secure systems as well as an understanding of the base technologies and threats in today’s interconnected environment.

Prerequisite: **Computer Science 210** or permission of the instructor.

**375a. Optimization and Uncertainty.** Spring 2010. **Stephen Majercik.**

Optimization problems and the need to cope with uncertainty arise frequently in the real world. A numeric framework, rather than the symbolic one of traditional artificial intelligence, is useful for expressing such problems. In addition to providing a way of dealing with uncertainty, this approach sometimes permits performance guarantees for algorithms. Topics include constraint satisfaction, systematic and non-systematic search techniques, probabilistic inference and planning, and population-based optimization techniques (e.g., genetic algorithms and ant colony optimization).

Prerequisite: **Computer Science 210** and **Mathematics 200**, or permission of the instructor.

**380a. Artificial Intelligence and Computer Games.** Spring 2012. **Stephen Majercik.**

Computer games are becoming an increasingly utilized test-bed for the development of new techniques in certain areas of artificial intelligence (AI) research (knowledge representation; search; planning, reasoning, and learning under uncertainty). At the same time, AI techniques are becoming increasingly necessary in commercial computer games to provide interesting and realistic synthetic characters. Explores that symbiosis by studying a subset of relevant AI techniques, using those techniques to create AI-endowed characters, and testing the characters in actual computer games.

Prerequisite: **Computer Science 210** or permission of the instructor.

**401a–404a. Advanced Independent Study and Honors in Computer Science.** The Department.

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**Economics**

Rachel Ex Connely, **Department Chair**

Elizabeth Weston, **Department Coordinator**

**Professors:** Rachel Ex Connely, Deborah S. DeGraff†, John M. Fitzgerald,
Jonathan P. Goldstein, David J. Vail

**Associate Professors:** Gregory P. DeCoster, Guillermo Herrera, B. Zorina Khan

**Assistant Professors:** Paola Boel, Julian P. Diaz†, Joon-Suk Lee, Stephen J. Meardon

**Instructor:** Yao Tang

The major in economics is designed for students who wish to obtain a systematic introduction to the basic theoretical and empirical techniques of economics. It provides an opportunity to learn economics as a social science with a core of theory, to study the process of drawing inferences from bodies of data and testing hypotheses against observation, and to apply economic theory to particular social problems. Such problems include Third World economic development, the functioning of economic institutions (e.g., financial markets, labor markets, corporations, government agencies), and current policy issues (e.g., the federal budget, poverty, the environment, globalization, deregulation). The major is a useful preparation for graduate study in economics, law, business, finance or public administration.
Requirements for the Major in Economics

The major consists of three core courses (Economics 255, 256, and 257), two advanced topics courses numbered in the 300s, at least one of which must be designated as a seminar, and two additional courses in economics numbered 200 or higher. Only one of Economics 260 and 360 may be counted toward the economics major. Because Economics 101 is a prerequisite for Economics 102, and both are prerequisites for most other economics courses, most students will begin their work in economics with these introductory courses. Prospective majors are encouraged to take at least one core course by the end of the sophomore year, and all three core courses should normally be completed by the end of the junior year. Note that Economics 255 is a prerequisite to Economics 256. Advanced topics courses normally have some combination of Economics 255, 256, and 257 as prerequisites. Qualified students may undertake self-designed, interdisciplinary major programs or joint majors between economics and related fields of social analysis.

To fulfill the major (or minor) requirements in economics, or to serve as a prerequisite for non-introductory courses, a grade of C- or better must be earned in a course. Courses required for the major must be taken on a graded basis.

All prospective majors and minors are required to complete Mathematics 161, or its equivalent, prior to enrolling in the core courses. Students who aspire to advanced work in economics (e.g., an honors thesis and/or graduate study in a discipline related to economics) are strongly encouraged to master multivariate calculus (Mathematics 181) and linear algebra (Mathematics 201) early in their careers. Such students are also encouraged to take Mathematics 265 instead of Economics 257 as a prerequisite for Economics 316. The Economics 257 requirement is waived for students who complete Mathematics 265 and Economics 316. Students should consult the Department of Economics about other mathematics courses that are essential for advanced study in economics.

Interdisciplinary Major

The department participates in an interdisciplinary major in mathematics and economics. See page 212.

Requirements for the Minor in Economics

The minor consists of Economics 255, and any two additional courses numbered 200 or higher. Only one of Economics 260 and 360 may be counted toward the economics minor. To fulfill the minor requirements or to serve as a prerequisite for other courses, a grade of C- or better must be earned in a course. Courses required for the minor must be taken on a graded basis.

Requirements for the Minor in Economics and Finance

The minor in Economics consists of Economics 255, 260, and 360, and one additional course at the 200 or 300 level selected from among Economics 209, 216, 238, 256, 257, 302, and 355. Since Economics 255 is a prerequisite for Economics 360 and other upper-level economics courses, prospective minors are encouraged to complete 255 by the end of their sophomore year. To fulfill the minor requirements or to serve as a prerequisite for other courses, a grade of C- or better must be earned in a course. Courses required for the minor must be taken on a graded basis.

Economics majors cannot also minor in Economics and Finance. Economics majors who complete the requirements for this minor will be provided language by the department to enable them to indicate that they have done so.
Introductory, Intermediate, and Advanced Courses

A non-technical introduction to the operation of modern capitalist economies, with a focus on the United States. Emphasizes use of a small number of fundamental concepts to clarify how economies function and to provide a foundation for informed evaluation of contemporary economic debates. Topics include incentives, decision-making, markets as a means of allocating resources, characteristics of market allocation, measures and history of U.S. economic performance, structure and function of the financial system, sources of economic growth, and business cycles. Periodic discussions of the role of government in the economy. Seeks to provide a level of economic literacy adequate to understanding debates as conducted in the popular press. Intended for students not planning to major in economics. Not open to students who have credit for Economics 101 or 102. Does not satisfy the prerequisite for any other course in economics.

101b - MCSR. Principles of Microeconomics. Every semester. The Department.
An introduction to economic analysis and institutions, with special emphasis on the allocation of resources through markets. The theory of demand, supply, cost, and market structure is developed and then applied to problems in antitrust policy, environmental quality, energy, education, health, the role of the corporation in society, income distribution, and poverty. Students desiring a comprehensive introduction to economic reasoning should take both Economics 101 and 102.

102b - MCSR. Principles of Macroeconomics. Every semester. The Department.
An introduction to economic analysis and institutions, with special emphasis on determinants of the level of national income, prices, and employment. Current problems of inflation and unemployment are explored with the aid of such analysis, and alternative views of the effectiveness of fiscal, monetary, and other governmental policies are analyzed. Attention is given to the sources and consequences of economic growth and to the nature and significance of international linkages through goods and capital markets.
Prerequisite: Economics 101.

Examines the development of institutions from the colonial period to the rise of the modern corporation in order to understand the sources of economic growth in the United States. Topics include early industrialization, technological change, transportation, capital markets, entrepreneurship and labor markets, and legal institutions. Not open to students who have credit for Economics 238 or 348.
Prerequisite: Economics 101 and 102.

Introduction to the principles of money and banking. Closely examines the tools of monetary policy, as well as the determination of short- and long-term interest rates and exchange rates. Discusses the institutional structure of central banking and of financial intermediation in the American economy.
Prerequisite: Economics 101 and 102.

Theoretical and applied evaluation of government activities and the role of government in the economy. Topics include public goods, public choice, income redistribution, benefit-
cost analysis, healthcare, social security, and incidence and behavioral effects of taxation. Not open to students who have credit for Economics 310.

Prerequisite: Economics 101.

Examines the causes and consequences of poverty and inequality in the United States and analyzes policy responses. Topics include social welfare theory, poverty measurement, discrimination, rising wage inequality, the working poor, and consequences of poverty for families and subsequent generations. Substantial focus on benefit-cost analysis and experimental and non-experimental evaluations of current policy, including welfare reform, education and training, and employment programs. Makes limited use of comparisons to other countries.

Prerequisite: Economics 101.

Note: This course counts toward the major and minor in gender and women’s studies.

A study of labor market supply and demand, with special emphasis on human resource policies, human capital formation, and wage inequality.

Prerequisite: Economics 101.

Note: This course counts toward the major and minor in gender and women’s studies.

A historical study of insights and methods of inquiry into the functions of markets and the role of government in shaping them. Readings include the original works of economic thinkers from the eighteenth to twentieth centuries, including Adam Smith, David Ricardo, Henry Carey, Karl Marx, Henry George, Thorstein Veblen, and John Maynard Keynes, among others. Different historiographical approaches are employed, including examination of the problems motivating past thinkers as well as the relevance of their ideas to modern economics.

Prerequisite: Economics 101 and 102, or permission of the instructor.

A study of the organization of firms, their strategic interaction and the role of information in competitive markets, and related policy issues such as antitrust. Introduces basic game-theoretic tools commonly used in models of industrial organization. Features industry sector analyses, antitrust cases, and classroom applications.

Prerequisite: Economics 101 or permission of the instructor.

[218b - MCSR. Environmental Economics and Policy. (Same as Environmental Studies 218.)]

An alternative (heterodox) analysis of a capitalist market economy rooted in Marx’s methodological framework, which focuses on the interconnected role played by market relations, class/power relations, exploitation and internal tendencies towards growth, crisis, and qualitative change. Students are introduced to the Marxian method and economic theory through a reading of Volume I of Capital. Subsequently, the Marxian framework is applied to analyze the modern capitalist economy with an emphasis on the secular and cyclical instability of the economy, changing institutional structures and their ability to promote growth, labor market issues, globalization, and the decline of the Soviet Union.

Prerequisite: Economics 100 or 101, or permission of the instructor.
[223b - MCSR. Africa’s Economic Prospects: Globalization and Economic Institutions.]

[225b. The Economy of Latin America. (Same as Latin American Studies 235.)]


Examines programs for economic and political integration of the Americas from the early nineteenth century to the present. Surveys the material and ideological motives for Pan-Americanism from the Congress of Panama (1826) to the Organization of American States (1948), the draft of a Free Trade Area of the Americas (2001), and beyond. Different forms of integration are evaluated in light of historical consequences and economic ideas. (Same as Latin American Studies 226.)

Prerequisite: Economics 101.


An analysis of human resource issues in the context of developing countries. Topics include the composition of the labor force by age and gender, productivity of the labor force, unemployment and informal sector employment, child labor and the health and schooling of children, and the effects of structural adjustment policies and other policy interventions on the development and utilization of human resources. Examples from selected African, Asian, and Latin American countries are integrated throughout and the interaction of sociocultural environments with economic forces is considered.

Prerequisite: Economics 101.


A study of the economic issues surrounding the existence and use of renewable natural resources (e.g., forestry/land use, fisheries, water, ecosystems, and the effectiveness of antibiotics) and exhaustible resources (such as minerals, fossil fuels, and old growth forest). A basic framework is first developed for determining economically efficient use of resources over time, then extended to consider objectives other than efficiency, as well as the distinguishing biological, ecological, physical, political, and social attributes of each resource. Uncertainty, common property, and various regulatory instruments are discussed, as well as alternatives to government intervention and/or privatization. (Same as Environmental Studies 228.)

Prerequisite: Economics 101.


A study of economic issues that occur at each age such as economics of education, career choice, marriage (and divorce), fertility, division of labor in the household, child care, glass ceilings, poverty and wealth, healthcare, elder care, and retirement. Considers age-relevant economic models, the empirical work that informs understanding, and the policy questions that emerge at each age lifecycle stage. Differences in experience based on race, gender, sexuality, income level, and national origin are an important component for discussion. Not open to students who have credit for Economics 301. (Same as Gender and Women’s Studies 231.)

Prerequisite: Economics 101.

Considers the history of American enterprise over the past two centuries. First examines key issues in the economics of the firm, entrepreneurship, and innovation during the nineteenth century (the period of the second industrial revolution). Then addresses these issues from a more recent perspective (the so-called third industrial revolution). Assesses what lessons for the twenty-first century can be learned from an examination of the development of enterprise since the nineteenth century; and analyzes the extent to which today’s “New Economy” raises novel questions for economic theory and its applications. Not open to students who have credit for Economics 208 or Economics 348.

Prerequisite: Economics 101 and 102.

255b - MCSR. Microeconomics. Every semester. The Department.

An intermediate-level study of contemporary microeconomic theory. Analysis of the theory of resource allocation and distribution, with major emphasis on systems of markets and prices as a social mechanism for making resource allocation decisions. Topics include the theory of individual choice and demand, the theory of the firm, market equilibrium under competition and monopoly, general equilibrium theory, and welfare economics.

Prerequisite: Economics 101, 102, and Mathematics 161 or the equivalent.

256b - MCSR. Macroeconomics. Every semester. The Department.

An intermediate-level study of contemporary national income, employment, and inflation theory. Consumption, investment, government receipts, government expenditures, money, and interest rates are examined for their determinants, interrelationships, and role in determining the level of aggregate economic activity. Policy implications are drawn from the analysis.

Prerequisite: Economics 101, 102, 255, and Mathematics 161 or the equivalent.

257b - MCSR. Economic Statistics. Every semester. The Department.

An introduction to the data and statistical methods used in economics. A review of the systems that generate economic data and the accuracy of such data is followed by an examination of the statistical methods used in testing the hypotheses of economic theory, both micro- and macro-. Probability, random variables and their distributions, methods of estimating parameters, hypothesis testing, regression, and correlation are covered. The application of multiple regression to economic problems is stressed. Students who have taken Mathematics 265 are encouraged to take Economics 316 instead of this course.

Prerequisite: Economics 101, 102, and Mathematics 161 or the equivalent.

260b - MCSR. Finance I. Fall 2009. GREGORY P. DECOSTER.

As the first in a two-course sequence (Finance I and II—Economics 260 and 360), provides a thorough exposure to the fundamental concepts involved in corporate financial decision-making, investment analysis, and portfolio management. In addition, presents the financial accounting principles and practices necessary to understand and utilize corporate financial statements as inputs to decision-making and valuation exercises. Topics include functions and structure of the financial system; overview of valuation—measures of return and risk, and discounted cash-flow analysis; sources of financial information—basic accounting concepts, balance sheet, income statement, statement of cash-flows, and financial ratios; portfolio theory, the capital asset pricing model, and efficient markets theory; corporate decision-making, the cost of capital, capital budgeting, and capital structure. Mathematics 161 is recommended.

Prerequisite: Economics 101 and 102.
Courses numbered higher than 300 are advanced courses in economic analysis intended primarily for majors. Enrollment in these courses is limited to eighteen students in each unless stated otherwise. Elementary calculus will be used in all 300-level courses.

**301b. The Economics of the Family.** Fall 2010 or Spring 2011. Rachel Ex Connelly.
Seminar. Microeconomic analysis of the family—gender roles and related institutions. Topics include marriage, fertility, married women’s labor supply, divorce, and the family as an economic organization. (Same as Gender and Women’s Studies 302.)
Prerequisite: Economics 255 and 257, or permission of the instructor.

Seminar. A survey of competing theories of the business cycle, empirical tests of cycle theories, and appropriate macro stabilization policies. Topics include descriptive and historical analysis of cyclical fluctuations in the United States, Keynesian-Kaleckian multiplier-accelerator models, growth cycle models, theories of financial instability, Marxist crisis theory, new classical and new Keynesian theories, and international aspects of business cycles. The current global financial crisis is also analyzed.
Prerequisite: Economics 256 or permission of the instructor.

Offers a theoretical and empirical analysis of international trade. Particular attention is given to the standard models of trade: the Ricardian model, the Heckscher-Ohlin model, the specific factors model, and the monopolistic competition model, as well as an introduction to applied general equilibrium models of trade liberalization. Also analyzes current topics such as barriers to trade (quotas, tariffs); the effects of trade liberalization on wage inequality; regional integration blocs; the globalization debate; and the relation between trade, growth, and productivity. Data analysis is used in order to evaluate the success or shortcomings of the theoretical models.
Prerequisite: Economics 255 and 256.

Seminar. A survey of theoretical and empirical evaluations of government activities in the economy, considering both efficiency and equity aspects. Topics include public choice, income redistribution, benefit-cost analysis, analysis of selected government expenditure programs (including social security), incidence and behavioral effects of taxation, and tax reform. Current public policy issues are emphasized. Not open to students who have credit for Economics 210.
Prerequisite: Economics 255 and 257, or permission of the instructor.

Seminar. A study of the mathematical formulation of economic models and the statistical methods of testing them. A detailed examination of the general linear regression model, its assumptions, and its extensions. Applications to both micro- and macroeconomics are considered. Though most of the course deals with single-equation models, an introduction to the estimation of systems of equations is included. An empirical research paper is required.
Prerequisite: Economics 257 or Mathematics 265, and Mathematics 161, or permission of the instructor.

Seminar. Analysis of externalities and market failure; models of optimum control of pollution and efficient management of renewable and nonrenewable natural resources such as fisheries, forests, and minerals; governmental vs. other forms of control of common-pool resources; and benefit-cost analysis of policies, including market-based and non-market valuation. Not open to students who have credit for Economics 218 or 228. (Same as Environmental Studies 318.)

Prerequisite: Economics 255 and 257.


Seminar. Theoretical and empirical analysis of selected microeconomic issues within the context of developing countries. Has a dual focus on modeling household decisions and on the effects of government policy and intervention on household behavior and well being. Topics include agricultural production, land use systems, technology and credit markets, household labor allocation and migration, investment in education and health, and income inequality.

Prerequisite: Economics 257 or Mathematics 265, and Economics 255, or permission of the instructor.


Seminar. Technological change represents one of the most essential conditions for economic and social progress. Examines the microeconomics of R&D, invention, innovation, and diffusion from both a theoretical and empirical perspective. Topics include the history of technology, the intellectual property system, the sources of invention and innovation, R&D joint ventures, the “information economy,” and globalization. Applications range from the industrial revolution of the nineteenth century through contemporary issues such as digital technology, biotechnology and the human genome project, Silicon Valley, and the Internet.

Prerequisite: Economics 255 and 257, or permission of the instructor.


Seminar. Law and economics is one of the most rapidly growing areas in the social sciences. The field applies the concepts and empirical methods of economics to further our understanding of the legal system. Explores the economic analysis of law and legal institutions, including the economics of torts, contracts, property, crime, courts, and dispute resolution. Also focuses on topics in law and economics such as antitrust and regulation, corporations, the family, labor markets, product liability, and intellectual property. Students are introduced to online sources of information in law, and are required to apply economic reasoning to analyze landmark lawsuits in each of these areas. Not open to students who have credit for Economics 341.

Prerequisite: Economics 255 and 257, or permission of the instructor.


Seminar. Investigates the sources of economic growth and development using cliometrics, or the quantitative study of economic history. Students are required to apply economic theories and methodology to the analysis of primary historical materials in order to produce a professional-quality research paper. Not open to students who have credit for Economics 208 or 238.


An introduction to game theory, a theory analyzing and characterizing optimal strategic behavior. Strategic behavior takes into account other individuals’ options and decisions. Such behavior is relevant in economics and business, politics, and other areas of the social sciences,
where game theory is an important tool. The main game theoretic equilibrium concepts are introduced in class and applied to a variety of economics and business problems. Elementary calculus and probability theory are used.

Prerequisite: Economics 255 or permission of the instructor.

Examines the role that money plays in market economies. Monetary policies, fiscal policies, and payment systems are studied. Particular attention is given to how inflation and taxes affect saving, investment, and output. The interaction of money with other assets, the banking system, forms of credit, and alternatives to fiat money are also investigated.

Prerequisite: Economics 255 and 256.

A continuation of Economics 260. The focus is essentially two-fold: (1) What are the sources of business value, and how can it be created? (2) How can the uncertainty and risk inherent to intertemporal choices, i.e., capital accumulation, be “managed”? Involves analysis of business strategy with regard to both operations and financing decisions; the pricing and uses of financial derivatives (i.e., futures, options, and swaps); sources of risk and basic risk management techniques; and an examination of recent insights from behavioral finance.

Prerequisite: Economics 255 and 260.

401b–404b. Advanced Independent Study and Honors in Economics. The Department.

Education

Charles Dorn, Department Chair
Lynn A. Brettler, Department Coordinator

Associate Professors: Nancy E. Jennings†, Charles Dorn
Assistant Professor: Doris A. Santoro**
Lecturer: Kathleen O’Connor
Visiting Faculty: Kathryn Byrnes, Kenneth S. Templeton
Fellow: Mariana M. Cruz

Bowdoin College does not offer a major in education.

Requirements for the Minor in Education

The department offers two minors: a Teaching minor for students who plan to teach in some capacity following graduation and an Education Studies minor for those who do not. Four courses are required for the Education Studies minor: either Education 20 or 101 and three others chosen from among Education 202, 203, 204, 205, 221, 235, 245, 250, 251, 305, 310. Four courses are required for the Teaching minor: Education 20 or 101, 203, 301, 303. Students may only count graded courses (not Credit/D/Fail) toward either minor. Students must earn a grade of C- or better in order to have a course count toward either minor in education. Students must earn a grade of C- or higher in all prerequisite courses.