HARVARD UNIVERSITY PH.D. PROGRAM IN HEALTH POLICY
DECISION SCIENCES CONCENTRATION
2009-2010

Decision sciences are the collection of quantitative techniques that are used for decision-making at the individual and collective level. They include decision analysis, risk analysis, cost-benefit and cost-effectiveness analysis, decision modeling, and behavioral decision theory, as well as parts of operations research, microeconomics, statistical inference, management control, cognitive and social psychology, and computer science. The concentration in decision sciences prepares students for research careers that involve the application of these methods to health problems. Examples of research topics in health decision sciences include: cost-effectiveness analysis of medical technologies and pharmaceuticals; optimal screening policies for cancer and other chronic diseases; measurement and evaluation of health outcomes, including quality of life; policy simulation modeling of diseases such as AIDS, tuberculosis, cancer, and asthma; and optimal resource allocation for biomedical research.

Verification of all course offerings listed below, including instructors and class times, is suggested before determining a final course schedule. Final course information may be accessed from the following sources:

Graduate School of Arts and Sciences (http://www.registrar.fas.harvard.edu/fasro/courses/)
Harvard School of Public Health
(http://www.hsph.harvard.edu/administrative-offices/registrar/courses-and-schedules/)
Kennedy School of Government (http://hks.harvard.edu/degrees/teaching-and-courses/courses)
MIT (http://web.mit.edu/registrar/www/schedules)
Harvard Business School (http://www.hbs.edu/doctoral/registrar/course.html)
Graduate School of Education (http://www.gse.harvard.edu/academics/catalogue/)

Incoming students should have completed courses that cover multivariate calculus and linear algebra before entering the program. For reference, the Harvard course equivalents would be Mathematics 21a and 21b. This prerequisite may be satisfied by taking courses during the summer prior to matriculation.

REQUIRED COURSES

Students in the decision sciences concentration must satisfy the requirements listed below. If students have had prior courses or training that would make any of these courses redundant and wish to be waived from a specific requirement, they should discuss this situation with their advisors. Further, students may petition to substitute alternative courses that cover the required course contents. In unusual circumstances, students may petition to be exempt from any specific course content requirements, if they state the case that this material is not relevant to their area of application. However, they may face the risk that some of this content would be useful in completing the qualifying examination.

Highly recommended courses are marked with an asterisk (*). Any future changes in the core requirements for the PhD in Health Policy program supersede the requirements listed below.

Decision Analysis, Cost-Effectiveness and Cost-Benefit Analysis

The following five classes are required. Students are also required to attend an advanced methods research seminar beginning in their second year.

RDS280†	Decision Analysis for Health and Medical Practices	Goldie; TTh 1:30–3:20 (Fall 2)
RDS282	Cost-Effectiveness and Cost-Benefit Analysis for Health Program Evaluation	Salomon, Resch; MW 1:30–3:20 (Spring 2)
RDS284	Decision Theory	Hammitt; MW 10:30–12:20 (Fall)

RDS285	Decision Analysis Methods in Public Health and Medicine	Kim; MW 1:30–3:20 + section (Spring 1)
API-302	Analytic Frameworks for Policy	Zeckhauser; TTh 10:10–11:30 + F section (Fall)

† *Note: RDS286 Decision Analysis in Clinical Research may be substituted for RDS280, but RDS286 is only open to MDs enrolled in the Summer Program in Clinical Effectiveness.*

Research Seminar

This year-long seminar will explore advanced topics in decision science methods. It is required of all students starting in their second year.

Economics

Two semesters of intermediate microeconomic theory with calculus is required:

ECON 2020a	Microeconomic Theory I	Avery; MW 8:30–10 + section (Fall)
ECON 2020b	Microeconomic Theory II	Hojman; MW 8:30–10 + section (Spring)

Some students may find it useful to take either API-101A or ECON 1011a prior to taking ECON 2020a, but these courses will not count toward the concentration requirements:

API-101A	Markets and Market Failure	Luttmer; MW 8:40–10 + F section (Fall)
ECON 1011a	Microeconomic Theory	Glaeser; TTh 11:30–1 + section (Fall)

Probability and Statistics

All students in the decision sciences concentration are required to complete full-semester courses in probability theory, statistical inference, econometrics, survival analysis, and Bayesian data modeling. Suggested courses that meet these requirements include:

- Probability theory & statistical inference:

ECON 2110	Introductory Probability and Statistics for Economists	Mueller; MW 10–11:30 (Fall)
STAT 110	Introduction to Probability	Blitzstein; MWF at 12 + section (Fall)

- Econometrics:

ECON 2120	Introduction to Applied Econometrics	Jorgenson; TTh 2:30–4 (Spring)

Some students may find it useful to take ECON 1123 prior to taking ECON 2120, but **this course will not count toward the concentration requirements**:

ECON 1123	Introduction to Econometrics	Chaney; TTh 11:30–1 + section (Fall) Imbens; TTh 1-2:30 + section (Spring)

- Survival analysis:

BIO223	Applied Survival Analysis	Wei; TTh 10:30–12:20 (Spring)

- Bayesian data modeling:

BIO249**	Bayesian Methodology in Biostatistics	Paciorek; MW 8:30–10:20 (Spring)
OR		
GOV 2001	Advanced Quantitative Research Methodology	King; M 2–4 (Spring)

**not offered 2009-2010 (as of 8/28/09)

Equivalent courses, or higher level courses in probability and statistics, may be substituted for the courses listed above.

Operations Research

Students are required to complete one full-semester course in operations research. The following courses satisfy the operations research requirement:

APM 121*	Introduction to Optimization: Models and Methods	Chen; MW 1–2:30 + section (Spring)
MIT 15.053	Optimization Methods in Management Science	Schulz, TTh 1-2:30 or 2:30-4 + optional section (Spring)
MIT 6.251J/15.081J	Introduction to Mathematical Programming	Tsitsiklis/Bertsimas; TTh 8:30–1 + section (Fall)

Epidemiology

One half-semester course in epidemiology is required. The following courses satisfy this requirement.

EPI201*	Introduction to Epidemiology	Hernan; TTh 10:30–12:20 + weekly 2-hr section (Fall 1)
EPI200†	Principles of Epidemiology	Buring; TTh 8:30–9:20 + weekly 2-hr section (Fall 1)

† *Note: EPI200 may be substituted only when scheduling conflicts prevent enrollment in EPI201.*

Teaching Requirement

All decision sciences students are expected to have at least 5 HSPH credits (equivalent to one full semester) of experience as teaching fellows in the core decision sciences courses.

ADDITIONAL COURSES

Upon consultation with their advisors, students may substitute equivalent or higher level courses in place of the courses listed above. These courses may also be used to supplement the required curriculum in decision science.

Economics

ECON 2460	The Health Economics Workshop	Cutler/Newhouse; W 1-3 (Spring)
GHP291	Microeconomics and Applications to Public Health in Developing Countries	Mahal; MW 1:30–3:20 (Spring)

Uncertainty and Multi-Person Decisions

ECON 1051	Introduction to Game Theory	Ambrus; TTh 10–11:30 + section (Spring)
ECON 1052	Advanced Game Theory	Möbius; TTh 10–11:30 + section (Fall)
ECON 2052	Game Theory I: Equilibrium Theory	Fudenberg; M 4–7 (Spring)
GOVT 2005	Formal Political Theory I	not offered 2009–10
STM-221	Introduction to Negotiation Analysis	A:Mandell; MW 10:10–11:30, T 4:10–10 (Fall) *OR* B:Mandell; MW 1:10–2:30, T 4:10–10 (Fall) *OR* C:Kaboolian; TTh 2:40-4, T 4:10–6 (Spring) *OR* D:Zelleke; MW 2:40-4, T 4:10–6 (Spring)

Behavioral Economics and Psychology of Decision Making

ECON 2010c	Economic Theory	Laibson/Farhi; TTh 1–2:30 + section (Fall)
ECON 2030	Psychology and Economics	Mullainathan/Laibson/Shleifer; W 1–3 (Fall)
ECON 2040	Experimental Economics	Roth; F 9–12 (Spring)
ECON 2057	Rational Choice	Sen; M 1-3, M 4-6 (Spring)
PSYCH 1104	Psychology of Economic Decision Making	not offered 2009–10
PSYCH 2650/ HBS 4420	Behavioral Approaches to Decision Making and Negotiation	Bazerman; hours to be arranged (Spring)

PSYCH 2670a	Decision Making and the Psychology of Possibility	Langer; W 1–3 (Fall)
PSYCH 2670b	Decision Making and the Psychology of Possibility II	Langer; T 1:30–3:30 (Spring)

Program Evaluation

API-208	Program Evaluation: Estimating Program Effectiveness with Empirical Analysis	Abadie; not offered 2009-10
HPM212	Program Evaluation in Health Policy	not offered 2009–10

Probability and Statistics

BIO230	Probability Theory and Applications I	Schwartzman; MW 8:30–10:20 + section (Fall)
BIO231	Statistical Inference I	Li; MW 10:30–12:20 + section (Spring)
STAT 110	Introduction to Probability	Blitzstein; MWF at 12 + section (Fall)
STAT 111	Introduction to Theoretical Statistics	Airoldi; TTh 1–2:30 (Spring)
STAT 210	Probability Theory	Morris/Blitzstein; MW 2:30-4 (Fall)
STAT 211	Statistical Inference	Morris; MW 2:30-4 (Spring)
MIT 6.431	Applied Probability	Bertsekas/Tsitsiklis; MW 12–1 + section (Fall & Spring)

Data Analysis

BIO210	The Analysis of Rates and Proportions	Rosner; MW 8:30–10:20 + section (Fall) Glynn; MW 8:30–10:20 + section (Spring)
BIO211	Regression and Analysis of Variance in Experimental Research	Catalano; TTh 3:30–5:20 + section (Fall)
BIO213	Applied Regression for Clinical Research	Orav; MW 8:30–10:20 + section (Fall)
BIO226	Applied Longitudinal Analysis	Hughes; TTh 1:30–3:20 (Spring)
BIO232	Methods I	Neubery; MW 10:30–12:20 (Fall)
BIO233	Methods II	Coull; MW 8:30–10:20 + section (Spring)
ECON 1127	Statistical Methods for Evaluating Causal Effects	Rubin; TTh 2:30–4 (Spring)
ENG SCI 103	Spatial Analysis of Environmental and Social Systems	Srinivasan; TTh 11:30-1 (Spring)
GHP274	Applied Quantitative Methods I	Linnemayr/Finlay/Fink; MW 1:30–3:20 (Fall 1)
MIT 17.802	Quantitative Research Methods II: Multivariate Statistics	Hainmueller; TBA (Spring)
PSYCH 2200	Statistics and Data Analysis Through Computer Simulation	not offered 2009–10
S-030	Intermediate Statistics: Applied Regression and Data Analysis (School of Education)	A: TBA; TTh 10–11:30 (Spring) B: TBA; TTh 1–2:30 (Spring)
S-052	Applied Data Analysis (School of Education)	Willett; TTh 11:30–1 (Fall)
STAT 155/ BIO283	Spatial Statistics for Social Inquiry & Health Research	Ryan; TBA (Spring)
STAT 160	Design and Analysis of Sample Surveys	Zaslavsky; MW 2:30-4 (Fall)
STAT 171	Introduction to Stochastic Processes	Liu; TTh 2:30–4 + section (Spring)
STAT 220	Bayesian Data Analysis	Rubin/Kou; TTh 2:30–4 (Fall)
STAT 221	Statistical Computing Methods and Learning	Airoldi; TTh 1-2:30 (Spring)
STAT 225	Spatial Statistics	TBA; TBA
STAT 239	Statistical Sleuthing Through Linear Models	Lee; TTh 10–11:30 + section (Fall)
STAT 249	Statistical Sleuthing Through Generalized Linear Models	Glickman; MW 2–3:30 (Spring)

Epidemiology and Clinical Trials

BIO214	Principles of Clinical Trials	Lagakos; MW 1:30–3:20 (Spring 1); Stanley/Gelber MTWThF 10:30–12:20 (Summer 2)
EPI204	Analysis of Case-Control and Cohort Studies	Spiegelman; TTh 10:30–12:20 (Spring 1)
EPI207	Advanced Epidemiologic Methods	Robins/Hernan; MW 3:30–5:20 + section (Fall 1)
EPI221	Pharmacoepidemiology	Walker; MW 1:30–3:20 (Fall 1)
EPI233	Research Synth & Meta-Analysis	Hsieh; W 3:30–5:20 (Spring)

EPI241	Measuring Health Status	not offered in 2009–10
EPI288	Data Mining and Prediction	Cook/Cook; TBA (Winter)
EPI289	Causal Inference	Hernan; MW 10:30–12:20 (Spring 1)
HPM530	Measuring and Analyzing the Outcomes of Health Care	Testa/Simonson; TBA (Summer 1)

Infectious Disease Modeling†

EPI260	Mathematical Modeling of Infectious Diseases	Not offered 2009-10 (offered every other year)
EPI501	Dynamics of Infectious Diseases	Murray; MW 1:30–3:20 (Fall 2)
ID298	Inference in Infectious Disease Epidemiology	Lipsitch/Mills; TBA (Winter)

† *Note: Infectious Disease Modeling courses typically are offered in alternate years.*

Decision Theory, Optimization Theory, and Operations Research

APM 115	Mathematical Modeling	Bossert; MW 1–2:30 (Fall). Hutchinson; TTh 11:30–1 (Spring)
ECON 1059	Decision Theory	Strzalecki; MW 1-2:30 (Spring)
ENG SCI 201	Decision Theory	Brockett; MWF 10 (Spring)
ENG SCI 210	Mathematical Programming	Anderson; TTh 2:30-4 (Spring)
MIT 6.251J/ 15.081J	Introduction to Mathematical Programming	Tsitsiklis/Bertsimas; TTh 8:30-10 + section (Fall)
MIT 6.255J/ 15.093J	Optimization Methods	Bertsimas/Parrilo; TTh 10-11:30+ section (Fall)
MIT 14.128	Dynamic Optimization and Economic Applications	not offered 2009–10
MIT 15.871	Introduction to System Dynamics	Sterman/ Repenning; MW 8:30–10 *OR* MW 10–11:30 (Fall- ends 10/23)
MIT 15.872	System Dynamics II	Sterman/ Repenning; MW 8:30–10 *OR* MW 10–11:30 (Fall- begins 10/26)
MIT 15.879	Research Seminar in System Dynamics	TBA; Sterman, Repenning (Fall)

Ethics of Resource Allocation

ECON 2054	Social Choice and Welfare Economics	Not offered in 2009-10 (expected to be given in 2010-11)
ID292	Justice and Resource Allocation	Daniels; TTh 10:30–12:20 (Spring 2)
ID513	Ethics and Health Disparities	Daniels; TTh 10:30-12:20 (Spring 1)
PHIL 276x	Bioethics: Seminar	Not offered in 2009-10
GHP293	Individual and Social Responsibility for Health	Wikler; MW 8:30–10:20 (Fall 1)

Biomedical Informatics

MIT HST.950J/ 6.872J	Biomedical Computing	Szolovits/Kohane/Ohno-Machado; TTh 9:30–11 (Fall)

Faculty associated with the decision sciences track:

Milton C. Weinstein, Chair, Decision Sciences concentration, and Henry J. Kaiser Professor of Health Policy and Management, Harvard School of Public Health.

Kenneth A. Freedberg, Associate Professor of Medicine, Harvard Medical School; Associate Professor in the Department of Health Policy and Management, Harvard School of Public Health

G. Scott Gazelle, Professor of Radiology, Harvard Medical School; Professor in the Department of Health Policy and Management, Harvard School of Public Health

Thomas Gaziano, Assistant Professor of Health Decision Sciences, Harvard School of Public Health

Sue J. Goldie, Roger Irving Lee Professor of Public Health, Harvard School of Public Health

James K. Hammitt, Professor of Economics and Decision Sciences, Harvard School of Public Health

M. G. Myriam Hunink, Adjunct Professor of Health Policy, Harvard School of Public Health

Jane J. Kim, Assistant Professor of Health Decision Science, Harvard School of Public Health

Karen M. Kuntz, Adjunct Professor of Health Decision Science, Harvard School of Public Health

Jennifer Lerner, Professor of Public Policy and Management, Harvard Kennedy School

Tracy A. Lieu, Professor of Ambulatory Care and Prevention, Harvard Medical School; Professor in the Department of Health Policy and Management, Harvard School of Public Health
Peter J. Neumann, Professor of Medicine, Tufts University School of Medicine
Joseph Pliskin, Adjunct Professor of Health Policy and Management, Harvard School of Public Health
Lisa A. Prosser, Adjunct Assistant Professor of Ambulatory Care and Prevention, Harvard Medical School
Howard Raiffa, Frank Plumpton Ramsey Professor of Managerial Economics, Emeritus, Harvard Kennedy School and Harvard Business School
Stephen Resch, Adjunct Lecturer of Health Decision Science, Harvard School of Public Health
Joshua Salomon, Associate Professor of International Health, Harvard School of Public Health
Uwe Siebert, Associate Professor of Radiology, Harvard Medical School
Rochelle P. Walensky, Assistant Professor of Medicine, Harvard Medical School
Jane C. Weeks, Professor of Medicine, Harvard Medical School; Professor of Health Policy and Management, Harvard School of Public Health
Richard C. Zeckhauser, Frank Plumpton Ramsey Professor of Political Economy, Harvard Kennedy School

COURSE DESCRIPTIONS

REQUIRED COURSES

Decision Analysis, Cost-Effectiveness and Cost-Benefit Analysis

(SPH) RDS280 Decision Analysis for Health and Medical Practices
Fall 2
Department of Health Policy and Management and the Department of Biostatistics
Dr. S. Goldie
2.5 credits
Lectures. Two 2-hour sessions each week.
This course is designed to introduce the student to the methods and growing range of applications of decision analysis and cost-effectiveness analysis in health care technology assessment, medical decision making, and health resource allocation. The objectives of the course are: (1) to provide a technical understanding of the methods used, (2) to give the student an appreciation of the practical problems in applying these methods to the evaluation of clinical interventions and public health policies, and (3) to give the student an appreciation of the uses and limitations of these methods in decision making at the individual, organizational, and policy level both in developed and developing countries.
Course Note: Introductory course in probability and statistics required; BIO200, BIO201, or BIO203 may be taken concurrently; introductory economics is recommended but not required.

(SPH) RDS282 Cost-Effectiveness and Cost-Benefit Analysis for Hlth Prog. Eval
Spring 2
Departments of Health Policy and Management, Biostatistics, and Global Health and Population
Dr. Steven Resch and Dr. Uwe Siebert
2.5 credits
Lectures, seminars. Two 2-hour sessions each week.
Provides an introduction to methods for economic evaluation of health and environmental programs, including theory and applications. Topics include theory of benefit-cost and of cost-effectiveness analysis, definition and methods for estimating costs, stated-preference and revealed-preference methods for valuing health and mortality risk, quality-adjusted life years.
Course Note: Introductory decision analysis (e.g. RDS280, HPM286) and economics (e.g. HPM205, HPM206) are recommended.

(SPH) RDS284 Decision Theory
Fall
Department of Health Policy and Management and Department of Environmental Health
Dr. J. Hammitt
5 credits
Lectures. Two 2-hour sessions each week.
Introduces the standard model of decision-making under uncertainty, its conceptual foundations, challenges, alternatives, and methodological issues arising from the application of these techniques to health issues. Topics include von Neumann-Morgenstern and multi-attribute utility theory, Bayesian statistical decision theory, stochastic dominance, the value of information, judgment under uncertainty and alternative models of probability (Dempster-Shafer theory, generalized probability), and decision making (regret theory, prospect theory, generalized expected utility). Applications are to preferences for health and aggregation of preferences over time and across individuals.
Course Note: Prior course work in decision analysis required.

(SPH) RDS285 Decision Analysis Methods in Public Health and Medicine
Spring 1
Department of Health Policy and Management and the Department of Biostatistics
Dr. J. Kim
Lectures, seminars, lab. Two 2-hour sessions each week, one 1-hour lab
An intermediate-level course on methods and health applications of decision analysis and other modeling techniques. Topics include Markov models, life expectancy modeling, deterministic and probabilistic sensitivity analysis, simulation models, ROC analysis and diagnostic technology assessment, quality of life valuation, multi-attribute utility, and behavioral decision theory.
Course Note: RDS 280, RDS 286, or equivalent introductory course on decision analysis required or signature of instructor required; familiarity with matrix algebra and elementary calculus may be helpful but not required; lab or section times to be announced at first meeting.

(KSG) API-302 Analytic Frameworks for Policy
Fall, 1.0 credit
Richard Zeckhauser
Develops abilities in using analytic frameworks in the formulation and assessment of public policy. It considers a variety of analytic techniques, particularly those directed toward uncertainty and interactive decision problems. It emphasizes the application of techniques to policy analysis, not formal derivations. Students encounter case studies, methodological readings, the computer, a final exam, and challenging problem sets.
Prerequisites: An understanding of intermediate-level microeconomic theory and introductory techniques of optimization and decision analysis; API-101, API-102, or equivalent.

Research Seminar
Research Seminar on Risk and Decision Analysis
Fall/Spring
Not for course credit.
Seminars. One 1.5-hour session every two weeks.
This doctoral level seminar introduces students to state-of-the-art scholarship in theory and applications of decision science to public health. Biweekly guest speakers from within and outside the university will present their current research. The seminar will aim for balance between theoretical and applied projects. While specific topics will change from year to year, relevant fields will include: theory and techniques of risk analysis; choice under uncertainty; health policy models; cost-effectiveness analysis; statistical decision theory; subjective probability and utility assessment.
Course note: No auditors.

Economics
Economics 2020a. Microeconomic Theory I
Catalog Number: 0339 Enrollment: Limited to 102.
Christopher N. Avery (Kennedy School)
Half course (fall term). M., W., 8:30–10, and a weekly section to be arranged. EXAM GROUP: 1, 2
A comprehensive course in economic theory designed for doctoral students in all parts of the University. Consumption, production, uncertainty, markets, general equilibrium. Applications to policy analysis and business decisions. Emphasizes the use of economic theory in practical research.
Note: Offered jointly with the Kennedy School as API-111 and with the Business School as 4010.
Prerequisite: Two years of calculus and one course in probability theory. Thorough background in microeconomic theory at the intermediate level. Undergraduates with the appropriate background are welcome.

Economics 2020b. Microeconomic Theory II
Catalog Number: 4058
Daniel Andres Hojman (Kennedy School)
Half course (spring term). M., W., 8:30–10; and a one-hour weekly section to be arranged. EXAM GROUP: 1, 2
A continuation of Economics 2020a. Topics include game theory, economics of information, incentive theory, and welfare economics.
Note: Offered jointly with the Kennedy School as API-112 and with the Business School as 4011.
Prerequisite: Economics 2010a or 2020a.

(KSG) API-101 A Markets and Market Failure
Faculty: Erzo Luttmer
Semester: Fall
1st day 9/8
Meet Time M/W 8:40–10 L140
Review F 11:40–1:00 L140
This course applies microeconomic reasoning to public issues, policies, and programs. It considers economic incentives and organizations; models of economic behavior, including markets, the absence of markets, and interventions in markets; the price system and how it works; and policy objectives and instruments. All sections cover a common set of core topics; the pedagogical approaches vary with the individual instructor. Prerequisite: The A section of this course presumes some prior exposure to the field and the ability to use basic calculus.

Economics 1011a. Microeconomic Theory
Catalog Number: 7230
Edward Glaeser
Half course (fall term). Tu., Th., 11:30–1. EXAM GROUP: 13, 14
Economics 1011a is similar to Economics 1010a, but is more mathematical and covers more material. The course teaches the basic tools of economics and to apply them to a wide range of human behavior. Tools include consumer theory, optimization under uncertainty, game theory, welfare economics, incentive theory, and the economics of information. Topics include industrial organization, public finance, law and economics, the economics of the family, religion, and riots. Note: Economics 1011a fulfills the intermediate microeconomic theory requirement for Economics concentrators. Students may take **either** Economics 1010a **or** Economics 1011a for credit. This course, when taken for a letter grade, meets the Core area requirement for Social Analysis.
Prerequisite: Mathematics 21a or permission of the instructor.

Probability and Statistics
Economics 2110. Introductory Probability and Statistics for Economists
Catalog Number: 7213
Ulrich K. Mueller (Princeton University)
Half course (fall term). M., W., 10–11:30. EXAM GROUP: 3, 4
Introduction to probability and statistics. Emphasis on general methods applicable to both econometrics and economic theory. Topics include probability spaces, random variables, limit laws, estimation, hypothesis testing, and Bayesian methods.
Prerequisite: Statistics (Stat 100), Linear Algebra and Calculus (Math 21a and 21b), and Real Analysis (Math 112).

Economics 2120. Introduction to Applied Econometrics
Catalog Number: 2352
Dale W. Jorgenson
Half course (spring term). Tu., Th., 2:30–4. EXAM GROUP: 16, 17
Introduction to methods employed in applied econometrics, including linear regression, instrumental variables, panel data techniques, generalized method of moments, and maximum likelihood. Includes detailed discussion of papers in applied econometrics and computer exercises using standard econometric packages.
Prerequisite: Economics 2110 or equivalent.

Economics 1123. Introduction to Econometrics
Catalog Number: 0813
Eric Chaney (fall term) and Guido W. Imbens (Spring term)
Half course (fall term). Tu., Th., 11:30-1; (spring term). Tu., Th., 1-2:30. EXAM GROUP: 15, 16
An introduction to multiple regression techniques with focus on economic applications. Discusses extensions to discrete response, panel data, and time series models, as well as issues such as omitted variables, missing data, sample selection, randomized and quasi-experiments, and instrumental variables. Aims to provide students with an understanding of and ability to apply econometric and statistical methods using computer packages.
Prerequisite: Statistics 100.

(SPH) BIO223 Applied Survival Analysis and Discrete Data Analysis
Spring
Dr. Lee-Jen Wei
5 credits
Lectures. Two 2-hour sessions each week. One 1-hour optional lab each week.
This course will cover topics in both discrete data analysis (25% of class) and applied survival analysis (75% of class). The course will begin with a review of sampling plans and contingency table for discrete data. Further topics in discrete data analysis will include logistic regression, exact inference, and conditional logistic regression. This short survey of discrete data topics will provide a natural transition to analysis of survival data. Survival topics include: hazard, survivor, and cumulative hazard functions, Kaplan-Meier and actuarial estimation of the survival distribution, comparison of survival using log rank and other tests, regression models including the Cox proportional hazards model and accelerated failure time model, adjustment for time-varying covariates, and use of parametric distributions (exponential, Weibull) in survival analysis. Class material will include presentation of statistical methods for estimation and testing, along with current software (SAS, Stata, Splus) for implementing analyses of discrete data and survival data. Applications to real data will be emphasized.
Course Note: BIO210, BIO213, or BIO230 required, or signature of instructor.

(SPH) BIO249 Bayesian Methods in Biostatistics
Spring
Dr. C. Paciorek
5 credits
Lectures. Two 2-hour sessions each week.
General principles of the Bayesian approach, prior distributions, hierarchial models and modeling techniques, approximate inference, Markov chain Monte Carlo methods, model assessment and comparison. Bayesian approaches to GLMMs, multiple testing, nonparametrics, clinical trails, survival analysis.
Course Note: BIO230 (Probability Theory and Applications I), BIO231 (Statistical Inference I), and BIO232 (Methods I), or the signature of the instructor is required. BIO233 (Methods II) will also be helpful for the second part of the course.

Government 2001. Advanced Quantitative Research Methodology
Catalog Number: 8941
Gary King
Half course (spring term). M., 2–4. EXAM GROUP: 7, 8
Graduate-level version of Gov. 1002. Meets with Gov. 1002, introduces theories of inference underlying most statistical methods and how new approaches are developed. Examples include discrete choice, event counts, durations, missing data, ecological inference, time-series cross sectional analysis, compositional data, causal inference, and others. Will require extra homework and examination problems in addition to those for Gov. 1002.
Prerequisite: Government 2000 or the equivalent.

Operations Research
***Applied Mathematics 121. Introduction to Optimization: Models and Methods**
Catalog Number: 3187 Enrollment: Limited to 40.
Yiling Chen
Half course (spring term). Tu., Th., 1–2:30. EXAM GROUP: 15, 16
Introduction to basic mathematical ideas and computational methods for solving deterministic and stochastic optimization problems. Topics covered: linear programming, integer programming, branch-and-bound, branch-and-cut, Markov chains, Markov decision processes, queuing theory. Emphasis on modeling. Examples from business, society, engineering, sports, e-commerce. Exercises in AMPL, complemented by Maple or Matlab.
Note: May not be taken in addition to Engineering Sciences 102.
Prerequisite: Applied Mathematics 21b or Mathematics 21b (linear algebra) and some knowledge of probability and statistics at the level of Statistics 110 or Engineering Sciences 101 or permission of instructor.

(MIT) 6.251J Introduction to Mathematical Programming
(Same subject as 15.081J)
J. N. Tsitsiklis, D. Bertsimas
Prereq: 18.06
Units: 4-0-8
Lecture: TR 1-2:30; Recitation: M EVE (6PM) +final
Introduction to linear optimization and its extensions emphasizing both methodology and the underlying mathematical structures and geometrical ideas. Covers classical theory of linear programming as well as some recent advances in the field. Topics: simplex method; duality theory; sensitivity analysis; network flow problems; decomposition; integer programming; interior point algorithms for linear programming; and introduction to combinatorial optimization and NP-completeness.

Epidemiology
***(SPH) EPI201 Introduction to Epidemiology: Methods I**
Fall 1
M. Hernán
2.5 credits
Lectures, labs. Two 2-hour sessions each week, one 2-hour lab each week.
EPI201 introduces the principles and methods used in epidemiologic research. The course discusses the conceptual and practical issues encountered in the design and analysis of epidemiologic studies for description and causal inference. The final exam requires the application of the learned skills to a real problem in epidemiology. EPI201 is the first course in the series of methods courses designed for students majoring in Epidemiology or Biostatistics, and those interested in a detailed introduction to the design and conduct of epidemiologic studies. Students who take EPI201 are expected to take EPI202

(Methods II).
Course Note: Thursday or Friday lab required. Credit is not given for more than one of EPI 200, EPI 201, EPI 208, or EPI500; no auditors.

(SPH) EPI200 Principles of Epidemiology
Fall 1
Dr. J. Buring
2.5 credits
Lectures, seminars. Two 1-hour sessions and one 2-hour seminar each week.
Introduces the basic principles and methods of epidemiology. Lectures are complemented by seminars devoted to exercises or to the discussion of current examples of epidemiologic studies.
Course Activities: Lectures, seminar participation, midterm, final examination.
Course Note: Thursday or Friday lab required. Credit is not given for more than one of EPI 200, EPI 201, EPI 208, or EPI500

ADDITIONAL COURSES

Economics
Economics 2460. Health Economics Workshop
Catalog Number: 7617
David M. Cutler, Joseph P. Newhouse (Kennedy School, Medical School, Public Health)
Half course (spring term). T., 6–8. EXAM GROUP: 18
Focuses on theory, econometric models, and public policy of health care. Frontier work in health economics presented and discussed by instructors and outside speakers.
Note: May be taken for credit only by dissertation students writing a research paper. Offered jointly with the Kennedy School as HCP-581.

(SPH) GHP291. Microeconomics and Applications to PH in Developing Countries
Spring
Dr. A. Mahal
5.0 credits
Lectures. Two 2-hour sessions each week.
This is a course in applied microeconomic theory (formerly GHP271). We use basic calculus, differentiation, and simple constrained maximization theory to develop empirical models of the behavior of individuals, households, firms, and markets, as well as normative theories of social welfare and resource allocation within the health sector. All applications will be drawn from population and public health issues in developing countries. Empirical applications include individuals' demand for health care, health insurance, and retirement saving; the determinants of fertility and educational investments in children; the distribution of resources within households; formal and informal mechanisms for risk sharing; the supply of physician and health services; market failures and inefficiencies due to asymmetric information in health insurance markets; and applications of the theory externalities and public goods to disease control and environmental policy. Normative applications include the trade-off between equity and efficiency, criteria for resource allocation and project evaluation within the health sector such as cost-benefit and cost-effectiveness analysis, and ethical issues such as the valuation of life, the multiple competing objectives of health policy, and fairness.
Course note: The course makes use of calculus and constrained maximization at the level of GHP274 or equivalent.

Uncertainty and Multi-Person Decisions
Economics 1051. Introduction to Game Theory
Catalog Number: 3692
Attila Ambrus
Half course (spring term). Tu., Th., 10–11:30. EXAM GROUP: 12, 13
Presents an introduction to the modern game theory, focusing on its use in economics. Main ideas of game theory are introduced and illustrated using examples from industrial organization, labor economics, and macroeconomics.
Note: Students may not take both Economics 1051 and Economics 1052 for credit.
Prerequisite: Economics 1010a or 1011a.

Economics 1052. Advanced Game Theory
Catalog Number: 2634
Markus M. Möbius
Half course (fall term). Tu., Th., 10–11:30, and a weekly section to be arranged. EXAM GROUP: 12, 13
Introduction to game theory and its applications to economics at a high level of rigor. Topics include extensive form and strategic form games, Nash's equilibrium and existence theorem, subgame-perfect equilibrium, Bayesian equilibrium, and applications to repeated games, auctions, and bargaining.
Note: Students may not take both Economics 1051 and Economics 1052 for credit.
Prerequisite: Economics 1011a and Mathematics 21a, or equivalent.

Economics 2052. Game Theory I: Equilibrium Theory
Catalog Number: 3690
Drew Fudenberg
Half course (spring term). M., 4–7 pm. EXAM GROUP: 9
Equilibrium analysis and its applications. Topics vary, but typically include equilibrium refinements (sequential equilibrium), the equilibria of various classes of games (repeated games, auctions, signaling games) and the definition and application of common knowledge.
Prerequisite: Economics 2010a or permission of the instructor.

Government 2005. Formal Political Theory I
(not offered 2008-2009)
Catalog Number: 1719
John W. Patty
Half course (fall term). Hours to be arranged.
A graduate seminar on microeconomic modeling, covering price theory, decision theory, social choice theory, and game theory.
Note: Expected to be given in 2009–10.

(KSG) STM-221 A and B. Introduction to Negotiation Analysis
Faculty: Brian Mandell
Semester: Fall
Course Credit: 1.0
1st Day 9/10
Meet Time M/W 10:10–11:30 for Section A OR M/W 1:10–2:30 for Section B, both in L230
Negotiation Exercise Tues 4:10–10:00 Land
This course introduces students to the theory and practice of negotiation. The ability to successfully negotiate rests on a combination of analytical and interpersonal skills. Analysis is important because negotiators cannot develop promising strategies without a deep understanding of the context of the situation, the interests of the other parties, and the range of possible moves and countermoves. Interpersonal skills are important because negotiation is essentially a process of communication, trust building (or breaking), and mutual persuasion. This course will develop a set of conceptual frameworks that should help students analyze future negotiation situations and prepare more effectively. Through participation in negotiation simulations, students will have the opportunity to exercise powers of communication and persuasion and to experiment with a variety of negotiation tactics and strategies.

(KSG) STM-221 C. Introduction to Negotiation Analysis
Faculty: Linda Kaboolian
Semester: Spring
Course Credit: 1.0
1st Day 1/29
Meet Time T/Th 1:10–2:30, L230
Negotiation Exercise Tues. 4:10–6:00, L380
(See Description Above)

(KSG) STM-221 D. Introduction to Negotiation Analysis
Faculty: Yoel Inbar
Semester: Spring
Course Credit: 1.0
1st Day 1/28
Meet Time M/W 11:40–1:00, Starr
Negotiation Exercise Tues. 4:10–6:00, Land
(See Description Above)

Behavioral Economics and Psychology of Decision Making
Economics 2010c. Economic Theory
Catalog Number: 4431
David I. Laibson and Emmanuel Farhi
Half course (fall term). Tu., Th., 1–2:30, and a 1.5-hour weekly section to be arranged. EXAM GROUP: 15, 16
Topics include discrete-time and continuous-time dynamic programming, consumption, investment, economic growth, and business cycles.
Note: Enrollment is strictly limited to PhD students in the Economics Department, Business Economics program, and PEG program. Qualified Harvard undergraduates may also enroll. No other students may take the course for credit or as auditors.

Economics 2030. Psychology and Economics
Catalog Number: 3828
Sendhil Mullainathan, David I. Laibson, and Andrei Shleifer
Half course (fall term). W., 1–3. EXAM GROUP: 6, 7
Explores economic and psychological models of human behavior. Theoretical topics include bounded rationality, intertemporal choice, decision making under uncertainty, inference, choice heuristics, and social preferences. Economic applications include asset pricing, corporate finance, macroeconomics, labor, development, and industrial organization.
Note: Primarily for graduate students but open to undergraduates.
Prerequisite: Knowledge of multivariable calculus and econometrics.

Economics 2040. Experimental Economics
Catalog Number: 8485 Enrollment: Limited to 48.
Alvin E. Roth (FAS, Business School)
Half course (spring term). F., 9–12. EXAM GROUP: 2, 3, 4
An introduction to experimental economics, and some of the major subject areas that have been addressed by laboratory experiments. We concentrate on series of experiments, to see how experiments build on one another.
Note: Offered jointly with the Business School as 4160.

Economics 2057. Rational Choice
Catalog Number: 3755
Amartya Sen and Christine M. Jolls (Law School)
Half course (fall term). Hours to be arranged.
Rationality is a central idea in economics, law, politics and moral and political philosophy. This course will provide a critical examination of the different ways of characterizing rationality and its requirements.
Note: Open to graduate students in Economics, Philosophy, Government and Law. Offered jointly with the Law School as 45510-11.

Psychology 1104. Psychology of Economic Decision Making
Catalog Number: 1700
Half course (fall term). Hours to be arranged.
Examines the role of psychological mechanisms in decision-making contexts such as rational choice, intertemporal choice, cooperation, fairness, punishment, and signaling. Focuses on the effects of learning, memory, attention, self-control, framing, and theory of mind on choice behavior in both humans and nonhuman animals.

Psychology 2650. Behavioral Approaches to Decision Making and Negotiation
Catalog Number: 7147
Max H. Bazerman (Business School)
Half course (spring term). M., 3–6. EXAM GROUP: 8, 9

Research overview of behavioral decision making and decision analytic perspectives to negotiation. Explores bounded rationality, decision biases, human decision making. Develops a behavioral decision perspective to negotiation, and examines how the field is currently evolving.
Note: Offered jointly with the Business School as 4420. Open to juniors and seniors in psychology and economics who are writing, or plan to write, a senior thesis.

Psychology 2670a. Decision Making I
Catalog Number: 1193
Ellen J. Langer
Half course (fall term). W., 1–3. EXAM GROUP: 6, 7
Decision theory and research, including the illusions of predictability, probability and control; rational/irrational models of decision-making; interpersonal decisions; risk-taking; learned helplessness; and mindfulness examined in applied contexts, with special focus on health.
Note: Open to qualified undergraduates.

Psychology 2670b. Decision Making II
Catalog Number: 3434
Ellen J. Langer
Half course (spring term). Tu., 1:30–3:30. EXAM GROUP: 15, 16, 17
A deeper exploration into the theoretical and experimental issues, pertaining to decision making and mindfulness, raised in Psychology 2670a.
Prerequisite: Psychology 2670a or Psychology 1571a.

Program Evaluation
(KSG) API-208 Program Evaluation: Estimating Program Effectiveness with Empirical Analysis
Faculty: Alberto Abadie
Semester: Spring
Course Credit: 1.0
1st Day 1/31
Meet Time T/Th 1:10–2:30 L130
Review F 11:40–1:00 L140
Program evaluation comprises a set of statistical tools for assessing the impact of public interventions. This methodological course will develop students' skills in quantitative program evaluation. Students will study a variety of evaluation designs (from random assignment to quasi-experimental evaluation methods) and analyze data from actual evaluations, such as the national Job Training Partnership Act Study. The course evaluates the strengths and weaknesses of alternative evaluation methods. This course meets the PhD requirement for empirical methods.
Prerequisite: Familiarity with the basic concepts of statistical inference, regression analysis, and instrumental variables (such as API-202 or API-210).

(SPH) HPM212 Program Evaluation in Health Policy
Fall
Instructor to be announced
5 credits
Course not offered 2008–2009
Lectures, case studies. Two 2-hour sessions each week.
Course provides a one-semester overview of evaluation for those likely to participate in the design or implementation of evaluations in private organizations or government agencies. Topics include establishing the scope for an evaluation, evaluation design, data and measurement issues, issues in inference (appropriate controls, changing program design and unique local circumstances), and problems of assuring the accuracy, relevance and credibility of findings. Both quantitative and qualitative methods are addressed.

Probability and Statistics

(SPH) BIO230 Probability Theory and Applications I
Fall
Cross listed at FAS as BIST230
Dr. A. Schwartzman
5 credits
Lectures, laboratories. Two 2-hour sessions each week. One 2-hour lab each week.
Axiomatic foundations of probability, independence, conditional probability, joint distributions, transformations, moment generating functions, characteristic functions, moment inequalities, sampling distributions, modes of convergence and their interrelationships, laws of large numbers, central limit theorem, and stochastic processes.
Course Note: Enrollment in the Biostatistics department, or BIO 222, or signature of instructor required; lab or section times to be announced at first meeting; cross-listed: HSPH student must register for HSPH course.

(SPH) BIO231 Statistical Inference I
Spring
Cross-listed as FAS as BIST231
Dr.Y. Li
5 credits
Lectures, laboratories. Two 2-hour sessions each week. One 1.5-hour lab each week.
A fundamental course in statistical inference. Discusses general principles of data reduction: exponential families, sufficiency, ancillarity and completeness. Describes general methods of point and interval parameter estimation and the small and large sample properties of estimators: method of moments, maximum likelihood, unbiased estimation, Rao-Blackwell and Lehmann-Scheffe theorems, information inequality, asymptotic relative efficiency of estimators. Describes general methods of hypothesis testing and optimality properties of tests: Neyman-Pearson theory, likelihood ratio tests, score and Wald tests, uniformly and locally most powerful tests, asymptotic relative efficiency of tests.
Course Note: BIO230 or signature of instructor required; lab or section time to be announced at first meeting; cross-listed: HSPH student must register for HSPH course.

Statistics 110. Introduction to Probability
Catalog Number: 0147
Joseph K. Blitzstein
Half course (fall term). M., W., F., at 12, and a section to be arranged. EXAM GROUP: 5
A comprehensive introduction to probability. Basics: sample spaces and events, conditional probability, and Bayes' Theorem. Univariate distributions: density functions, expectation and variance, bounds, Normal, t, Binomial, Negative Binomial, Poisson, and Gamma distributions. Multivariate distributions: joint and conditional distributions, independence, transformations, and Multivariate Normal. Limit laws: law of large numbers, central limit theorem. Markov chains: transition probabilities, stationary distributions, convergence.
Note: When taken for a letter grade, this course meets the Core area requirement for Quantitative Reasoning.
Prerequisite: Mathematics 19a or equivalent or above required (may be taken concurrently), Mathematics 19b or equivalent or above recommended.

Statistics 111. Introduction to Theoretical Statistics
Catalog Number: 1836
S.C. Samuel Kou
Half course (spring term). Tu., Th., 1–2:30, and a weekly section to be arranged. EXAM GROUP: 15, 16
Basic concepts of statistical inference from frequentist and Bayesian perspectives. Topics include maximum likelihood methods, confidence and Bayesian interval estimation, hypothesis testing, least squares methods, and categorical data analysis.
Prerequisite: Statistics 110 and Mathematics 19a and 19b (may be taken concurrently) or equivalent.

Statistics 210. Probability Theory
Catalog Number: 2487
Carl N. Morris and Joseph K. Blitzstein
Half course (fall term). Tu., Th., 1–2:30. EXAM GROUP: 15, 16
Random variables, measure, representations. Families of distributions: Multivariate Normal, conjugate, marginals, mixtures. Conditional distributions and expectation. Convergence, laws of large numbers, and central limit theorems. Markov chains and martingales.
Prerequisite: Statistics 110 or equivalent required; Statistics 111 or equivalent recommended.

Statistics 211. Statistical Inference
Catalog Number: 1946
Carl N. Morris
Half course (spring term). Tu., Th., 1–2:30. EXAM GROUP: 15, 16
Inference: frequency, Bayes, decision analysis, foundations. Likelihood, sufficiency, and information measures. Models: Normal, exponential families, multilevel, and non-parametric. Point, interval and set estimation; hypothesis tests. Computational strategies, large and moderate sample approximations.
Prerequisite: Statistics 111 and 210 or equivalent.

(MIT) 6.431 Applied Probability
Units 4-0-8
D. P. Bertsekas, J. N. Tsitsiklis
Fall & Spring
Meets with undergraduate subject 6.041. Requires the completion of additional advanced home problems.
An introduction to probability theory, and the modeling and analysis of probabilistic systems. Sample space, probabilistic models, conditional probability. Discrete and continuous random variables. Transform techniques. Bernoulli and Poisson processes. Markov processes. Limit theorems and elements of statistical inference.
Prerequisite: Calculus II
URL: http://web.mit.edu/6.041/www/home.html

Data Analysis
(SPH) BIO210 The Analysis of Rates and Proportions
Fall: Dr. M. Pagano
Spring: Dr. J. Ware
5 credits
Lectures, laboratories. Two 1.5-hour sessions each week. One 1.5-hour lab each week.
Emphasizes concepts and methods for analysis of data which are categorical, rate-of-occurrence (e.g., incidence rate), and time-to-event (survival duration). Stresses applications in epidemiology, clinical trials, and other public health research. Topics include measures of association, 2x2 tables, stratification, matched pairs, logistic regression, model building, analysis of rates, and survival data analysis using proportional hazards models.
Course Note: BIO200, or BIO201, or BIO202 and BIO203, or BIO206 and one of BIO207, BIO208, or BIO209, or signature of instructor required; lab or section times to be announced at first meeting.

(SPH) BIO211 Regression and Analysis of Variance in Experimental Research
Fall
Dr. P. Catalano
5 credits
Lectures, laboratories. Two 1.5-hour sessions each week; one 1-hour lab each week.
Covers analysis of variance and regression, including details of data-analytic techniques and implications for study design. Also included are probability models and computing. Students learn to formulate a scientific question in terms of a statistical model, leading to objective and quantitative answers.
Course Note: BIO200, or BIO201, or BIO202 and BIO203, or BIO206 and one of BIO207, BIO208, or BIO209, or signature of instructor required; lab or section times to be announced at first meeting.

(SPH) BIO213 Applied Regression for Clinical Research
Fall
Dr. E. J. Orav
5 credits
Lectures. Two 1.5-hour sessions each week. One 1.5-hour lab each week.
This course will introduce students involved with clinical research to the practical application of multiple regression analysis. Linear regression, logistic regression and proportional hazards survival models will be covered, as well as general concepts in model selection, goodness-of-fit, and testing procedures. Each lecture will be accompanied by a data analysis using SAS and a classroom discussion of the results. The course will introduce, but will not attempt to develop the underlying likelihood theory. Background in SAS programming ability required.
Course Note: BIO200, or BIO201, or BIO202 and BIO203, or BIO206 and one of BIO207, BIO208, or BIO209, or signature of instructor required; lab or section times to be announced at first meeting.

(SPH) BIO226 Applied Longitudinal Analysis
Spring
Dr. M. Hughes
5 credits
Lectures, laboratories. Two 2-hour sessions each week.
This course covers 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 the analysis of correlated data, repeated measures ANOVA, random effects and growth curve models, and generalized linear models for correlated data, including generalized estimating equations (GEE).
Course Activities: Homework assignments will focus on data analysis in SAS using PROC GLM, PROC MIXED, and PROC GENMOD.
Course Note: BIO210, BIO211, BIO213, or BIO232, or signature of instructor required; lab or section times will be announced at first meeting

(SPH) BIO232 Methods I
Fall
Cross-listed at FAS as BIST232
Dr. V. De Gruttola
5 credits
Lectures. Two 2-hour sessions each week.
Introductory course in the analysis of Gaussian and categorical data. The general linear regression model, ANOVA, robust alternatives based on permutations, model building, resampling methods (bootstrap and jackknife), contingency tables, exact methods, logistic regression.
Course Note: Enrollment in the Department of Biostatistics, or signature of instructor required; lab or section times to be announced at first meeting; cross-listed: HSPH student must register for HSPH course.

(SPH) BIO233 Methods II
Spring
Dr. B. Coull
5 credits
Lectures, laboratories (optional). Two 2-hour sessions each week. One 1.5-hour lab each week.
Intermediate course in the analysis of Gaussian, categorical, and survival data. The generalized linear model, Poisson regression, random effects and mixed models, comparing survival distributions, proportional hazards regression, splines and smoothing, the generalized additive model.
Course Note: BI 232, or signature of instructor required; lab or section times to be announced at first meeting.

Economics 1127. Statistical Methods for Evaluating Causal Effects
Catalog Number: 9967 Enrollment:
Donald B. Rubin
Half course (spring term). Tu., Th., 2:30–4. EXAM GROUP: 16, 17
Statistical methods discussed for inferring causal effects from data from randomized experiments or observational studies. Students will develop expertise to assess the credibility of causal claims and the ability to apply the relevant statistical methods for causal analyses. Examples will come from many disciplines: economics, education, other social sciences, epidemiology, and biomedical science. Evaluations of job training programs, educational voucher schemes, changes in laws such as minimum wage laws, medical treatments, smoking, military service.

Note: Students may not take both Economics 1127 and Statistics 186 for credit.
Prerequisite: Statistics 100 or preferably Statistics 111; Mathematics 20.

Engineering Sciences 103. Spatial Analysis of Environmental and Social Systems
(not offered in 2008-2009)
Catalog Number: 9277
Half course (spring term). Tu., Th., 11:30–1. EXAM GROUP: 13, 14
Introduces the fundamental statistical and mapping tools needed for analysis of environmental systems. Topics will be linked by environmental and social themes and will include GIS concepts; data models; spatial statistics; density mapping; buffer zone analysis; surface estimation; map algebra; suitability modeling. Students will acquire technical skills in both mapping and spatial analysis. Software packages used will include ArcGis. There will be guest lectures by researchers and practitioners who use GIS for spatial analysis.
Note: Expected to be given in 2009–10.
Prerequisite: Applied Mathematics 21 or equivalent.

(SPH) GHP 274 Applied Quantitative Methods I
Fall 1
Dr. S. Linnemayr, Dr. J. Finlay, Dr. G. Fink
2.5 credits
Lectures. Two 2-hour sessions each week.
This course will review, as well as introduce, methods of mathematical analysis that form an essential tool kit for doctoral level courses in economic analysis. The course is a pre-requisite for GHP291 (Microeconomics and applications to public health in developing countries) that is taught in the spring semester. Topics covered include differential and integral calculus, and optimization methods. Some applications of these methods to economic analysis will also be discussed. Participants in the course will be expected to be proficient in introductory level calculus and linear algebra.
Course note: There will be weekly problem sets, a take-home mid-term examination and an in-class final examination. Lab or section time will be announced at first meeting.

(MIT) 17.802 Multivariate Statistics
Snyder
Spring term, TBD
Focus on multivariate data analysis procedures, emphasizing regression. Considers model specification, autocorrelation, instrumental variables, and causal modeling. Students must have taken at least one previous subject in statistics. Open to qualified undergraduates.
Prereq: 17.871 or 17.872

Psychology 2200. Statistics and Data Analysis Through Computer Simulation
Catalog Number: 6960
Ken Nakayama
Half course (spring term).
An inquiry-based course to evaluate data analysis techniques. Uses Monte Carlo simulation to assess strengths and limitations of formal arguments and bootstrap resampling to understand how conclusions can be derived from data.
Prerequisite: Advanced course in statistics or permission of instructor.

(EDU) S-030 Intermediate Statistics: Applied Regression and Data Analysis
Faculty TBA
A: Spring 2009 course, four credits; Tuesday and Thursday, 10:00 a.m. - 11:30 a.m.
B: Spring 2009 course, four credits; Tuesday and Thursday, 1:00 p.m. - 2:30 p.m.
Are scores on high-stakes tests primarily a function of socioeconomic status? Do mandatory seat belt laws save lives? In this class, students will learn how to use a set of quantitative methods referred to as the general linear model--regression, correlation, analysis of variance, and analysis of covariance--to address these and other questions that arise in educational, psychological, and social research. Using dozens of real data sets as catalysts, we will discuss how to (1) formulate interesting research questions; (2) select appropriate statistical techniques; (3) conduct necessary calculations; (4) examine assumptions necessary for the technique to work appropriately; (5) interpret analytic results; (6) identify rival explanations of the results; and (7) summarize the findings in a cogent and convincing argument. Because quantitative skills are learned best through practice, computer-based statistical analyses will be an integral part of the course.
Prerequisite: An introductory statistics course at the level of S-012/S-010Y or permission of the instructor.

(EDU) S-052 Applied Data Analysis
John B. Willett
Half-course; Fall 2008; Tuesday and Thursday, 11:30 a.m. - 1:00 p.m.
S-052 is designed for those who want to extend their data-analytic skills beyond a basic knowledge of multiple regression analysis and ANOVA, and who want to communicate their findings clearly to audiences of researchers, scholars, and policymakers. The course contributes directly to the diverse data-analytic tool kit that the well-equipped empirical researcher must possess in order to perform sensible analyses of complex educational, psychological, and social data. Topics in the course include more extensive use of transformations in regression analysis, influence statistics, building and comparing taxonomies of regression models, general linear hypothesis testing, an introduction to multilevel modeling, nonlinear regression analysis, binomial and multinomial logistic regression analysis, ordinal logit analysis, principal components analysis, cluster analysis, exploratory factor analysis, introduction to discrete-time survival analysis, and others. S-052 is an applied course that offers conceptual explanations of statistical techniques, along with opportunities to examine, implement, and practice them in real data. Learning the computer skills necessary to conduct these kinds of analyses, and the communication skills to discuss them, is an integral part of the course. No more than 20 non-HGSE students will be permitted to enroll in the course.
Prerequisite: Successful completion of S-030, or permission of the instructor.

Statistics 155. Spatial Statistics for Social Inquiry and Health Research
Catalog Number: 1993
Christopher J. Paciorek (Public Health), and Louise M. Ryan (Public Health)
Half course (spring term). Hours to be arranged.
Introduction to spatial statistics as applied to social science and public health. Emphasizes analysis and visualization methods for areal data, geostatistical data, and point processes. Practical focus on case studies, guest lectures, and student projects.
Note: Expected to be given in 2009–10. Basic GIS skills will be covered in a short module. Offered jointly with the School of Public Health as BIO 283. May not be taken for credit if Biostatistics 283 has already been taken. May not be taken concurrently with Biostatistics 283.
Prerequisite: Coursework or equivalent experience in regression at the level of Statistics 139 or 149, Economics 1123, Psychology 1951, Biostatistics 210, 211, or 213, and coursework or equivalent experience in statistical programming such as Statistics 135 or Biostatistics 503 or permission of instructors. Prerequisites are guidelines and students are encouraged to consult instructors.

Statistics 160. Design and Analysis of Sample Surveys
Catalog Number: 2993
Alan Zaslavsky (Medical School)
Half course (fall term). Hours to be arranged.
Methods for design and analysis of sample surveys. The toolkit of sample design features, their use in optimal sample design strategies, and sampling weights) and variance estimation methods (including resampling methods). Brief overview of nonstatistical aspects of survey methodology such as questionnaire design and validation. Additional topics include variance estimation for complex surveys and estimators, nonresponse, missing data, hierarchical models for survey data, and small-area estimation.
Note: Expected to be given in 2009–10.
Prerequisite: Statistics 111 or 139, or permission of instructor.

Statistics 171. Introduction to Stochastic Processes
Jun S. Liu
Half course (spring term). Tu., Th., 2:30–4, and a weekly section to be arranged. EXAM GROUP: 16, 17
An introductory course in stochastic processes. Topics include Markov chains, branching processes, Poisson processes, birth and death processes, Brownian motion, martingales, introduction to stochastic integrals, and their applications.
Prerequisite: Statistics 110 or equivalent.

Statistics 220. Bayesian Data Analysis
Catalog Number: 6270
Donald B. Rubin and S.C. Samuel Kou
Half course (fall term). Tu., Th., 2:30–4. EXAM GROUP: 16, 17
Basic Bayesian models, followed by more complicated hierarchical and mixture models with nonstandard solutions. Includes methods for monitoring adequacy of models and examining sensitivity of models.

Note: Emphasis throughout term on drawing inferences via computer simulation rather than mathematical analysis.
Prerequisite: Statistics 110 and 111.

Statistics 221. Applied Bayesian Statistical Computing
Catalog Number: 5959
Jun S. Liu
Half course (spring term). Tu., Th., 10–11:30. EXAM GROUP: 12, 13
Computing methods commonly used in statistics: Generation of random numbers, Monte Carlo methods, optimization methods, numerical integration and advanced Bayesian computational tools such as the Gibbs sampler, Metropolis Hastings, method of auxiliary variables, marginal and conditional data augmentation, slice sampling, exact sampling and reversible jump MCMC.
Note: Computer programming exercises will apply the methods discussed in class.
Prerequisite: Linear algebra, Statistics 111, and knowledge of a computer programming language required; Statistics 220 recommended.

Statistics 225. Spatial Statistics
(not offered in 2008-2009)
Catalog Number: 6499
Rima Izem
Half course (fall term). M., W., 1–2:30. EXAM GROUP: 6, 7
Introduction of three types of spatial data: point pattern, geospatial, and lattice. For each type of data, presentation and application of statistical and computational methods for description, modeling, and analysis.
Note: Expected to be given in 2009–10.

Statistics 239. Statistical Sleuthing Through Linear Models
Catalog Number: 8433
Members of the Department
Half course (fall term). Tu., Th., 10–11:30 and a weekly section to be arranged. EXAM GROUP: 12, 13
Meets with Statistics 139, but graduate students will be required to complete additional assignments designed to cover theoretical aspects of regression analysis.

Statistics 249. Statistical Sleuthing Through Generalized Linear Models
Catalog Number: 3987
Members of the Department
Half course (spring term). M., W., 2:30–4. EXAM GROUP: 7, 8
Meets with Statistics 149, but graduate-level covers supplementary topics such as Bayesian analysis for generalized linear models and generalized mixed effect models. Requires extra homework and examination problems in addition to those for Statistics 149.
Prerequisite: Statistics 139, Statistics 220 or Statistics 221, or by permission of instructor.

<u>Epidemiology and Clinical Trials</u>
(SPH) BIO214 Principles of Clinical Trials
Spring 1
Dr. S. Lagakos
2.5 credits
Lectures. Two 2-hour sessions each week.
Designed for individuals interested in the scientific, policy, and management aspects of clinical trials. Topics include types of clinical research, study design, treatment allocation, randomization and stratification, quality control, sample size requirements, patient consent, and interpretation of results. Students design a clinical investigation in their own field of interest, write a proposal for it, and critique recently published medical literature.
Course Note: BIO 200, or BIO 201, or BIO202 and BIO203, or BIO206 and one of BIO 207, BIO 208 or BIO 209, or signature of instructor required. (5.06)

(SPH) EPI204 Analysis of Case-Control and Cohort Studies
Spring 1
Dr. D. Spiegelman
2.5 credits
Lectures, seminars labs. Two 2-hour sessions each week.
Examine, through practical examples, analysis of case-control and cohort studies using, primarily, conditional logistic and Cox regression model etiologic studies. Explore analytic approaches in the presence of missing data, confounding, and interaction. Emphasize analysis and interpretation of results in the context of research question and study design. Familiarity with SAS is desirable.
Course Activities: Written group projects, class discussion, quizzes, homework.
Course Note: EPI200, EPI201 or EPI208, EPI202 and EPI203 required. Concurrent enrollment permitted. BIO210 required. Concurrent enrollment permitted. Lab optional.

(SPH) EPI207 Advanced Epidemiologic Methods
Fall 1
Dr. J. Robins, Dr. M. Hernan
2.5 credits
Lectures. Two 2-hour sessions and one 2-hour lab each week.
Provides an in-depth investigation of statistical methods for drawing causal inferences from observational studies. Informal epidemiologic concepts such as confounding, selection bias, overall effects, direct effects, and intermediate variables will be formally defined within the context of a counterfactual causal model and with the help of causal diagrams. Methods for the analysis of the causal effects of time-varying exposures in the presence of time dependent covariates that are simultaneously confounders and intermediate variables will be emphasized. These methods include g-computation algorithm estimators, inverse probability weighted estimators of marginal structural models, g-estimation of structural nested models. As a practicum, students will reanalyze data sets using the above methods.
Course Activities: Class discussion, homework, practicum and final examination.
Course Note: EPI204, BIO210 and EPI289, or BIO233, or signature of instructor required; familiarity with logistic regression and survival analysis is expected; lab time will be announced at first meeting.

(SPH) EPI221 Pharmacoepidemiology
Fall 1
Dr. A. Walker
2.5 credits
Lectures. Four 2.5-hour sessions each week.
Within the framework of formal epidemiologic analysis, this course covers inference about the effects of pharmaceuticals from case reports, case series, vital statistics and other registration schemes, cohort studies, and case-control studies. Decision-making with inadequate data is examined from the perspectives of manufacturers and of regulators. Students are graded on the basis of group projects. This course is intended primarily for students wishing to pursue a career in the pharmaceutical industry or in national regulatory bodies, but may have more general interest as an applied mid-level course with a heavy methodological emphasis.
Course Activities: Written and oral group projects, individual class presentations, class discussion.
Course Note: Knowledge of epidemiology at the level of EPI 202 and a basic understanding of drug use and nomenclature are assumed; completion of EPI203 preferred; enrollment limited to 25 students; signature of instructor required; course meets Monday through Thursday 1:30 pm to 4 pm during WinterSession.

(SPH) EPI233 Research Synthesis & Meta-Analysis
Spring
Dr. R. Van Dam
2.5 credits
Seminars. Two 1.5-hour sessions each week.
Concerned with the explosion of biological data for etiologic inquiry and the use of existing data to inform clinical decision making and health care policy, the course focuses on research synthesis and evidence-based medicine and public health (meta-analysis.) The epidemiologic principles and relevant statistical methods are reviewed and applied to real case studies. Application of methods includes considerations for randomized clinical trials and observational studies of various topics. The use of meta-analysis to explore data and identify sources of variation among studies is emphasized, as is the use of meta-analysis to identify future research questions.

Course Activities: Students learn the principles of a systematic review, prepare a protocol to conduct a meta-analysis and use existing meta-analysis software to apply principles outlined in the course to many data sets provided for this purpose. Students are encouraged to bring their own data for analysis.
Course Note: EPI200 or EPI201 and BIO200, BIO201, or BIO202 and BIO203 required.

(SPH) EPI241 Measuring Health Status
(not offered 2008-2009)
Fall 2
TBA
2.5 credits
Lectures. One 2-hour session each week.
Examines methodologic issues related to measures of health status encountered in clinical research. Topics to be covered include instrument development, scaling, space assessment of reliability, validity and responsiveness to change; principal component analysis and factor analysis; diagnostic test evaluation.
Course Activities: Class discussion, examination, paper.
Course Note: Minimum enrollment of 10 students required.

(SPH) EPI288 Data Mining and Prediction
WinterSession
Dr. N. Cook, Dr. E. F. Cook
2.50 credits
Lecture, computer lab. Eight 3-hour lectures and 5 2-hour computer labs over two weeks.
This course will present an introduction to the methods of data mining and predictive modeling, with applications to both genetic and clinical data. Basic concepts and philosophy of supervised and unsupervised data mining as well as appropriate applications will be discussed. Topics covered will include multiple comparisons adjustment, cluster analysis, self-organizing maps, principal component analysis, and predictive model building through logistic regression, classification and regression trees (CART), multivariate adaptive splines (MARS), neural networks, random forests, and bagging and boosting.
Course Activities: Computer labs.
Course Note: Students should be familiar with logistic regression (EPI236, BIO213, BIO210, or equivalent); signature of instructor required; no auditors.

(SPH) EPI289 Causal Inference
Spring 1
Dr. M. Hernan
2.5 credits
Causal inference from observational data is a key task of epidemiology and of allied sciences such as sociology, education, behavioral sciences, demography, economics, health services research, etc. These disciplines share a methodological framework for causal inference that includes the application of statistical models to estimate causal effects. EPI289 presents the most commonly used models for causal inference and shows how, in practical applications, the epidemiologic concepts and methods introduced in EPI201/EPI202 need to be reformulated within a modeling framework. The course also introduces methods for causal inference for time-varying exposures, which will be extensively studied in EPI207.
Course Note: Wednesday lab required; no auditors.

(SPH) HPM530 Measuring and Analyzing the Outcomes of Health Care
Summer 1
Dr. M. Testa, Dr. D. Simonson
2.5 credits
Lectures, case studies. Five 1.75-hour sessions each week.
This course emphasizes introductory concepts, methods, and practical procedures for measuring and analyzing patients' health status, quality of life, satisfaction and cost-effectiveness for health outcomes research. The course reviews the fundamentals of health outcomes research methods necessary for 1) demonstrating improvement in patient outcomes, 2) controlling costs and allocating resources, 3) implementing disease management programs and 4) making effective public health, health technology and clinical decisions. Statistical methods needed to evaluate and use scales and indices are also presented and discussed. The course would be useful to public health and clinical researchers who must critically review and utilize outcomes data for public health, health care and clinical decision-making. The course should enable students to 1) conceptually define the meaning and purpose of outcomes research, 2) understand the role of epidemiology, health economics and database and information technology in conducting outcomes research, 3) evaluate the usefulness and utility

of outcomes measures, 4) recognize the different types of measures used in outcomes research, including clinical, health status, quality-of-life, work/role performance, health care utilization, and patient satisfaction, 5) adopt new methods for modeling patient responses, interpret the meaning of measurement concepts and obtain a basic appreciation of the statistical analyses appropriate for outcomes research, 6) locate available research-quality instruments for measuring health care outcomes in order to make informed choices among existing instruments and 7) interpret the results of health outcomes research. Course note: No auditors.

Infectious Disease Modeling

EPI260 Mathematical Modeling of Infectious Diseases
Spring 2
Dr. M. Lipsitch
2.5 credits
Lectures, seminars. Two 2-hour sessions each week.
This course will cover selected topics and techniques in the use of dynamical models to study the transmission dynamics of infectious diseases. Class sessions will primarily consist of lectures and demonstrations of modeling techniques. Techniques will include design and construction of appropriate differential equation models, equilibrium and stability analysis, parameter estimation from epidemiological data, determination and interpretation of the basic reprodutive number of an infection, techniques for sensitivity analysis, and critique of model assumptions. Specific topics will include the use of age-seroprevalence data, the effects of population heterogeneity on transmission, stochastic models and the use of models for pathogens with multiple strains. This course is designed for students with a basic understanding of mathematical modeling concepts who want to develop models for their own work.
Course Note: Previous course in calculus is required; EPI225, EPI285, EPI501, or permission of instructor required.

EPI501 Dynamics of Infectious Diseases
Fall 2
Dr. M. Murray
2.5 Credits
Lectures. Two 2-hour class sessions each week.
This course covers the basic concepts of infectious disease dynamics within human populations. Focus will be on transmission of infectious agents and the effect of biological, ecological, social, political, economic forces on the spread of infections. We will emphasize the impact of vaccination programs and other interventions. The dynamics of host-parasite interaction are illustrated using basic mathematical modeling techniques.
Course activities: written homework assignments and final exam. Previous coursework in epidemiology helpful.

ID298 Inference in Infectious Disease Epidemiology
WinterSession
Department of Epidemiology and Department of Immunology and Infectious Diseases
Dr. M. Lipsitch, Dr. C. Mills
1.25 credits
Course Offered 2008-2009; Offered Alternate Years.
Seminar. Eight 2-hour sessions.
This course will cover advanced issues in the design and interpretation of studies of infectious disease epidemiology. The course will consist of readings and student presentations on topics such as: interpretations of molecular typing data for infectious agents, assessment of incomplete and temporary immunity, immune correlates of protection, spatial effects in disease transmission, and inference about the carrier state. Each session will be led by a student whose responsibility will be to synthesize knowledge on the topic, describe open research areas, and stimulate discussion of the topic based on course readings. This course is intended for advanced students in infectious disease epidemiology.
Course note: Interested students should contact the instructor by the end of Fall 1 to choose a topic for presentation and to discuss possible readings. EPI225 or EPI285 or permission of the instructor required; Minimum enrollment of 7 required. Course dates TBA, 10:30 am to 12:30 pm.

Decision Theory, Optimization Theory, and Operations Research

Applied Mathematics 115. Mathematical Modeling
Catalog Number: 1768
L. Mahadevan (fall term) and Eli Tziperman (spring term)
Half course (fall term; repeated spring term). Fall: M., W., 1–2:30; Spring: Tu., Th., 11:30–1.
EXAM GROUP: Fall: 6, 7; Spring: 13, 14
Abstracting the essential components and mechanisms from a natural system to produce a mathematical model, which can be analyzed with a variety of formal mathematical methods, is perhaps the most important, but least understood, task in applied mathematics. This course approaches a number of problems without the prejudice of trying to apply a particular method of solution. Topics drawn from mechanics, biology, economics and the behavioral sciences.
Prerequisite: Mathematics at least at the level of Applied Mathematics 21a,b. Additional skills in analysis, algebra, probability, statistics and computer programming will increase the value of the course to students.

Economics 1059. Theories of Decisionmaking in Economics
Catalog Number: 1322
Barton Leslie Lipman (Boston University)
Half course (fall term). Tu., Th., 10–11:30. EXAM GROUP: 12, 13
An introduction to decision theory and other formal approaches for modeling decision making in economics, including both classical and psychologically-motivated approaches. Topics include uncertainty, ambiguity, temptation, and wishful thinking.
Prerequisite: Economics 1010a or 1011a and Mathematics 21a.

Engineering Sciences 201. Decision Theory
Catalog Number: 2362
Roger W. Brockett
Half course (spring term). M., W., F., at 10. EXAM GROUP: 3
Mathematical analysis of decision making. Bayesian inference and risk. Maximum likelihood and nonparametric methods. Algorithmic methods for decision rules: perceptrons, neural nets, and back propagation models. Hidden Markov models, Blum-Welch, principal and independent components.
Note: Expected to be given in 2009–10.
Prerequisite: Applied Mathematics 21a,b or Mathematics 21a,b, and Statistics 110 or equivalents.

Engineering Sciences 210. Mathematical Programming
(not offered 2010-2011)
Catalog Number: 5499
Donald G. M. Anderson
Half course (spring term). Tu., Th., 2:30–4. EXAM GROUP: 16, 17
Introduction to basic optimization techniques. Linear programming: the simplex method and related algorithms, duality theory, interior-point methods. Unconstrained optimization, nonlinear programming, convexity.
Note: Expected to be given in 2009–10. Offered in alternate years.
Prerequisite: Applied Mathematics 21a and 21b, or Mathematics 21a and 21b; Applied Mathematics 120, or equivalent.

(MIT) 6.251J Introduction to Mathematical Programming
(See Description Above)

(MIT) 6.255J/15.093J Optimization Methods
D. Bertsimas, P. Parrilo
Fall term. TTh 2:30–4 , recitation F1 + final
Prereq: 18.06
Units: 4-0-8
Introduces the principal algorithms for linear, network, discrete, nonlinear, dynamic optimization and optimal control. Emphasis on methodology and the underlying mathematical structures. Topics include the simplex method, network flow methods, branch and bound and cutting plane methods for discrete optimization, optimality conditions for nonlinear optimization, interior point methods for convex optimization, Newton's method, heuristic methods, and dynamic programming and optimal control methods.
URL: http://stellar.mit.edu/S/course/15/fa08/15.093/index.html

(MIT) 14.128 Dynamic Optimization and Economic Applications
I. Werning
Prereq: 14.102
Units: 2-0-4
Spring. Hours to be determined.
Dynamic systems: local and global analysis. Deterministic and stochastic dynamic programming: theory and numerical implementation. Euler equations. Markov processes: weak and strong convergence. Applications.

(MIT) 15.871 Introduction to System Dynamics
Sterman/ Repenning
Fall: MW8.30-10 (ENDS OCT 24) or MW10-11.30 (ENDS OCT 24) Recitation: F2.30-4 or F10-11.30 or F8.30-10
Spring: TBD
Introduction to systems thinking and system dynamics modeling applied to strategy, organizational change, and policy design. Students use simulation models, management flight simulators, and case studies to develop conceptual and modeling skills for the design and management of high-performance organizations in a dynamic world. Case studies of successful applications of system dynamics in growth strategy, management of technology, operations, supply chains, product development, and others. Principles for effective use of modeling in the real world.
Note: You must pre-register and participate in Sloan's Prioritization process to take this subject.

(MIT) 15.872 System Dynamics II
Sterman/ Repenning
Fall: MW10-11.30 (BEGINS OCT 24) or MW8.30-10 (BEGINS OCT 24) Recitation: F2.30-4 or F10-11.30
Spring: TBD
Continuation of 15.871, emphasizing tools and methods needed to apply systems thinking and simulation modeling successfully in complex real-world settings. Uses simulation models, management flight simulators, and case studies to deepen the conceptual and modeling skills introduced in 15.871. Through models and case studies of successful applications students learn how to use qualitative and quantitative data to formulate and test models, and how to work effectively with senior executives to implement change successfully. Prerequisite for further work in the field.
Note: You must pre-register and participate in Sloan's Prioritization process to take this subject.

(MIT) 15.879 Research Seminar in System Dynamics
Fall
Sterman/Repenning
Doctoral level seminar in system dynamics modeling, with a focus on social, economic and technical systems. Covers classic works in dynamic modeling from various disciplines and current research problems and papers. Participants critique the theories and models, often including replication, testing, and improvement of various models, and lead class discussion. Topics vary from year to year.

Ethics of Resource Allocation
Economics 2054. Social Choice and Welfare Economics
Catalog Number: 1118
Sen/Foster
Half course (fall term). M., 1–3. EXAM GROUP: 6, 7
A basic course in social choice theory and its philosophical foundations. An examination of “impossibility” results, collective rationality, domain restrictions, interpersonal comparability, and the role of rights and liberties.

(SPH) ID292 Justice and Resource Allocation
Spring 2
Department of Global and Population Health and the Department of Health Policy and Management
Dr. N. Daniels
2.5 credits
Lectures. Two 2-hour sessions each week
This course explores the ethical issues, especially issues of distributive justice, raised by health and health care resource allocation methodologies and decisions. We begin with examination of distributive issues raised by measures of summary population health and their extensions into cost effectiveness analysis, paying special attention to the strengths and weaknesses of the underlying welfare economic and utilitarian assumptions. Philosophical and empirical efforts to clarify our beliefs about these distributive issues and our commitments to them will also be discussed. We then turn to recent efforts to make health inequalities and inequities a focus of priority in resource allocation, examining both conceptual and

moral issues raised by different approaches to such inequalities and by the fact that the distribution of health is so significantly affected by non-health sector factors. We take up two problems of cross-cutting interest, the different concern shown for identified versus statistical victims, and emerging issues about intergenerational equity concerning the elderly and young. Finally, we turn to fair decision process as a way of resolving disputes about allocation. The goal of the course is to equip students with the ethical basis for addressing resource allocation issues in practical public health contexts, and throughout the course there is a focus real cases where controversy surrounds such decisions.

(SPH) ID513 Ethics and Health Disparities
Spring 1
Department of Global and Population Health and Department of Society Human Development and Health
Dr. Norman Daniels
2.5 credits
Lectures, case studies. Two 2-hour sessions each week.
When is an inequality in health status an injustice or inequity? This course examines various aspects of this issue, bringing appropriate perspectives from ethical theories (utilitarian, libertarian, liberal egalitarian, feminist) to bear on case studies revealing a range of important health disparities. Four main cases will be discussed, each focusing on a central type of health disparity: U.S. racial disparities, class disparities, gender disparities in a developing country setting, and global health inequalities. Key questions to be pursued in each case include: when is an inequality in health between this type of demographic variable unjust? When is a policy that produces, or fails to address, such an inequality race- or gender- or class-biased in an morally objectionable way? What ethical issues are raised by different methods of measuring health inequalities? How does ascription of responsibility for health affect the fairness of health inequalities? What kind of obligations exist to address health inequalities across national boundaries? What ethical issues are raised by policy approaches to addressing health inequalities and giving priority to reducing them?

Philosophy 276x. Bioethics: Seminar
Catalog Number: 3452
Frances Kamm (Kennedy School)
Half course (spring term). W., 5–7 p.m. EXAM GROUP: 9
Philosophical discussion of selected issues in bioethics, such as allocation of scarce resources, equity in healthcare, death, euthanasia and assisted suicide, abortion, embryonic stem cell research. Readings primarily from contemporary philosophical sources.
Note: Offered jointly with the Harvard Kennedy School of Government as LAW-90335A.

(SPH) GHP293 Individual and Social Responsibility for Health
Fall 1
Dr. D. Wikler
2.5 credits
Lectures, case studies. Two 2-hour sessions each week.
The concept of responsibility for health plays a key role in health policy, but it is rarely articulated or evaluated. In this course, students will consider alternative understandings of assignments of responsibility for health to individuals, the state, the family, communities, nonprofit and for-profit firms, and other entities. They will identify their occurrences in health policy debates, assess the cogency of their use in ethical arguments in health policy, and trace the policy consequences of their normative analyses. The course will also serve as an introduction to ethical perspectives on public health.
Course Note: Minimum enrollment of 15 required. Evaluation of Performance: Exams and a term project identifying and evaluating the role of responsibility for health in an area health policy.

Biomedical Informatics
(MIT) HST.950J/6.872J Biomedical Computing
P. Szolovits, I. Kohane, L. Ohno-Machado
Fall. T/Th 9:30-11.
Units: 3-0-9
Analyzes computational needs of clinical medicine, reviews systems and approaches that have been used to support those needs, and the relationship between clinical data and gene and protein measurements. Topics: the nature of clinical data; architecture and design of healthcare information systems; privacy and security issues; medical expert systems; introduction to bioinformatics. Case studies and guest lectures describe contemporary systems and research projects. Term project using large clinical and genomic data sets integrates classroom topics.
Prereq: 6.034
URL: http://www.chip.org/teaching/hst950/