COURSES OF INSTRUCTION

First year Courses

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

V. Sevroglou


Essential Reading:
- 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:

G. Psarrakos

Algebraic group, Semi group, Ring, Field, Euclidean space $\mathbb{R}^n$, 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:

• 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:


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

G. Tzavelas – K. Politis


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.

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


**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:**

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

*V. Sevroglou*


**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:**


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

*P. 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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*Course Description for ERASMUS*


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.


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:**

**DEPARTMENT OF STATISTICS AND INSURANCE SCIENCE**

**Algebra, Elective, Weekly hours: 4, ECTS units: 4.**  
*V. Sevroglou*

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

**Essential Reading:**  
- Seimour 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:**  

**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
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:**


**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:**

Second Year Courses

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

A. Sinanioti


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

C.l. Tsimpos – G. Verropoulou


Essential Reading:


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

Essential Reading:


*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:

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

**Th. Artikis**


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

**Essential Reading:**


**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:**

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

*A. Sinanioti*


**Essential Reading:**

- Karsten Schmidt/Marcus Lutter (2008) Aktiengesetz Kommentar, Band I und II.

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

*Pl. Tinios*


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.


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

_H. Nina-Pazarzi_


**Essential Reading:**


**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 R of the real numbers, measurable functions and random variables, functions of bounded variation, Riemann-Stieltjes integral, Lebesgue integral

**Essential Reading:**

**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:


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:**

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

*M.Glezakos*


**Essential Reading:**

- PRINCIPLES OF FINANCE, M. Glezakos (in Greek)

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

*E. Chatzikonstantinidis*


Essential Reading:


**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.


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).
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:**

**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:**

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

*V. Sevroglou*


**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:**


**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:**

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:**

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.


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:


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...
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:**

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

*M. Glezakos*

**Essential Reading:**
- Company Appraisal, M. Glezakos (in Greek)
- Foster G. Financial statement analysis. Prentice Hall.

**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:**

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

*Cl. Tsimpos*


**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:**


**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.
**DEPARTMENT OF STATISTICS AND INSURANCE SCIENCE**

*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:**


**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).
Essential Reading:

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

*G. Pitselis*


**Essential Reading:**

**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


Two-stage sampling.

Non probability sampling techniques: convenience, purposive, quota sampling.
Comparison of the various sampling techniques.
Applications.

**Essential Reading:**

**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:**

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

*M. Glezakos*


**Essential Reading:**
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:


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

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

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

*G. Pitselis*


**Essential Reading:**
- Foundations of Casualty Actuarial Science (1990), Chapters 2-5

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

*Cl. Tsimpos*


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**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:**
DEPARTMENT OF STATISTICS AND INSURANCE SCIENCE

Fourth Year Courses

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

G. Iliopoulos


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

Essential Reading:

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

**Essential Reading:**

**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:**

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

*G. Pitselis*


**Essential Reading:**
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:


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

Th. Artikis


Essential Reading:

• Th. Artikis, A. Malliaris (1992) Economic of Uncertainty, 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:


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

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:**

**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.
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:**

- Swiss Re. Annual Reports on Natural Catastrophes and Reinsurance.

**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. Hotteling’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:

Social Statistics, Elective, Weekly hours: 4, ECTS units: 4
G. Verropoulou


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),

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

Essential Reading:


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.