

COURSES OF INSTRUCTION

First year Courses

Calculus I, Required, Weekly hours: 5, ECTS units: 6.

V. Sevroglou

Real Numbers, Algebra of Sets, Relations and Basic Functions, Sequences, Convergence, Limit Theorems, Infinite Limits, Limits of Functions, Limit at a Real Number, Sided Limits, Continuity, Continuity of a Function, Discontinuity of a Function, Properties of Continuous Functions, Differentiation, Derivative of a Function, Properties of Differentiable Functions, Higher Order Derivatives, L' Hopital's Rules, Maximum and Minimum of Functions, Critical Points, Integration, Riemann Integral, Integrable Functions, Properties of the Riemann Integral, Improper Integrals.

Essential Reading:

- R.L. Finney, M.D.Weir, F.R. Giordano (2009) Calculus Vol. I, University of Crete (Translated Into Greek)
- R. Bartle and D. Sherbert (1982), Introduction to Real Analysis, John Wiley & sons, inc.
- T Apostol (1967), Calculus, Vol. I, Xerox, Wattham (Translated Into Greek)

Introduction to Insurance, Required, Weekly hours: 4, ECTS units: 4.

M. Nektarios

This is an introductory course in risk management and insurance. The first part presents the basic analysis of insurance mechanisms and the pricing of premiums. The second part analyses the legal and insurance principles of insurance contracts. The third part presents the main insurance policies in Life insurance, individual and group; as well as in Property and Liability. The last part presents the operation of insurance companies and the framework of insurance supervision.

Essential Reading:

- Nektarios. M. (2003). Introduction to Private Insurance. FORUM Editions, Athens (In Greek)

Applied Linear Algebra, Required, Weekly hours: 5, ECTS units: 6.

G. Psarrakos

Algebraic group, Semi group, Ring, Field, Euclidean space R^n , Coordinates, Geometric interpretation, Vector spaces and subspace, Linear independence, Basis, Dimension, Kernel, Image, Inner and exterior product, Linear functions, Matrices, Matrix operators, Matrix multiplications, Identity, scalar, diagonal and null matrices, Determinant, Matrix inverse, Linear transformations, Rank, Linear systems, Gaussian elimination, Cramer's rule, rules of rank.

Essential Reading:

- Kyriazis, A. (2006), Applied Linear Algebra, Interbooks Editions (in Greek).
- G. Strang (2009) Linear Algebra and Applications, University of Kriti Editions (Translated Into Greek)

Microeconomic Theory, Required, Weekly hours: 4, ECTS units: 4.

A. Panopoulou

This course provides an overview of microeconomic theory at the beginning undergraduate level. The course focuses on topics such as consumer theory, producer theory, market equilibrium, monopoly, and oligopoly. More in detail, the topics covered are the following: Budget Constraint, Preferences and Utility, Choice and Demand, Market Demand, Technology, Cost Minimization and Cost Curves, Firm and Industry Supply, Equilibrium, Monopoly, Oligopoly.

Essential Reading:

- Hal Varian (2006) Microeconomic: A modern approach, Volume I & II, Kritiki Editions (Translated into Greek).
- Michael Katz, Harvey S. Rosen (2007) Microeconomic, Kritiki Editions (Translated into Greek).

Descriptive Statistics, Required, Weekly hours: 5, ECTS units: 5.

G. Tzavelas – K. Politis

Introduction, scope of statistics. Population and sample. Types of statistical data. Random variables and their types.

The role of exploratory analysis. Graphical and tabular displays. Bar charts, histograms, frequency and cumulative frequency polygons, stem and leaf plots.

Introduction to time series, index numbers and cross-sectional data.

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Summary statistics: Arithmetic, geometric and harmonic average. Median and mode. Properties and examples. Extreme values. Box plots.

Summary statistics for grouped data. Calculation for the median, quartiles and the mode for grouped data.

Measures of variability. Variance, standard deviation, and absolute deviation. Properties and formulae for grouped data.

Moments, measures for skewness and kurtosis.

Bivariate populations. Two-way tables, conditional moments.

Independence and correlation between two variables. Covariance and sample correlation coefficient.

Essential Reading:

- Anderson, T. W. and Finn, J. D. (1996) *The New Statistical Analysis of Data*. Springer Verlag.
- Fisher, R. A. (1970) *Statistical Methods for Research Workers* (14th ed) Edinburgh, Oliver and Boyd.
- Freedman, D., Pisani, R. and Purves, R. (1978) *Statistics*. W.W.Norton & Co. N.Y.
- Mood, A., Graybill, F. and Boes, D. (1974) *Introduction to the Theory of Statistics* McGraw-Hill,.
- Tukey, J. W. (1977) *Exploratory Data Analysis*. Addison Wesley.
- Ott, R. L. (1993) *An Introduction to Statistical Methods and Data Analysis* (4th ed.) Belmont, CA: Duxbury Press.
- Yamane, T. (1973) *Statistics, An introductory Analysis*. Harper International.

Computers Lab, Required, Weekly hours: 4, ECTS units: 5.

E. Kofidis-G.Verropoulou-N.Pelekis

This course aims at familiarizing students with computers, starting from basic operations and going on to MS-Office applications. Special emphasis is put on the use of Excel for (statistical) data analysis. The latter part includes fundamentals of Excel and a number of applications in problems of Descriptive Statistics.

Essential Reading:

- Albright, C. S., Winston, W.L., Zappe, C. (1999) *Data Analysis and Decision Making with Microsoft Excel*. Duxbury Press.
- Berk, K.N., Carey, P. (1998) *Data Analysis with Microsoft Excel*. Duxbury Press.

Calculus II, Required, Weekly hours: 5, ECTS units: 6.

V. Sevoglou

Sequences and Series of Functions, Power Series, Taylor Series, Infinite Series, Convergence, Tests for Convergence, Ratio and Root Tests, Vector Calculus, Cartesian, Cylindrical and Spherical Coordinates in R^3 , Vectors in R^2 and R^3 , Dot Product and Cross Product, Inner Product, Polar Coordinates, Functions of Two Variables, Limits and Continuity, Partial Derivatives, Differentiation, Directional Derivative, Chain Rule, Maximum and Minimum for Functions of Two and Three Variables, Critical Points, The Method of Lagrange Multipliers, Multiple Integration, Double Integrals, Triple Integrals, Change of Variables, Integrals Over General Regions.

Essential Reading:

- G.B. Thomas, R.L. Finney, M.D.Weir, F.R. Giordano (2009), Calculus Vol. II, University of Crete (Translated into Greek)

Introduction to Computer Science, Required, Weekly hours: 4, ECTS units: 5.

E. Kofidis - N.Pelekis

The aim is to introduce the students to fundamentals of computer science, with emphasis on computer programming. The main part of the course is about programming in C, with applications in statistics. Lectures are accompanied by weekly lab exercises.

Essential Reading:

- Kelley, A., Pohl, I. (1997) A Book on C: Programming in C, 4th ed. Addison-Wesley.
- Deitel, H. M., Deitel, P. J. (2003) C: How to Program, 4th ed. Prentice-Hall.
- Schildt, H. (1986) Advanced C. McGraw-Hill.

Macroeconomic Theory, Required, Weekly hours: 4, ECTS units: 5.

Pl. Tinios

This course introduces the basic principles of Macroeconomics: The national accounts. The determination of full employment output, the labour market, Theories of consumption and investment, monetary theory – the supply and the demand for money, the IS-LM model, National debt dynamics, the problems of inflation and unemployment, Open economy macroeconomics.

Essential Reading:

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- Andrew B. Abel, Ben S. Bernanke και Dean Croushore (2010) Macroeconomic. Kritiki Editions (Translated into Greek).
- N.G.Mankiw (2000) Principles of Economics, Harcourt International

Probability I, Required, Weekly hours: 5, ECTS units: 6.

D. Antzoulakos - K.Politis

Concept of probability: Sample space and events, Axioms of probability, Properties of probability, Sample spaces having equally likely outcomes, combinatorial methods (basic counting principles, permutations, combinations).

Conditional probability and independence: Conditional probability, Law of multiplication, Law of total probability, Bayes' formula, Independent events.

Distribution functions and discrete random variables: Random variables, Distribution functions, discrete random variables, Probability mass function, Expectation, Variance and moments of discrete random variables.

Special discrete distributions: Bernoulli trials, Bernoulli and binomial distributions, Geometric and negative binomial distributions, Hyper geometric distribution, Poisson process, Poisson distribution.

Continuous random variables: Probability density function, Distribution of a function of a continuous random variable, Expectation, Variance and moments of continuous random variables.

Special continuous distributions: Uniform distribution, Normal distribution, Exponential distribution, Gamma and Beta distribution.

Essential Reading:

- Feller, W. (1968) An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Freund, J. (1992) Mathematical Statistics. Prentice Hall.
- Hogg , R. & Tanis, E. (2006) Probability and Statistical Inference, Seventh Edition, Pearson International Edition.
- Hogg , R., McKean, J. & Craig, A. (2005) Introduction to Mathematical Statistics, Seventh Edition, Pearson International Edition.
- Meyer, P. L. (1970) Introductory Probability and Statistical Applications. Addison Wesley, Reading Mass.
- Olkin, I.,Glesser, and Derman, C. (1980) Probability Models and Applications Macmillan Publ. Co, N.Y

Algebra, Elective, Weekly hours: 4, ECTS units: 4.

V. Sevoglou

Bilinear illustrations, Unitary space, Diagonalization, generalized eigenvectors, canonical forms Jordan. Quadratic forms, extreme function, Details algebra of polynomials, Linear Transformations, Linear Programming.

Essential Reading:

- Seymour Lipschitz, Marc Lipson (2005) Linear Algebra, SCHAUM, Tziola Editions (Translated into Greek)

General Insurance, Elective, Weekly hours: 4, ECTS units: 4.

M. Nektarios

This course is about business insurance. The first part deals with the objective of risk management for a business firm. The second part analyses the pricing of insurance products and the structure of insurance policies. The third part presents the main business insurance policies for property damage, business interruption, third-party liabilities, cargo and marine insurance.

Essential Reading:

- Nektarios, M. (2010). Risk Management and Insurance Operations. Stamouli Editions, Athens. (In Greek)

Management Information Systems, Elective, Weekly hours: 4, ECTS units: 4.

N. Pelekis

The course aims at a thorough study of subjects related to Management Information Systems (MIS) and is structured in two parts. In the first part of the course are the basic definitions for MIS and categorization and correlation with organizational levels and business processes of an organization. Specifically, it examines issues such as (without limitation): the organizational structure of the "digital" business, the role of MIS in business, the effects of MIS in organizations and organizational structures. We will also present the technological infrastructure for GSN, various types and models of infrastructure, the dependence of the MIS databases where organized and stored vast amounts of data. The second part focuses on the analysis (Who uses the system what to do, where and how to use the system and design;) (How the system works;) systems presenting relevant theoretical, technical and methodological issues. Presentation of the different phases of development of information systems, systems analysis learning activities using

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the basic symbolism of unified modeling language systems (UML) (e.g. use cases, class diagrams, charts cooperation, action diagrams, charts mapping the states of a system).

Essential Reading:

- Alter S. (2002) Information Systems: Foundation of e-business. Prentice-Hall.
- O'Brien, J. A. (1997) Introduction to Information Systems. Irwin.
- O'Brien, J. A. (2004) Management Information Systems: Managing Information Technology in the Business Enterprise. McGraw-Hill.
- Oz, E. (2006) Management Information Systems. Thompson Course Technology.
- Post, G. V. (2005) Database Management Systems: Designing and Building Business Applications. McGraw-Hill.
- Turban, E. (2006) Information Technology for Management: Transforming Organizations in the Digital Economy. John Wiley & Sons.

Combinatorics, Elective, Weekly hours: 3, ECTS units: 4.

H. Evangelaras

The course aims to give students all the necessary skills in order to be able to enumerate arrangements of items. The assimilation of both concepts and tools is made with simple examples and with applications that are related to everyday problems of practical interest. The course also aims to prepare the students, so that they can then easily tackle the relevant problems of probability theory. Topics that are covered in this course include basic enumeration principles, combinations and permutations with or without replication, factorials, binomial coefficients and the binomial theorem, the multinomial theorem, the principle of inclusion and exclusion, integer solutions of linear equations.

Essential Reading:

- Anderson I. A. (1974) A First Course in Combinatorial Mathematics. Clarendon Press, Oxford.
- Berge C. (1971). Principles of Combinatorics. Academic Press, N.Y
- Bose, R.C. and Manvel, B. (1984) Introduction to Combinatorial Theory. Wiley, N.Y.
- Brualdi, R.A. (1999) Introductory Combinatorics. Prentice Hall, N.J.
- Cohen, D.I.A. (1978) Basic Techniques of Combinatorial Theory. Wiley, N.Y

Second Year Courses

Insurance Law, Required, Weekly hours: 4, ECTS units: 5.

A. Sinanioti

Introduction to Insurance Law. Sources of Insurance Law. Insurance-Insurance Contract. General insurance law provisions for insurance losses. The main types of life insurance. Marine insurance. Insurance Card. Auxiliary Fund and Office of International Security. The law on private security firm. The law on private security firm. Community law on private insurance and intermediaries

Demography, Required, Weekly hours: 4, ECTS units: 5.

Cl.Tsimpos – G.Verropoulou

Aim of course: Introduction to concepts of demographic characteristics and phenomena, presenting the basic techniques of demographic analysis and linkages with demographic, economic and social phenomena. Infrastructure for electives domain knowledge Demography. Basic demographic analysis principles, concepts and definitions. Chronological and genealogical analysis. Sources of errors and demographics. Graphic depictions. Study of mortality, genealogical analysis and annual indicators. Life tables, theory and applications. Analysis of fertility, annual indicators and characteristics of the distributions of births. Census fertility. Condition population. Breakdown by sex and age pyramids ages. Composition of the population by marital status, economic characteristics of the population. Applications.

Essential Reading:

- Newell, C. (1988). *Methods and Models in Demography*, London: Belhaven Press.
- Roland, D. T. (2003). *Demographic Methods and Concepts*, Oxford: Oxford University Press.
- Weinstein, J. and V.K.Pillai (2001). *Demography, The Science of Population*. London: Allyn and Bacon.

Introduction to Accounting, Required, Weekly hours: 4, ECTS units: 5.

Ch. Alexakis

Introduction, Balance Sheet, Inventory, accounting event, Identification, measurement and display of accounting profit, Income Statement, Account and project accounts, Ac-

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counting and audit process circuit, Detailed, general ledger, Calendar, Principles of valuation and accounting issues handling assets, Applications.

Essential Reading:

- P. Efthimoglou (2001). Financial Accounting, Volume I. Efthimoglou Editions (in Greek)
- G. Alifadis (2008) Financial Accounting, Volume I, Business Group TOTSI (In Greek)

Probability II, Required, Weekly hours: 5, ECTS units: 6.

D. Antzoulakos – M. Koutras

Bivariate distributions: Joint distribution of two random variables, Marginal distributions, Expectation of a function of two random variables, Conditional distributions, Conditional expectations, Geometric probability, Covariance and correlation coefficient

Multivariate distributions and independence: Joint distribution of $n > 2$ random variables, Independent random variables, Random sample, Order statistics.

Distributions of functions of random variables: Joint distribution of functions of two random variables, Distribution of sum, difference, product and ratio of two random variables, Chi-square distribution, Student's t distribution, F distribution.

Special multivariate distributions: Multinomial distribution, Multivariate hypergeometric distribution, Bivariate Normal distribution.

Generating functions: Moment generating function, Probability generating function, Characteristic function, Generating functions of sums of independent random variables, Generating functions of multivariate distributions.

Limit Theorems: Convergence of a sequence of random variables, Weak law of large numbers, Strong law of large numbers, Central limit theorem.

Essential Reading:

- Feller, W. (1968) An Introduction to Probability Theory and its Applications. Wiley, N.Y.
- Freund, J. (1992) Mathematical Statistics. Prentice Hall.
- Hogg, R. & Tanis, E. (2006) Probability and Statistical Inference, Seventh Edition, Pearson International Edition.
- Hogg, R., McKean, J. & Craig, A. (2005) Introduction to Mathematical Statistics, Seventh Edition, Pearson International Edition.
- Meyer, P. L. (1970) Introductory Probability and Statistical Applications. Addison Wesley, Reading Mass.
- Pitman, J. (1993) Probability. Springer-Verlag, N.Y.
- Ross, S. (2006) A First Course in Probability, Seventh Edition, Pearson International Edition.

Financial Mathematics, Required, Weekly hours: 4, ECTS units:5.

Th. Artikis

Capital, Interest Rate, Interest, Simple Future Value, Simple Present Value, Discrete Compounding, Discrete Discounting, Continuous Compounding, Continuous Discounting, Discrete Cash Flows, Compounding of Discrete Cash Flows, Discounting of Discrete Cash Flows, Continuous Cash Flows, Compounding of Continuous Cash Flows, Discounting of Continuous Cash Flows.

Stochastic of Considerations of Simple Future Value, Simple Present Value, Discrete Compounding, Discrete Discounting, Continuous Compounding, Continuous Discounting, Discrete Cash Flows, Compounding of Discrete Cash Flows, Discounting of Discrete Cash Flows, Continuous Cash Flows, Compounding of Continuous Cash Flows and Discounting of Continuous Cash Flows.

Fundamental Concepts of Loans, Types of Loans, Basic Financial Derivatives.

Essential Reading:

- Alexandri. N. (1989) Financial Mathematics. Stamouli Edition (In Greek)
- Papamihail. D. (1993) Financial Mathematics. Stamouli Edition (In Greek)

Numerical Analysis, Elective, Weekly hours: 4, ECTS units: 4.

E. Kofidis

The course's subject is numerical methods for computer-aided mathematical problem solving. Theory is accompanied by programming of the methods and their practical applications. Main chapters: computer arithmetic; errors: analysis and propagation; linear systems solvers: direct and iterative methods; computing eigenvectors and eigenvalues; polynomial interpolation methods; solving nonlinear equations; numerical differentiation and integration.

Essential Reading:

- Burden, R. L., Douglas, Faires J. (1997) Numerical Analysis, 6th ed., Brooks/Cole.
- Ralston, A., Rabinowitz, P. (1978, 2001 reprint) A First Course in Numerical Analysis, 2nd ed., NY: Dover Publications
- Monahan J. F. (2001) Numerical Methods of Statistics, Cambridge University Press.

Commercial Law, Elective, Weekly hours: 3, ECTS units: 4.

A. Sinanioti

Commercial law. The meanings and significance. Branches of commercial law. Trade. A trader and consequences. Commercial capacity. Commercial enterprise. The concept of a trading company. Legislation and commercial companies such discrimination. Legal personality and commercial status of these companies. Personal and limited companies. The liability of the partners. Management of companies. Industrial Property (name, mark, trade name, patents, industrial designs, computer programs). Competition (unfair competition, free competition, prohibited agreements, abuse of dominant position, abuse of economic dependence, concentration, procedural competition law). Banking and Brokerage Services. E-Commerce. Electronic Banking.

Essential Reading:

- Karsten Schmidt/Marcus Lutter (2008) Aktiengesetz Kommentar, Band I und II.
- Germain, M. (2002) Les sociétés commerciales.

Social Insurance, Elective, Weekly hours: 4, ECTS units: 4.

Pl. Tinios

Introductory Concepts. Distinction welfare and social Insurance. The concept and measurement of poverty. The concept of reciprocity. Reasons of state involvement in social security. The approach of the Lisbon Strategy in the EU.

Social protection systems. Definitions of social protection. The European System of Social Protection Statistics. Stylized facts for social spending in Greece compared with the EU. Classifications of the welfare states. The Mediterranean welfare state. Globalization and the Open Method of Coordination in the EU.

Social Insurance Pensions A: Topics of the Greek social security as addressed in various stages of the life cycle: (a) entry to employment (b) mid-career, (c) pension vesting (d) retirement (e) pensioners' issues (f) survivors' pensions.

Social Insurance Pension B: Financing schemes (PAYG - funded). Pensions and macroeconomics - what is the weight of pensions? Aging population and its impact on social insurance. Strategies to address the pension problem. Immigration as a solution. Changes possible in funding models. Problems of transition from one funding system to another. The Greek and international experience in pension reform.

Health-Sickness Insurance. Peculiarities of health care as an economic good. Public Health Insurance in Greece: Insurance Funds and the NHS. Role of public and private sector in service delivery and health insurance.

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Essential Reading:

- Tinios Pl. (2010) Insurance: A reading method, Kritiki Editions (In Greek)
- Tinios Pl. (2003) Development with Solidarity. A framework for the pensions of the new century, Papazisi Editions (In Greek)

Sociology, Elective, Weekly hours: 3, ECTS units: 4.

H. Nina-Pazarzi

Scope, methodology and basic concepts of Sociology in the industry. Relationship of Sociology with other social sciences. The first theorists of Sociology. The classics of sociology: Karl Marx, Max Weber. The classics of sociology: Emile Durkheim, G. Simmel, V. Pareto. Major Sociology: Functionalism. Major sociological Approaches: Approaches conflict. Approaches exchange. Main sociological Approaches: Approaches interaction. Nation method. Phenomenology. Methods of Social Science. Issues of social psychology: Major theories. Issues of social psychology: Socialization. Issues of social psychology: Attitudes. Issues of social psychology: Social groups.

Essential Reading:

- Baron R.& Byrne D. (1997) Social Psychology, Mass.
- Cabin Ph. et Dortier J.-F. (2000) La Sociologie. ed. Editions Sciences Humaines, Paris.
- Giddens A. (2000) Sociology, Oxford : The Polity Press.
- Haralambos & Holborn (2000) Sociology. Themes and Perspectives. London, Unwin Hyman.
- Macionis J. & Plummer K., (1997) Sociology. A Global Introduction, New Jersey, Prentice – Hall.

Real Analysis, Elective, Weekly hours: 4, ECTS units: 4

N.D. Macheras

Elementary set theory, countable and uncountable sets (infinite Cartesian product, choice axiom), σ -algebras over a set, real numbers (axioms of algebraic fields, order axioms, completeness axiom, choice axiom, continuum hypothesis), sequences of real numbers, double series, open and closed sets and Borel sets in the set \mathbb{R} of the real numbers, measurable functions and random variables, functions of bounded variation, Riemann-Stieltjes integral, Lebesgue integral

Essential Reading:

- Royden H.L. (1988) Real analysis, 3rd ed, Macmillan, NY.
- Ash, R.B. (1972) Real Analysis and Probability, Academic Press, NY.

Actuarial Mathematics, Required, Weekly hours: 5, ECTS units: 7

E. Chatzikonstantinidis – Sp. Vrontos

The course's objective is to introduce the student to the most important actuarial mathematical models, such as the Individual Risk Model and the Collective Risk Model. Furthermore, emphasis is given in the applications of these models in non-life insurance, life insurance and reinsurance. More specifically we are considering:

Decision making under uncertainty. Premium calculation principles and their properties. Utility theory and its applications in insurance. Risk aversion and risk appetite. Jensen inequality.

Coverage Modifications (Deductible, Policy Limit, Coinsurance). Reinsurance schemes. Proportional and non - proportional (excess-of-loss, stop-loss) insurance and reinsurance schemes. Calculation of moments of losses covered by the insurer and the reinsurer. Optimality of the excess-of-loss insurance.

Individual Risk Model. Convolutions. Direct and recursive method of calculation of the distribution of the aggregate loss for an insurance portfolio. Moment generating functions, moments of the aggregate loss and approximations of the distribution of the aggregate loss. Applications in non-life and life insurance of short term.

Collective Risk Model of one period. Models of compound distributions for the distribution of the aggregate loss. Analytic results for the calculation of the distribution of the aggregate loss. Compound Poisson, compound Binomial and compound Negative Binomial distribution and their properties. Calculation of the distribution of the aggregate loss using recursive formulas. Panjer, Jewell and Sundt distribution families.

Mixed Poisson and Compound Mixed Poisson distributions and their properties. Sichel, Poisson – Inverse Gaussian, Generalized Poisson-Pascal distribution. Compound Poisson approximation of the Individual Risk Model.

Excess of loss and stop loss reinsurance. Distribution of losses covered by the insurer and reinsurer. Loss elimination ratio and mean excess loss. Tail behavior of compound distributions and stop loss premiums. Distribution of dividends payable by the insurer.

Essential Reading:

- Booth P., Chadburn R., Haberman S., and James D. (2004). *Modern Actuarial Theory and Practice*. Chapman & Hall
- Bowers N.L., Gerber H.U., Hickman J.C., Jones D.A. and Nesbitt C.J. (2002) *Actuarial Mathematics* Society of Actuaries, Ithaca.
- Kaas R., Goovaerts M., Dhaene J., and Denuit M. (2004). *Modern Actuarial Risk Theory*. Kluwer Academic Publishers.

Corporate Finance, Required, Weekly hours: 4, ECTS units: 6

M. Glezakos

The environment of the economic units:-Macroeconomic structure. Legal forms of the economic unit. The Financial System. The Financing Function. Time value of money. Methods of investment appraisal. Cost of Capital. Break-even point. Working capital management. Leasing. Financial ratios.

Essential Reading:

- PRINCIPLES OF FINANCE, M. Glezakos (in Greek)
- Brealey R. and Myers St. Principles of Corporate Finance. McGraw Hill, N.Y.
- Copeland T. and Weston J. Financial Theory and Corporate Policy. Addison-Wesley Publishing Company, N.Y.

Life Insurance I, Required, Weekly hours: 4, ECTS units: 6

E. Chatzikonstantinidis

Life insurance and annuity contracts. Traditional insurance contracts. Modern insurance contracts. Distribution methods. Underwriting. Premiums. Life annuities. Other insurance contracts. Pension benefits. Defined benefit and defined contribution pensions. Defined benefit pension design. Mutual and proprietary insurers.

Survival models. The future lifetime random variable. The force of mortality. Actuarial notation. Mean and standard deviation of T_x . Curtate future lifetime. K_x and e_x . The complete and curtate expected future lifetimes.

Life tables and selection. Life tables. Fractional age assumptions. Uniform distribution of deaths. Constant force of mortality. National life tables. Survival models for life insurance policyholders. Life insurance underwriting. Select and ultimate survival models. Notation and formulae for select survival models. Select life tables.

Insurance benefits. Valuation of insurance benefits. Whole life insurance: the continuous case. Whole life insurance: the annual case. Whole life insurance: the m thly case. Recursions. Term insurance. Pure endowment. Endowment insurance. Deferred insurance benefits. Relation between premiums. Using the uniform distribution of deaths assumption. Using the claims acceleration approach. Variable insurance benefits. Functions for select lives.

Annuities. Review of annuities-certain. Annual life annuities. Whole life annuity-due. Term annuity-due. Whole life immediate annuity. Term immediate annuity. Annuities payable continuously. Whole life continuous annuity. Term continuous annuity. Annuities payable m times per year. Life annuities payable m times a year. Term annuities payable m times a year. Comparison of annuities by payment frequency. Deferred annuities. Guaranteed annuities. Increasing annuities. Arithmetically increasing annuities.

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Geometrically increasing annuities. Evaluating annuity functions. Recursions. Applying the UDD assumption. Woolhouse's formula. Functions for select lives.

Premium calculation. The present value of future loss random variable. The equivalence principle. Net premiums. Gross premium calculation. Profit. The portfolio percentile premium principle. Extra risks. Age rating. Constant addition to μx . Constant multiple of mortality rates.

Policy values. Policies with annual cash flows. The future loss random variable. Policy values for policies with annual cash flows. Recursive formulae for policy values. Annual profit. Asset shares. Policy values for policies with cash flows at discrete intervals other than annually. Recursions. Valuation between premium dates. Policy values with continuous cash flows. Thiele's differential equation. Numerical solution of Thiele's differential equation. Policy alterations. Retrospective policy value. Negative policy values.

Essential Reading:

- D. C. M. Dickson, M. R. Hardy and H. R. Waters, (2009). Actuarial Mathematics for Life Contingent Risks. International Series on Actuarial Science, Cambridge University Press.
- N. L. Bowers, H. U. Gerber, J. C. Hickman, D. A. Jones and C. J. Nesbitt, (2002). Actuarial Mathematics. The Society of Actuaries, Ithaca.

Statistics I: Estimation Theory, Required, Weekly hours: 5, ECTS units: 7

G. Iliopoulos – G. Tzavelas

Basic notions (parameter, parameter space, data, random sample, statistic, estimator, estimate). Families of distributions, exponential family. Mean squared error, nonexistence of uniformly better estimator. Unbiased estimators, unbiasedness of sample mean and sample variance.

UMVU estimators, uniqueness of UMVU estimators. Cramer-Rao inequality, Fisher information. Sufficiency, Factorization (Neyman-Fisher) Theorem, Rao-Blackwell Theorem. Completeness, Lehmann-Scheffe Theorem. Properties of sample mean and sample variance for normal samples, Basu's Theorem.

Maximum likelihood estimation. Method of moments estimation.

Asymptotic properties: consistency, asymptotic normality, asymptotic efficiency, asymptotic relative efficiency. Delta method. Asymptotic properties of maximum likelihood estimators. Empirical distribution function, Glivenko-Cantelli Theorem.

Confidence intervals (c.i.) and bounds. Pivotal quantity. Quantiles. Equal tail and minimum length confidence intervals.

C.i. for the parameters of normal populations (c.i. for the mean and the variance, c.i. for the difference of means and the ratio of variances).

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Asymptotic confidence intervals (a.c.i.): a.c.i. for one proportion and the difference of two proportions, for the Poisson mean, a.c.i. based on maximum likelihood estimators.

Essential Reading:

- Casella, G. and Berger, R.L. (2002). Statistical Inference. 2nd ed. Duxbury Press.
- Hogg, R.V. and Craig, A.T. (1995). Introduction to Mathematical Statistics. 5th ed. New York: MacMillan.
- Mood, A.M., Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics. 3rd ed. McGraw Hill Higher Education.

Life and Health Insurance, Elective, Weekly hours: 4, ECTS units: 4

M. Nektarios

This course analyses the full spectrum of personal insurance policies. The basic principles of life-cycle planning are presented and the appropriate insurance policies are developed and analyzed as supplementary protection mechanisms to those of social insurance. An extensive discussion of life and health insurance policies is undertaken, both at the individual and group level.

Essential Reading:

- Nektarios, M. (2003) "Life and Health Insurance", Stamoulis Editions, Athens (in Greek)

Differential Equations, Elective, Weekly hours: 3, ECTS units: 4

V. Sevoglou

The Nature of Differential Equations, Introduction, Remarks on Solutions, Applications, First Order differential Equations, Equations of Separable Variables, Linear Differential Equations, Bernoulli and Riccati Differential Equations, Reduction of Order, Exact Equations, Integrating Factors, Second Order Linear Equations, Introduction, The General Solution of the Homogeneous Equation, The Homogeneous Equation with Constant Coefficients, The Method of Undetermined Coefficients, The Method of Variation of Parameters, Laplace Transforms, Introduction, Applications to Differential Equations, Derivatives and Integrals of Laplace Transforms, Applications.

Essential Reading:

- W.W. Boyce, R.C. Di Prima (1999), Differential Equations and Boundary Value Problems, National Technical University of Athens (Translated In Greek)

Operations Research, Elective, Weekly hours: 4, ECTS units: 4

E. Kofidis

The course aims at familiarizing students with the basic concepts and tools of Operations Research, concentrating on Linear Programming (LP). It is divided into two parts. The first is an introduction to the theory of LP and includes the graphical and simplex methods for solving LP problems. Duality theory for LP and introductory sensitivity analysis are also included here. Computer-aided LP is demonstrated with the aid of Excel (Solver). The second part is concerned with special LP problems, including transportation and assignment problems as well as network analysis problems, with emphasis on those of shortest path, minimum spanning tree, and maximum flow.

Essential Reading:

- R. Bronson and G. Naadimuthu, Schaum's Outline of Operations Research, 2nd edition, McGraw-Hill, 1997.
- A. H. Taha, Operations Research: An Introduction, 9th edition, Prentice-Hall, 2010.
- F. S. Budnick, Applied Mathematics for Business, Economics, and the Social Sciences, 4th edition, McGraw-Hill, 1993 (Chapters 10-12).

Entrepreneurship I, Elective, Weekly hours: 4, ECTS units: 4

J. Hassid - I. Fafaliou

This is an introductory course to the concept and practice of Entrepreneurship. The main purpose is to introduce the basic theoretical framework of entrepreneurship, to explore the various dimensions of new ventures creation in start-up firms and small and medium sized enterprises (SMEs), as well as to present practical implications of entrepreneurship during the entire business life-cycle. The emphasis is on a better understanding of the entrepreneurial activity in SMEs, the new venture creation and the entrepreneurship of nascent entrepreneurs, the impact of the social networking, as well as the economics of start-ups and SMEs. Furthermore, the course investigates the different stages of start-ups' development and puts extra emphasis on the potentially last stage (decline and closure) of a business life-cycle. It also focused on the financial tools and techniques that assist start-ups and SMEs, and on public policies for encouraging entrepreneurship. Each section includes theory presentation and case studies analysis (national or International evidence).

Keywords: Entrepreneurship, Corporate Entrepreneurship, Start-up firms, Small and Medium Sized Enterprises.

Essential Reading:

- "Entrepreneurship for small and medium sized enterprises ", David J. Storey – Francis J. Greene – Joseph Hassid and Irene Fafaliou, Pub: Kritiki , 2011 (In Greek)

Third Year Courses

Life Insurance II, Required, Weekly hours:4, ECTS units:6

D. Antzoulakos

Insurance models including expenses: Gross premiums and reserves, Withdrawal benefits, Types of expenses, Algebraic foundations of accounting, Asset shares, Modified prospective loss and modified reserves.

Multiple life functions: Joint distribution of future lifetime of two or more lives, Joint survival function, Joint-life status and last-survivor status, Force of mortality of a survival status, Curtrate future lifetime of a survival status, Insurance and annuity benefits depending on survival of two lives, Special mortality assumptions, Compound statuses, Contingent probabilities and insurances, Reversionary annuities.

Multiple decrement models: Causes of decrement, Force of decrement for each cause of decrement, Random survivorship group, Deterministic survivorship group, Multiple decrement table and its associated single decrement tables, Net probabilities of decrement, Central rates of multiple decrement, Constant force and uniform assumption for multiple decrements, Applications of multiple decrement theory in insurance, pension and social security.

Multi-state transition models: Basic concepts on Markov chains, Actuarial present value and cash flows upon transition, Actuarial present value and cash flows while in states, Benefit premiums and reserves.

Essential Reading:

- Newton L. Bowers, Hans U. Gerber, James C. Hickman, Donald A. Jones & Cesil J. Nesbitt (1997) *Actuarial Mathematics*, Published by "The Society of Actuaries", Schaumburg, Illinois.
- Hans, U. Gerber (1997) *Life Insurance Mathematics*, Third Edition, Springer Verlag.
- Gupta, A. K. & Varga, T. (2002) *An Introduction to Actuarial Mathematics*, Kluwer Academic Publishers.
- Menge, W. O. & Fischer, C. H. (1965) *The Mathematics of Life Insurance*, Macmillan Company.
- Alistair Neill (1977) *Life Contingencies*, Butterworth-Heinemann Ltd.
- Chester Wallace Jordan, Jr. (1975) *Life Contingencies*, Second Edition, Published by "The Society of Actuaries", Schaumburg, Illinois.

Loss Distributions, Required, Weekly hours:4, ECTS units:6

E. Chatzikonstantinidis – Sp. Vrontos

The course's objective is to introduce the student to the most important loss distributions. We examine the properties, the methods of estimation of their parameters and applications in insurance and reinsurance. More specifically we are considering:

Loss distributions and aggregate payment models. Heavy-tailed loss distributions.

The family of transformed Beta distributions (transformed Beta, generalized Pareto, Burr, Loglogistic, Paralogistic and Inverse Paralogistic distribution) as loss models.

The family of transformed Gamma distributions (transformed Gamma, Gamma, Inverse Gamma, Weibull, Inverse Weibull, Exponential and Inverse Exponential distribution) as loss models.

Lognormal, loggamma, Inverse Gaussian distribution and mixtures of distributions as loss models.

Model-free and parametric estimation of distributions. Advantages of parametric estimation of distributions. Estimation employing simulation. Point estimation and interval estimation. Algorithms and Bayesian inference .

Tests of statistical hypotheses and testing the goodness of fit of loss distributions.

Ungrouped data and grouped data. Truncated and shifted data. Truncation from below and truncation from above.

Inflation, percentile estimation, deductibles, leveraging, limits, applications in insurance and reinsurance. Comparisons of distributions with heavy tails.

Essential Reading:

- Hogg R. and Klugman S. (1984). Loss Distributions. Wiley.
- Klugman S., Panjer H., Wilmot G. (2008). Loss Models: From Data to Decisions. Wiley Series in Probability and Statistics.
- Kleiber C. and Kotz S. (2003). Statistical Size Distributions in Economics and Actuarial Sciences. Wiley.

Statistics II: Hypothesis Testing, Required, Weekly hours:4, ECTS units:6

M. Boutsikas

Statistical hypothesis, error types, significance level, power function, p-value, randomized tests. Testing simple statistical hypotheses, most powerful tests, Neyman-Pearson lemma. Composite hypothesis tests, uniformly most powerful tests (UMP test). Exponential family of distributions (EFD), construction of UMP tests for the parameters of

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EFD. Generalized likelihood ratio test. Tests for the parameters of one Normal sample (z-test, t-test, chi-square test for the variance). Tests for comparing the parameters of two Normal samples (two independent samples z-test, two independent samples t-test, paired t-test, F-test for equality of variances). Asymptotic tests for the mean, the variance, or a proportion of one or two samples. Chi square goodness of fit test

Essential Reading:

- Casella, G. and Berger, R.L. (2002) Statistical Inference, 2nd edition, Duxbury Advanced Series
- Cox, D.R. and Hinkley, D.V. (2000) Theoretical Statistics, Chapman & Hall/CRC
- D.R. Anderson, D.J. Sweeney, T.A. Williams (2011) Statistics for Business and Economics, Eleventh Edition, South-Western, Cengage Learning.

Financial Statement Analysis, Elective, Weekly hours:4, ECTS units:4

M. Glezakos

Sources - uses - quality of accounting information. International financial standards. Accounting statements. Financial statement analysis: Sources and uses of funds, Cash flow statement, Common size statements, Ratio analysis. Budgeting. Company valuation

Essential Reading:

- Company Appraisal, M. Glezakos (in Greek)
- Foster G. Financial statement analysis. Prentice Hall.
- Stickney Cl. Financial reporting and statement analysis: a strategic perspective: Dryden Press.

Business Administration, Elective, Weekly hours:4, ECTS units:4

F. Dalianis

Organizations and companies operate in an extremely competitive globalized environment, characterized by high costs of acquisition and utilization of resources, rapid social, economic and technological changes, and ethically controlled administration practices. In such an environment, it is expected that effective management can play a catalytic role in assisting organizations to achieve their goals.

The goal of this introductory course is to familiarize students with the basic management functions of planning, organizing, leading and controlling. The utmost goal is to prepare today's students to become tomorrow's effective managers.

Essential Reading:

- Daft, Richard L. (2005) The New Era in Management, International Edition, Thomson

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- Burnes, B. (2004) *Managing Change – A Strategic Approach to Organizational Dynamic*. 2nd Edition, FT Prentice Hall

Special Topics in Demography, Elective, Weekly hours:3, ECTS units:4

Cl. Tsimpos

Special topics in life tables and age standardisation. Decomposition of mortality rates and life expectancy. Population models and uses. Population dynamics, rate of increase, applications and data interpretations. Stationary population. Population projections, uses and types of analysis. Forward demographic projections at national level by age and sex assuming closed and open population conditions.

Marketing Research, Elective, Weekly hours:3, ECTS units:4

A. Kouremenos

The study of marketing involves the interpretation of the conditions prevailing in the market, through field research and other practices and foresees future trends. The increased demands for information on marketing to solve problems with it, created the need for specialists in marketing research. These specialists must not only understand the nature of marketing programs, but they know how to solve these problems using the methodology of research and analytical techniques. The lesson in marketing requires research and knowledge of Statistics and of course marketing knowledge. The result was done solo or group work on the subject.

Essential Reading:

- Stathakopoulos VI. (2005) *Market Research Methods*: Stamouli Editions. (In Greek)

Reliability Theory, Elective, Weekly hours:3, ECTS units:4

M. Boutsikas

Structural Reliability: coherent systems, serial and parallel systems, k -out-of- n systems, path and cut sets, systems' reliability via structure function or via the inclusion-exclusion method.

Reliability as a function of time, classes of life distributions: failure rate, hazard function, mean time to failure, lifetime distributions and their properties (exponential, Weibull, gamma, normal, lognormal, uniform distributions), Shock models.

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Notions of Aging: classes of distributions with common aging properties, IFR, DFR, Increasing- Decreasing Failure Rate in Average, New Better-worse than Used, New Better-worse than Used in Expectation,

Introduction to estimation techniques: estimating parameters of lifetime distributions from complete and censored samples.

Essential Reading:

- *Gertsbakh (1989) Statistical Reliability Theory.* Marcel Dekker.
- *Barlow and Proschan (1981) Statistical Theory of Reliability and Life Testing.* Wiley

Economics of Insurance, Elective, Weekly hours:3, ECTS units:4

Pl. Tinios

This course uses economics – both applied and theoretical – to promote an understanding of the economics of the insurance market: the notions of risk and uncertainty in economics, theoretical approaches to risk (the von Neumann- Morgenster expected utility hypothesis, behavioral economics), the demand for insurance, Asymmetric information and the insurance market, The supply of insurance and the role of regulation. The insurance market and the global economic crisis.

Students can submit an optional term paper as part of the requirements of the course.

Regression Analysis, Required, Weekly hours:4, ECTS units:6

M. Koutras – H. Evangelaras

Regression analysis includes many techniques for modeling and analyzing several variables, when the focus is on predicting one of them based on the values of the other(s). The course presents methods for establishing and studying a linear model that fits the experimental data. Emphasis is also given on practical applications.

A linear model with a single predictor variable (simple linear regression) is first introduced, the least squares estimators of its parameters are derived and their statistical properties are presented in detail. Then, the simple linear model with normal errors is studied and statistical inference on that is carried out (confidence intervals and hypothesis testing for its parameters). Moreover, regression diagnostics based on residual analysis and remedial measures (when there appear deviations from the normal linear model assumptions) are discussed. The last part of the course illustrates the theory of the linear model with several predictor variables (multiple linear regression).

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Essential Reading:

- Draper, N. R. and Smith, H. (1966, 1981), *Applied Regression Analysis*, Wiley.
- Goldberger, A. S. (1964), *Econometric Theory*, Wiley.
- Johnston J. (1972), *Econometric Methods*, McGraw - Hill.
- Neter J., Wasserman W. and Kutner M. H. (1985), *Applied Linear Statistical Models, Second edition*, Richard D. Irwin.
- Seber G.,A.,F. (1977), *Linear Regression Analysis*, Wiley.

Credibility Theory, Required, Weekly hours:4, ECTS units:5

G.Pitselis

Introduction to credibility theory. Bayes risk and Bayes estimator. Conjugate classes of distribution. Empirical Bayes estimation. The model of Buhlmann (1967), the model of Buhlmann & Starub (1970). Hierarchical credibility of Jewell. Credibility in the regression case, Hachemeister's model. Credibility estimation of the above model.

Essential Reading:

- Herzog. N. Introduction to Credibility Theory. ACTEX Publications, Inc., 1999
- Buhlmann, H, & Gisler A. (2005). A course in Credibility Theory and its Applications, Springer.

Sampling Methods and Techniques, Required, Weekly hours:4, ECTS units:5

G. Tzavelas

Basic concepts: population, sample, sampling frame, sampling and non sampling errors, bias and its effects, reasons to use sampling, probability and non probability sampling techniques.

Probability sampling techniques:

Random sampling with and without replacement: Estimation and confidence intervals, choice of sample size.

Stratified sampling: proportional and optimal allocation

Cluster sampling: Estimation of population proportion, total and proportion. Systematic sampling: Estimation of population proportion, total and proportion. The effect of ordering and periodicity.

Two-stage sampling.

Non probability sampling techniques: convenience, purposive, quota sampling.

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Comparison of the various sampling techniques.

Applications.

Essential Reading:

- Cohran, W.G. (1977) Sampling Techniques. Willey, N.Y
- Des Raj. (1968) Sampling Theory. McGraw-Hill
- Lohr, S.L (1999) Sampling: Design and Analysis. Duxbury Press

Stochastic Processes, Required, Weekly hours:4, ECTS units:6

Th. Artikis – N. D. Macheras

The notion of a stochastic process, Markov chains, transition probabilities of 1-step, transition matrices of 1-step, transition probabilities and matrices of m-step, Chapman-Kolmogorov equation, random walk, queing processes, absorbing state, first hitting time, branching chain, renewal processes, Poisson processes (basic theorems and applications).

Essential Reading:

- Cox, D. R. and Miller, H. D. (1978) The Theory of Stochastic Processes. Chapman & Hall.
- Hoel, G. P., Port, C. S. and Stone, C. J. (1972) Introduction to Stochastic Processes, Houghton Mifflin, Boston.
- Ross, S. (1996) Stochastic Processes. Wiley.

Money and Capital Markets, Elective, Weekly hours:4, ECTS units:4

M. Glezakos

Savings – Investment. The financial system. The banking system (nature, functions). The stock exchange (nature, functions, impact to real economy), The Athens Stock Exchange. Risk-return measurement. Financial assets (characteristics, valuation): Shares, Bonds, Convertibles, Derivatives. Portfolios: Diversification, Risk-return relationship, Portfolio formation. Capital Asset Pricing Model. Mutual Funds (nature, functions, performance appraisal).

Essential Reading:

- Frank K. Reilly and Keith C. Brown (2008) : Investment Analysis and Portfolio Management.
- Edwin J. Elton (2008): Modern Portfolio Theory and Investment Analysis.
- Robert A. Strong (2008): Portfolio Construction, Management and Protection.

Time Series Analysis, Elective, Weekly hours: 4, ECTS units: 4

D. Stengos

Descriptive methods : types of variation, trend, seasonal variation , cyclic variation, irregular fluctuation, additive and multiplicative models.

Probability models for time series: stochastic processes, stationarity, autocovariance, autocorrelation, partial autocorrelation, white noise, general linear process, moving average process, autoregressive process, mixed process, ARIMA, SARIMA.

Model identification and estimation, diagnostic checking, forecasting.

Frequency domain approach: spectral distribution / density function.

Spectral analysis : periodogram, smoothing methods, confidence interval for the spectrum.

Biostatistics, Elective, Weekly hours: 3, ECTS units: 4

S. Bersimis

Biostatistics is the science of obtaining, analyzing and interpreting data in order to understand and improve human health. The aim of the course is to introduce students to the theory as well as the thoughtful implementation of biostatistical methods in practice. Specifically, the students are introduced in hypothesis testing (parametric and non-parametric), in categorical data analysis (chi-square tests for categorical variables, odds ratios, risk, etc) and in survival analysis. Statistical software is used to supplement hand calculation.

Essential Reading:

- P. Armitage, G. Berry and J.N.S Matthews, Statistical Methods in Medical Research, Blackwell, 2002.
- M. Pagano and K. Gauvreau, Principles of Biostatistics, Duxbury, 2000.

Teaching Statistics, Elective, Weekly hours: 3, ECTS units: 4

Basic concepts: Goals and objectives of education. Learning theories. Teaching models.

The Teaching as a science: The failure of "traditional" teaching model, new trends in the teaching of natural sciences and especially in the teaching of statistics. Learning Strategies - instructional models for teaching Statistics. Research - Action - data processing. Difficulties in the teaching and understanding of concepts Statistics. Programming instruction, programming types, factors taken into consideration when planning. Organization and Administration of the classroom. Review student. Modern conceptions of assessment.

Ratemaking, Elective, Weekly hours: 4, ECTS units: 4

G. Pitselis

Introduction to ratemaking. Utility theory. Property and liability insurance. The method of loss ratio. The method of premium. The method of parallelogram Rate change. Overall average rate change. Changing risk classification differentials. Balancing Back. Loss reserving. Chain ladder method. The Bornhuetter-Ferguson method. The separation technique. The log-normal loss reserving method. Reinsurance methods: Excess loss. Stop loss, Quota share, coinsurance.

Essential Reading:

- Brown, R.L. Introduction to Ratemaking and Loss Reserving for Property and -Casualty Insurance. ACTEX Publications, Inc., 1993.
- Foundations of Casualty Actuarial Science (1990), Chapters 2-5

Population Geography, Elective, Weekly hours: 3, ECTS units: 4

Cl. Tsimpos

The nature of population geography. People on the move. Theories of international migration. Internal migration: census data, estimates, regional population projections. The Theory of Demographic Transition. Global population trends and prospects. Measures of population distribution and redistributions. Segregation and diversity indices. Graphical presentations: exploratory, mapping, concentration curve. Applications to Greek population data at prefecture level.

Statistical Quality Control, Elective, Weekly hours: 3, ECTS units: 4

S. Bersimis

Statistical Quality Control (SQC) is a collection of statistical methods that are used for the improvement of the quality of industrial products. SQC is divided into three major categories, the Design of Experiments (DOE), the Statistical Process Control (SPC) and Acceptance Sampling (AS). The aim of the course is mainly to introduce students to SPC. SPC is applied in order to monitor and control a process. Monitoring and controlling the process ensures that it operates at its full potential. At its full potential, the process can make as much conforming product as possible. SPC can be applied to any process where the "conforming product" (product meeting specifications) output can be measured. Some key tools are used in SPC. The main tool is the control chart. Thus, the most common control charts are presented.

Essential Reading:

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- D. C. Montgomery, Introduction to Statistical Process Control, Wiley: New York, 2001.
- T. P. Ryan, Statistical Methods for Quality Improvement, Wiley: New York, 2000.

Fourth Year Courses

Analysis of Variance Required, Weekly hours:4, ECTS units:6

G. Iliopoulos

Repetition of basic elements hypothesis testing. By t-test for equality of the mean values of two regular people to control for gender averages more than two normal populations: Analysis of variance (variance) by a factor. Checks assumptions: homogeneity tests and residue analysis (residuals). Multiple comparisons: Intervals Fisher, Bonferroni, Scheffé. Complete randomized design in blocks. Analysis of variance of two factors with and without interaction. Fixed and random effects. Analysis of Variance by a random factor. Introduction to Analysis of covariance.

Practice a statistical package: Analysis of variance in figures (real or not) data using statistical packages.

Essential Reading:

- Draper, N. R and Smith, H. (1966, 1981) Applied Regression Analysis, Wiley.
- Fisher, L. and McDonald, J. (1978) Fixed Effects Analysis of Variance, Academic Press

Ruin Theory, Required, Weekly hours:5, ECTS units:6

E. Chatzikonstantinidis – K. Politis

Stochastic processes: main properties and special examples. Markov processes, the Poisson process and renewal processes.

Compound distributions and compound processes, the compound Poisson process. the surplus process, the probability of ruin in finite/infinite time and in discrete/continuous time.

The classical risk model in continuous time. The adjustment coefficient: examples and approximations. Lundberg's inequality and the Cramér-Lundberg asymptotic formula. Variables related to the probability of ruin: the time of ruin, maximal aggregate loss, the surplus prior to ruin and the deficit at ruin. Renewal equations for the probability of ruin and non-ruin.

Exact formulae for the probability of ruin for exponential and mixtures of exponential distributions. Bounds for ruin probabilities. Approximations: Beekman-Bowers, De Vylder and Tijms approximations. Asymptotics for heavy-tailed distributions. The joint distribution of the surplus prior to ruin and the deficit at ruin.

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Surplus process in discrete time. Ruin probability and the adjustment coefficient. Lundberg's inequality.

Essential Reading:

- Bowers N.L., Gerber H.U., Hickman J.C., Jones D.A. and Nesbitt C.J. (2002) Actuarial Mathematics Society of Actuaries, Ithaca.

Statistical Packages, Required, Weekly hours:4, ECTS units:6

S. Bersimis

The course provides an introduction to the use of IBM Statistics for statistical data analysis. The course is an introduction to statistical data analysis using SPSS assuming a familiarity with using Windows applications and the basic statistical concepts. This course provide to students knowledge of main types of graphs and their use in statistics, an introduction to exploratory data analysis and understanding of some common statistical tests and their interpretation. The course covers Data entry and manipulation, Categorical and continuous data analysis, variables: definition, labelling, transforming and recoding, descriptive statistics, cross tabulation and the chi-square test, statistical testing and estimation, one-way ANOVA, correlation and simple regression.

Essential Reading:

- Field Andy (2005) Discovering Statistics Using SPSS, Prentice Hall
- Norusis Marija (2006) SPSS 14.0 Guide to Data Analysis, Prentice Hall

Actuarial Pension Plans, Elective, Weekly hours:4, ECTS units:4

G. Pitselis

Preliminary on the theory of interest. Life tables. Life Annuities. Pension plans methods: Unit risk, Projected Unit risk, Entry Age Norma (level Dollar), Entry Age Norma (level Percent), Individual level Premium, Aggregate cost methods (Individual Aggregate, Aggregate, Frozen Initial Liability).

Essential Reading:

- Aitken, W.H. (1996). A Problem-Solving Approach to pension Funding and Valuation
- Anderson, A.W. (1990). Pension Mathematics for Actuaries, 2nd edition, Actex Publications, P.O.Box 974, Winsted, CT 06098

Actuarial Modelling, Elective, Weekly hours:3, ECTS units:4

Sp. Vrontos

The course's objective is to introduce the student to modeling and solving actuarial problems in non-life insurance and life insurance with the use of statistical methods.

More specifically we are considering:

Ratemaking and pricing in automobile insurance, fire insurance and health insurance.

Claim number and claim size distributions. Application and fitting of them in automobile insurance.

Application and fitting of generalized linear models for the number of claims (Poisson regression, Negative Binomial regression) and the claims severity (Exponential regression, Pareto regression).

Bonus – Malus Systems.

Applications of clustering techniques in rate making.

Mortality, longevity and disability modeling. Pricing disability insurance.

Practical applications using R and Matlab.

Essential Reading:

- Booth P., Chadburn R., Haberman S., and James D. (2004). Modern Actuarial Theory and Practice. Chapman & Hall.
- Kaas R., Goovaerts M., Dhaene J., and Denuit M. (2004). Modern Actuarial Risk Theory. Kluwer Academic Publishers.
- Lemaire J., (1995). Bonus-malus Systems In Automobile Insurance. Kluwer Academic Publishers.
- Haberman , S. and Pitacco, E. (1999). Actuarial Models for Disability Insurance. Chapman & Hall/CRC.
- Daykin, C. D., Pentikainen T. and M.Pesonen. (1993). Practical Risk Theory for Actuaries. Chapman & Hall/CRC.

Special Topics in Stochastic Processes, Elective, Weekly hours:3, ECTS units:4

N. D. Macheras

The notion of a stochastic process, taxonomy of stochastic process, stochastic process of independent increments, distribution of a stochastic process, mean value, co-variance function, strongly stationary processes, weakly stationary processes, Markov processes of continuous parameter, the Kolmogorov differential equations, Birth and Death processes, computing transition probabilities.

Essential Reading:

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- Hoel, G. P., Port, C. S. and Stone, C. J. (1972) Introduction to Stochastic Processes, Houghton Mifflin, Boston.
- Norris, J. R. (1998) Markov Chains. Cambridge University Press.
- Ross, S. (1996) Stochastic Processes. Wiley.

Risk and Insurance Theory, Elective, Weekly hours:4, ECTS units:4

Th. Artikis

Applications of Expected Value and Variance in Financial Decision Making – Premium Evaluation Principles – Risk Measures – Portfolio Theory – Financial Applications of Probability Distributions – Linear Transformation of a Random Variable – Logarithmic Transformation of a Random Variable – Exponential Transformations of a Random Variable – Product of Random Variables – Ratio of Random Variables – Applications of Functions of Random Variables in Risk and Insurance Theory – Financial Applications of Expected Utility – Selection of Insurance Contracts – Expected Utility and Bayes Methodology.

Essential Reading:

- Th. Artikis, A. Malliaris (1992) Economic of Uncertainty, Stamouli Editions (In Greek)
- Sapountzi K. (1992) Technical Operational Research Volume A, Stamouli Editions (In Greek)

Statistical Decision Theory, Elective, Weekly hours:4, ECTS units:4

D. Stengos

The no-data decision problem: action space, state space, loss function, admissibility and completeness, Bayes criterion, minimax criterion, elements of game theory.

Statistical decision theory: decision rules, risk function, Bayes risk, Bayes rules, posterior distribution, posterior risk, minimax rules, value of information.

Estimation problems: conjugate families of distributions, admissible estimators, Bayes estimators, minimax estimators.

Testing hypotheses : Bayes tests, minimax tests.

Designing Socioeconomic Surveys Elective, Weekly hours:3, ECTS units:4

G. Verropoulou

Basic concepts, approaches and types of survey data. Sampling surveys: research questions, sampling stages and phases, carrying out a survey, methodology and measurement scales. Questionnaire design, types of questions, organization, frames. Interviews: personal, by telephone, by post; advantages and disadvantages. Applications, examples of actual socioeconomic sampling surveys in Greece.

Nonparametric Statistics, Required, Weekly hours:4, ECTS units:7

D. Stengos

Point and interval estimates of quantiles, sign tests, tolerance limits.

Rank statistics, rank tests for comparing two treatments: Wilcoxon-Mann Whitney test, median test, Van der Waerden test, run test.

Sign tests for paired comparisons: Wilcoxon signed-rank test.

Comparison of more than two treatments: Kruskal-Wallis / Friedman test.

Rank tests for independence: Spearman / Kendall tests.

Kolmogorov-Smirnov goodness of fit tests.

Essential Reading:

- Conover, W. J. (1971) Practical Nonparametric Statistics. Wiley, New York.
- Gibbons, J. D. and Chakraborti, S. (1992) Nonparametric Statistical Inference (3rd ed.). Marcel Dekker.
- Randles, R. H. and Wolf, P. A. (1991) Introduction to the Theory of Nonparametric Statistics. Krieger Publ. Co.
- Sprent, P. (1993) Applied Nonparametric Statistical Methods (2nd ed.). Chapman and Hall.

Risk Management, Required, Weekly hours:4, ECTS units:7

Th. Artikis

Historical Consideration of Risk: Philosophical Phase, Technological Phase, Scientific Phase, Economic Loss, Economic Benefit

Risk: Risk Condition, Risk Cause, Risk Severity, Risk Frequency, Risk Duration

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Safety Operations: Risk Identification, Risk Measurement, Risk Communication, Risk Treatment, Risk Avoidance, Risk Control, Risk Severity Reduction, Risk Frequency Reduction, Risk Duration Deduction, Risk Separation, Risk Transfer, Risk Financing

Definition of Risk Management Cindynics: Cindynic Epistemology, Risk Phenomenology, Cindynic Psycho-sociology, Cindynic Hyperspace, Micro Cindynics, Mega Cindynics, Hyper Cindynics, Stochastic Models of Risk Management

Essential Reading:

- Tyson Shaun, York Alfred (2004) Human Resources Management, Gkiourdas Editions (Translated into Greek)

Population Aging and Insurance Economy, Elective, Weekly hours: 3, ECTS units: 4

Pl. Tinios

This course aims to apply knowledge from the fields of demography, economics, actuarial science, statistical packages to the specific empirical problems of global and European ageing economies and societies: Global ageing projections; the specific problems of the Mediterranean and the Mediterranean family. Consumption, saving, the life-course and the role of types of pension finance. The retirement decision – the labour market and older workers. Health and ageing. Long-term care and long term care insurance.

Students can submit an optional term paper as part of the requirements of the course, analyzing microdata from the Survey of Health, Ageing and Retirement in Europe, employing statistical packages such as SPSS.

Special Topics in Actuarial Science, Elective, Weekly hours: 3, ECTS units: 4

The course is a research-based course. In particular, the students are introduced to the literature search of academic journals in Actuarial Science, choose a topic of their own interest and write an assignment on this topic by studying recent papers in that area. They also have to make an oral presentation of their work. The mark for this course is based upon both the written assignment and the oral presentation.

Theory and Practice of Reinsurance, Elective, Weekly hours: 3, ECTS units: 4

The course's objective is to introduce the student in the theory and practice of reinsurance.

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More specifically we are considering the following:

Definition and types of reinsurance. Proportional reinsurance, excess of loss reinsurance and stop loss reinsurance. LCR and ECOMOR reinsurance. Combinations of reinsurance contracts.

Reinsurance contracts pricing using actuarial techniques.

Optimization with respect the reinsurance proportion, the layers in excess of loss reinsurance and stop loss reinsurance.

Reinsurance contracts pricing and hedging using financial techniques. Risk transfer using derivatives.

Reinsurance for life insurance companies.

Solvency and profit testing for reinsurance companies.

Essential Reading:

- G. Patrick, Reinsurance, Foundations of Casualty Actuarial Society, 2001.
- H. Panjer and G. E. Willmot, Insurance Risk Models, Society of Actuaries, 1992.
- P. Boland, Statistical and Probabilistic Methods in Actuarial Science, Chapman and Hall, 2007.
- R. Kaas, M. Goovaerts, J. Dhaene and M. Denuit, Modern Actuarial Risk Theory 2002, Springer.
- Swiss Re. Annual Reports on Natural Catastrophes and Reinsurance.
- Culp C. L. (2004). Risk Transfer: Derivatives in Theory and Practice. John Wiley & Sons.

Financial Derivatives, Elective, Weekly hours: 4, ECTS units: 4

A.Panopoulou

The purpose of the course is to provide the student with the necessary skills to value and to employ options, option-like-instruments and futures. It covers basics about forwards, futures, swaps, and options along with more advanced topics such as the Binomial Option Pricing model and the Black and Scholes Pricing model along with their extensions. Attention is paid on the use of derivatives for Risk Management and hedging properties.

Multivariate Analysis, Elective, Weekly hours: 4, ECTS units: 4

M. Boutsikas – H. Evangelaras

In the first part of the course, the basic results and properties of the multivariate normal distribution are presented, along with related statistical concepts: Basic notions of linear algebra. Random vectors and matrices. Mean vector and covariance matrix. Multivariate normal distribution. Wishart distribution. Hotelling's T^2 distribution. Sample estimation of the mean vector and the covariance matrix using the maximum likelihood method.

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Confidence intervals and hypothesis testing for the parameters of a multivariate normal distribution. In the second part of the course, well known multivariate techniques are introduced and presented. Students are getting familiar with Multivariate Analysis of Variance, Principal Components Analysis, Factor Analysis and Cluster Analysis. Emphasis is given to practical applications using the statistical package SPSS.

Simulation, Elective, Weekly hours: 3, ECTS units: 4

M. Boutsikas

Estimation using pseudorandom numbers: generating pseudorandom numbers, Monte Carlo integration.

Generating random variables from specific distributions (discrete or continuous): The inversion method. The acceptance – rejection method. The composition method. The polar (Box-Muller) method for normal random variables.

Statistical validation techniques: Monte Carlo estimation of upper critical points, p-value and the power of a test. Applications to t-test and control charts.

Emphasis is given to algorithms implementation using the MATHEMATICA package.

Essential Reading:

- Ross S. (1997) *Simulation* (2nd edition), Academic Press

Social Statistics, Elective, Weekly hours: 4, ECTS units: 4

G. Verropoulou

Tackling socio-economic phenomena. Coding, errors in variables, coding and data entry. Exploratory analysis of missing values. Data manipulation, exploratory analysis, coding of variables and re-coding. Basic statistical descriptive techniques of the sample. Nominal and ordinal data analysis. Correlation. Contingency tables, independence of variables. Interpretations: causal relationships, spurious correlation, indirect relationships. Partial correlation analysis. Chronbach's alpha. Ordinary least squares regression and logistic regression models. Applications.

Stochastic Analysis, Elective, Weekly hours: 4, ECTS units: 4

N. D. Macheras

Measure spaces, outer measure and Caratheodory's procedure, Lebasque measure on R_n , measurable functions, definition of the integral, convergence theorems, probability spaces and random variables, mean value, independence, conditional mean value (conditioning on an event, conditioning on a random variable, conditioning on a σ -algebra),

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martingales, stopping times, inequalities and convergence for martingales, Brownian motion, Ito's stochastic integral.

Essential Reading:

- Mikosh, Thomas (1998) Elementary stochastic calculus with finance in view. World Scientific
- Lambertson D. and Lapeyre, B. (1994) Introduction to Stochastic calculus applied to Finance. Chapman and Hall, London.

Financial Econometrics, Elective, Weekly hours: 4, ECTS units: 4

A. Panopoulou

The course is designed to introduce the econometric tools most used in finance and to gain understanding of the sources and characteristics of financial data. Emphasis is given on applications and there are many computer exercises with financial data. Topics include: stylized properties of financial time series, AR, MA and ARMA models, the family of ARCH models, GMM, forecasting financial returns and volatility and financial risk management.