE 520 -- Stochastic Modeling I (3 units)
Description: Modeling of stochastic processes from an applied viewpoint. Markov chains in discrete and continuous time, renewal theory, applications to engineering processes.

SIE 525 -- Queuing Theory (3 units)
Description: Application of the theory of stochastic processes to queuing phenomena; introduction to semi-Markov processes; steady-state analysis of birth-death, Markovian, and general single- and multiple-channel queuing systems.

SIE 529 -- Advanced Decision-Making Under Uncertainty (3 units)
Description: Review of statistical decision theory; utility, games, Bayesian decision theory. Conjugate priors, worth of data, worth of information, sequential decision making. Engineering and water resource applications.

SIE 538 -- Engineering Statistics (3 units)
Description: Statistical methodology of estimation, testing hypotheses, goodness-of-fit, nonparametric methods and decision theory as it relates to engineering practice. Significant emphasis on the underlying statistical modeling and assumptions. Graduate-level requirements include additionally more difficult homework assignments.

SIE 531 -- Simulation Modeling and Analysis (3 units)
Description: Discrete event simulation, model development, statistical design and
analysis of simulation experiments, variance reduction, random variate generation, Monte Carlo simulation. Graduate-level requirements include a library research report.

**SIE 533 -- Time Series Modeling, Analysis, and Applications** (3 units)
Description: Principles for identifying parametric time series models from discrete data and relationship to autocovariance, spectrum, and the Green's function from linear system theory are considered. Theory is developed for application to prediction characterization, signature analysis, and process identification and control. The applications of these theories include precision engineering, experimental mode analysis, process monitoring and diagnosis, quality control, analysis of machining operations, etc.

**SIE 536 -- Experiment Design and Regression** (3 units)
Description: Planning and designing experiments with an emphasis on factorial layout. Includes analysis of experimental and observational data with multiple linear regression and analysis of variance.

**SIE 629 -- Selected Topics in Probability Modeling** (3 units)
Description: An advanced discussion of a subject in applied probability with significant interest to engineering. Individual projects in stochastic modeling.

**SIE 636 -- Advanced Experiment Design** (2 units)
Description: Robust product and process design through planned experiments, emphasizing the integration of loss functions, parameter design and tolerance design.

**SOC 570A -- Social Statistics** (3 units)
Description: Problems in classical regression analysis, single equation generalizations, simultaneous equations, time series models, hierarchical models.

**SOC 570B -- Social Statistics** (2 units)
Description: Latent variable models, pooled cross-section models, event history models.
Appendix 2: Initial Core faculty

Listed alphabetically. Vitas are enclosed in Appendix 4.

Askin, Ronald Gene
Degree: Ph.D.
Title: Professor and Department Head (ENG)
Department: Systems and Industrial Engineering
Students directed: 48 M.S., 12 Ph.D.

Bhattacharya, Rabi
Degree: Ph.D.
Title: Professor
Department: Mathematics (COS)
Students directed: 10 Ph.D.

Chesno, Peter
Degree: Ph.D.
Title: Professor
Department: Ecology and Evolutionary Biology (pending August), Evolution and Ecology (currently at UC Davis)
Joint Appointments: Dept Biological Sciences, Idaho State University, Department of Environmental Biology, University of Adelaide, Research School of Biological Sciences, Australian National University
Students directed: 2 Masters, 14 Ph.D.

Sylvan B. Green
Degree: M.D.
Department: Division of Epidemiology & Biostatistics, COPH
Title: Professor, Public Health; Director of Biometry, Arizona Cancer Center; Linda McCartney Breast Cancer Chair in Biometry
Students directed: 1 Masters, 2 Ph.D.

Henderson, David
Degree: Ph.D.
Title: Assistant Professor
Department: Animal Sciences (CALS)
Joint Appointments: Epidemiology and Biostatistics (Joint), Bio5
Students directed: 1 Ph.D., 1 Post-doctoral fellow

Ker, Alan
Degree: Ph.D.
Department: Agricultural and Resource Economics (CALS)
Title: Associate Professor and Department Head
Adjunct Appointments: Economics. (Agricultural and Resource Economics.

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University of Guelph)
Current Students directed: 1 Masters, 3 Ph.D.

Lebowitz, Michael
Degree: Ph.D.
Department: Division of Epidemiology & Biostatistics (CPH)
Title: Professor and Director, Arizona Prevention Center
Students directed: 7 Masters, 7 Ph.D., 4 Ph.D. minors, directed
7 pulmonary fellows, Associate Director of NIH training program for 5 years.

Maier, Robert S.
Degree: Ph.D.
Department: Mathematics (CoS)
Title: Professor
Joint Appointments: Physics (CoS)
Students directed: 3 Masters, 1 Ph.D.

Merchant, Nirav
Degree: MS
Department: Arizona Research Laboratories
Title: Director for Biotechnology Computing

Roe, Denise
Degree: Dr.P.H.
Department: College of Public Health
Title: Professor of Epidemiology and Biostatistics and Associate Dean for
Academic Affairs
Students directed: 2 Ph.D.

Sherrill, Duane
Degree: Ph.D.
Department: Epidemiology and Biostatistics (CPH)
Title: Professor and Concentration Director for Biostatistics
Adjunct Appointments: Medicine
Students directed: 3 Masters, 12 Masters of Public health, 5 Ph.D.

Shaked, Moshe
Degree: Ph.D.
Department: Mathematics (COS)
Students directed: 6 Ph.D.

Steidl, Robern J.
Degree: Ph.D.
Department: School of Natural Resources (CALS)
Title: Associate Professor
Current students: 4 M.S., 2 Ph.D.
Completed students: 7 M.S.

Tabor, Michael
Degree: Ph.D.
Department: Mathematics (COS)
Title: Professor and Chair, Program in Applied Mathematics
Students directed: 8 Ph.D., 7 Post-doctoral Fellows.

Walsh, Bruce
Degree: Ph.D.
Department: Ecology and Evolutionary Biology (COS)
Title: Professor and Associate Department Head
Adjunct Appointments: Animal Sciences (CALS), Epidemiology & Biostatistics (CPH),
Molecular and Cellular Biology (COS), Plant Sciences (CALS), Bio5
Students directed: 2 Masters, 4 Ph.D.

Wright, Larry
Degree: Ph.D.
Department: Mathematics (COS)
Students directed: 6 Ph.D.
Appendix 3: Relevant Library Holdings

At the University of Arizona, Statistical Journals and scholarly texts are distributed over three libraries: Science, Main, and Health Sciences.

Key journals in Probability and Statistics

Annals of Applied Probability
Annals of Probability
Annals of Statistics
Biometrics
Biometrika
Clinical Trials
Current Index to Statistics
Journal of the American Statistical Association
Journal of the Royal Statistical Society, London Ser. B (Methodology)
Journal of Statistical Science
Probability Theory and Related Applications (Previously Zeit.
Wahrscheinlichkeitstheorie)
The American Statistician
Theory of Probability and Its Applications (Translation of the Russian
Probability Journal Teor. Ver.)
Statistics in Medicine

Journals that contain a high percentage of statistical applications

American Journal of Epidemiology
American Journal of Human Genetics
Econometrica
Econometric Theory
Genetic Epidemiology
Genetics
Journal of Applied Econometrics
Journal of Business and Economic Statistics
Journal of Econometrics
New England Journal of Medicine
Appendix 4: Proposed Statistics GIDP Bylaws

The Statistics Graduate Interdisciplinary Program administers both MS and Ph.D. degrees in statistics, as well as a Ph.D. minor in statistics. The statistics GIDP represents one of the broadest diversity of colleges of any GIDP, with faculty members in the Program from the Colleges of Medicine, Arts and Sciences, Agricultural and Life Sciences, Engineering, and Public Health. We likewise anticipate future committee members may also be recruited from the Colleges of Business, Education, and Social and Behavior Sciences. The Executive Committee, which is appointed by and responsible to the Director of Graduate Interdisciplinary Programs, serves as the executive, administrative and policy making board for the Program. The organization and structure of the Statistics GIDP shall conform to the guidelines for Graduate Interdisciplinary Programs as set forward by the Director of Graduate Interdisciplinary Programs.

The responsibilities of the Statistics Program include the running of the graduate program, which has training in statistical consulting as a key education component. The Program also has the responsibility to promote campus-wide interdisciplinary activities in the broad area of both theoretical and applied statistics through organized research seminars, retreats and journal clubs.

It is essential that the Program carry out timely planning and review of the faculty, the research and training programs. This is a function of the Executive Committee with the input of all of the members of the Program. In the following sections the By laws that govern the operating procedures and policies of the Program are outlined.

Article I. Executive Committee and Chairperson of the Statistics GIDP

The activities of the Statistics Graduate Interdisciplinary Program are administered by the Executive Committee. The Chairperson of this Executive Committee will also be Chair of the entire Statistics GIDP. The Executive Committee will report to the Director of Graduate Interdisciplinary Programs and to the Deans of the relevant Colleges. For clarification in what follows, the statement "entire Committee" (or simply Committee) refers to all members of the GIDP on Statistics, while Executive Committee refers to current Statistics members serving on the Executive Committee.

A. Chairperson of the Committee on Statistics

Chairperson of the Committee on Statistics (who is also chair of the executive committee) will be appointed by the Director of Graduate Interdisciplinary
Programs based on a candidate selected by a vote of the entire faculty of the Statistics Program. Nominations for the Chair position will be accepted from any member of the Committee.

The chair will serve a three year term, with the possibility of reappointment subject to a vote of the entire faculty of the committee.

The duties of the Chairperson of the Committee are: a) call and preside at meetings of the Executive Committee to be held not less than twice a semester; b) call and preside at meetings of the entire Committee on Statistics at least once per year and as needed. c) with the advice of the Executive Committee appoint and supervise the Standing Subcommittees on Graduate Recruiting and Admissions, Curriculum, Consulting, and Seminar Speaker Selection. Article II d) below discusses how these subcommittees will manage administrative matters of the Graduate Program including course requirements and changes.

B. Executive Committee

The Executive Committee will consist of eight faculty members and one student member. Faculty members of the Executive Committee will serve a three-year term and the terms will be staggered so that two members of the Executive Committee will be replaced each year. New members of the Executive Committee will be appointed by the Director of Graduate Interdisciplinary Programs based on recommendations from the Executive Committee. Faculty members of the Executive Committee may serve a maximum of three consecutive terms. The student member will serve a one-year term and will be elected by the students in the graduate program. The student member of the Executive Committee may only serve one term.

The Executive Committee is responsible for administering the graduate program. These responsibilities include the recruitment and admission of graduate students into the graduate program, monitoring the progress of these students, securing and allocating the necessary funding for students, promotion of interdepartmental awareness and interactions in terms of education and research related to the general field of statistics and advising the Director of Graduate Interdisciplinary Programs and the Vice President for Research on issues pertinent to statistics.

Article II. Standing Subcommittees

A. The Subcommittee on Recruiting and Admissions shall be appointed annually by the Chairperson of the Committee on Statistics with the advice of the Executive Committee. There will be three members who represent the
various disciplines within the entire Committee. The Subcommittee will be responsible for publicizing the program, maintaining the program brochure, evaluation of applicants and recommendations to the Executive Committee as to the students accepted into the graduate program.

B. The Curriculum Subcommittee shall be appointed annually by the Chairperson of the Committee on Statistics with the advice of the Executive Committee. There will be four members who represent the various disciplines within the Committee. The Subcommittee will be responsible for coordination of graduate level statistics classes among participating faculty, to present both Statistics GIDP students and graduate students in general with a more unified curriculum that reflects the diversity of statistical research and applications occurring across the University of Arizona campus. Any proposed changes in the curriculum requirements for the various degrees offered by the Committee must first be appropriated by Curriculum committee and then subsequently by the Executive Committee.

C. The Statistical Consulting Subcommittee will be appointed annually by the Chairperson of the Committee on Statistics and shall consist of three members who represent the various disciplines within the entire Committee. The Subcommittee will be responsible for overseeing the role on consulting in student training and also for allocating consulting resources provided by the GDP in statistics for the campus in general.

D. The Seminar Subcommittee shall be appointed annually by the Chair of the Committee on Statistics and shall consist of two members. The Subcommittee shall be responsible for soliciting the names of guest speakers from the membership and selecting the invited speakers. This Subcommittee will be responsible for organizing the seminar and the visit of the guest speakers.

Article III. Membership in the Committee on Statistics

The Committee on Statistics consists of tenured, tenure eligible and Research Series faculty at the University of Arizona who participate in research and education in the general area of statistics.

A. Membership

1. Criteria

a. Faculty shall be nominated for membership in the Committee on Statistics by submitting a request for membership and a recent curriculum vitae to the Executive Committee. The request for membership should include a statement of
interest in participating in graduate training in the general area of statistics. A two-thirds majority of positive votes of the Executive Committee shall be required for nomination to membership to the Director of Graduate Inter-disciplinary Programs who shall confer membership. Important criteria for membership shall include interest in graduate education, and/or demonstrated current scholastic activity in the general area of statistics.

b. A member of the Committee on Statistics shall be asked to leave the Program if they fail to participate in some of the activities of the Committee Participation in the Program includes service on a Subcommittee of the Committee on Statistics, thesis director for a graduate student in Statistics Graduate Program, teaching a graduate course in Statistics, being actively involved in Statistical Consulting, or continued scholarly productivity in the general area of statistics. Membership in the Committee shall be subject to periodic review at intervals no greater than five years. If a member is found not to satisfy those criteria by a two-thirds majority of the Executive Committee, they will lose their membership.

c. Members dropped from membership may reapply for membership as outlined in Article III. A.1.

2. Responsibilities.

a. Tenure track members of the Committee on Statistics may serve as thesis advisors for students in the Statistics GDP. Research series faculty who want to supervise a graduate student must petition the Director of GDP through the Statistics GDP for permission to mentor a student in the Program.

b. Members of the Committee on Statistics shall serve when asked on the various Subcommittees of the Program.

c. Each member of the Committee on Statistics shall have one vote on matters brought to the Committee by the Executive Committee. A quorum shall constitute one-third of the membership.

3. Faculty members should submit a written statement to the GDP outlining their involvement in the GDP and noting the percentage of their total workload spent in GDP activities. This statement should cover the period from January 1 through December 31 of the previous year. The GDP will provide written feedback on the faculty member’s statement. These comments will be forwarded to both the faculty member and the head of his/her primary department or academic unit.
Article IV Amendments

The By-laws shall be amended or revised by movement of the Executive Committee and a two-thirds vote of the Committee on Statistics.

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