Special Subjects of the Department of Statistical Science

Field	Subject Code	Subject	Credit	Content of subject	
Statistical Modeling	20DSSa01	Special Topics in Statistical Modeling Ⅰ	2	Starting with a linear model that is the basis of statistical modeling. Then, learn the basics of sparse modeling and how to apply its methodologies to real problems.	Hideitsu Hino
	20DSSa02	Special Topics in Statistical Modeling Ⅱ	2	When trying to solve practical problems with data driven approaches, it is critical to formulate the original problem as a “feasible” sub-problem. In this course, we study the methodology on how to formulate various practical problems and to efficiently solve them.	Hideitsu Hino
	20DSSa05	Computational Statistics Model	2	Statistical models which use computer intensively are explained. Techniques of data mining and interactive visual data handling are mainly discussed.	
	20DSSa06	Statistical Computing Ⅰ	2	Technologies for building advanced statistical computation systems are discussed. We focus on distributed computing over Internet, user-friendly parallel computation, and interactive data visualization.	
	20DSSa07	Statistical Computing Ⅱ	2	Statistical computing using parallel computing is the subject of this course. In particular, the following subjects will be discussed: problems which requires huge matrices, the particle filter using a parallel computer, and implementation of the ensemble Kalman filter on a parallel computer.	Shin'ya Nakano
	20DSSa34	Complex Systems Analysis Ⅰ	2	The aim of this course is to study the deterministic and stochastic approach in time series analysis.	Fumikazu Miwakeichi
	20DSSa35	Complex Systems Analysis Ⅱ	2	This course covers methods to extract significant signals, spatial correlation and causality analysis from time series data.	Fumikazu Miwakeichi
	20DSSa11	Monte Carlo algorithms and stochastic simulation	2	This course deals with Markov Chain Monte Carlo (MCMC) and other stochastic algorithms with real world applications.	Yukito Iba
	20DSSa12	Modeling of complex hierarchical structures	2	This course focused on statistical modeling of complex and hierarchical systems.	Yukito Iba
	20DSSa15	Digital Signal Processing	2	This lecture provides basic methods of treatment on signals and transfer functions based on z-transformation with practical design skill for digital system including prediction filters.	Yumi Takizawa
	20DSSa16	Communication and Information Systems	2	This lecture provides basic study of information theory by C.E.Shannon referring to contitative expression of information, fundamental characteristics and coding methods for information source and communication channel.	Yumi Takizawa

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Statistical Modeling	20DSSa27	Information Security Ⅰ	2	This course covers privacy-preserving data mining techniques for analyzing big data with sensitive information safely.	Kazuhiro Minam
	20DSSa28	Information Security Ⅱ	2	This course covers anonymization and differential privacy techniques for publishing datasets for secondary use safely.	Kazuhiro Minam
	20DSSa17	Special Topics in Time Series Analysis Ⅰ	2	This course will cover vector autoregressions and their applications to causal analysis of time series. To extend the arguments to non-stationary time series, after learning unit root tests to check the persistency of time series, we will proceed to the testing and estimation of cointegrated systems.	Yoshinori Kawasaki
	20DSSa18	Special Topics in Time Series Analysis Ⅱ	2	This course will cover various types of volatility models in financial time series. The following topics will be discussed; conditional heteroscedasticity models and their multivariate version, parameter-driven time varying variance models, realized volatility, realized quarticity, heterogeneous autoregression model.	Yoshinori Kawasaki
	20DSSa31	Stochastic systems Ⅰ	2	This course provides an elementary introduction of stochastic analysis and its applications.	Shinsuke Koyama
	20DSSa32	Stochastic Modeling Ⅱ	2	This course provides advanced topics on stochastic modeling and analysis.	Shinsuke Koyama
	20DSSa19	Special Course on Data Assimilation Ⅰ	2	This is a course of seminar and practice on sequential data assimilation methods such as the ensemble Kalman filter. On the basis of the state-space model, students derive the sequential methods and implement the procedure.	Genta Ueno
	20DSSa20	Special Course on Data Assimilation Ⅱ	2	This is a course of seminar and practice on variational data assimilation methods such as the adjoint method. On the basis of maximum a posteriori (MAP) estimation of the state-space model, students derive the variational methods and implement the procedure.	Genta Ueno
	20DSSa23	Basic theory of Point Processes	2	This course gives an introduction to the probability theory of point processes, including the concepts of random measures, Janossy density, Janossy measure, Campbell measure, moment measure, conditional intensity, Papangelou intensity, Palm intensity, etc..	Zhuang, Jiancang
	20DSSa24	Statistical Inferences for Point Processes	2	This course is on the techniques related to statistical inferences for random events in time and/or geographical space. In details, we focus on the issues of model construction, information recognition, model diagnostics, model selection, simulation, forecasting, forecast evaluation, etc..	Zhuang, Jiancang
	20DSSa33	Spatio-temporal Data Analysis	2	Statistical modelling and analysis of spatio-temporal data and their applications are covered in this course. In particular, the subjects which are applied for geoscience data analysis such as data assimilation will mainly be discussed.	Shin'ya Nakano

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Statistical Modeling	20DSSc16	Control Theory Ⅰ	2	Control Theory Ⅰ provides basic preliminaries in the field of control theory, such as state space representation, controllability and observability, canonical form, state feedback and optimal LQ control, state observer and Kalman filter, and servo control based on internal model principle.	Yoshihiko Miyasato
	20DSSc17	Control Theory Ⅱ	2	Control Theory Ⅱ focuses on several recent topics in the field of advanced control theory, such as adaptive control (model reference adaptive control and self tuning controller), nonlinear control (exact linearization and backstepping), robust control (robust analysis and H-infinity control), networked control, and related system identification methodology (subspace method, recursive estimation method, and closed-loop identification). Control Theory Ⅱ is based on preceding Control Theory Ⅰ.	Yoshihiko Miyasato
	20DSSc20	Applied Probability Ⅰ	2	Through this course, applications of a counting process, queueing theory and other stochastic processes are emphasized for prediction of renewable resources supply prediction and control.	Atsushi Yoshimoto
	20DSSc21	Applied Probability Ⅱ	2	Through this course, application of option theory and mathematical economics are studies for risk management of renewable resources.	Atsushi Yoshimoto
	90DSSa01	Statistical Modeling Research Ⅰ	2	This is a general course on statistical science consisting of seminars, special lectures and drills. Special emphasis is given to statistical modeling and modeling methodologies.	All the teaching staff in the field of Statistical Modeling
	90DSSa02	Statistical Modeling Research Ⅱ	2		
	90DSSa03	Statistical Modeling Research Ⅲ	2		
	90DSSa04	Statistical Modeling Research Ⅳ	2		
	90DSSa05	Statistical Modeling Research Ⅴ	2		
Statistical Data Science	20DSSb03	Spatial Statistics	2	Lectures are given on Spatial Statistical modeling and statistical inferences about spatial data. Basic statistical analytic techniques for sampled data from a continuously chaging variable, lattice data (e.g. data are given for each prefecture or city), point patterns (configuration), and circular data are explained.	Kenichiro Shimatani
	20DSSb04	Stochastic Geometry	2	Offers a series of lectures on statistical models of spatial events, such as the models of "Stochastic Geometry" (spatial tessellation, random packing and so on) together with their mathematical foundation and application. Exercises related to problems in "Stochastic Geometry" are also given.	Kenichiro Shimatani
	20DSSb05	Genomic Data Analysis Ⅰ	2	Genomic data analysis using inferring phylogenies from DNA sequences and their applications to evolutionary problems.	Jun Adachi
	20DSSb06	Genomic Data Analysis Ⅱ	2	Analysis of mechanisms of genome evolution and comparison of the genome structure.	Jun Adachi

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Statistical Data Science	20DSSb09	Topics in Sampling Theory Ⅰ	2	This course deals with various research designs and statistical inference based on data collected under these designs, with special emphasis on sampling theory. It aims to enhance the students' understanding of the importance of the design stage of reserach process.	Tadahiko Maeda
	20DSSb11	Topics in Social Research	2	This course deals with statistical approaches to various problems in the administration of social surveys, such as questionnaire design, non-sampling errors, survey mode comparison, and so on. Taking a few domestic and overseas surveys as examples, we will discuss various sources of errors in those surveys.	Tadahiko Maeda
	20DSSb13	On Cross-National Comparability of National Character Ⅰ	2	Lecture on the paradigm called Cultural Linkage Analysis (CLA) of the cross-national comparability of social survey data.	Ryozo Yoshino
	20DSSb14	On Cross-National Comparability of National Character Ⅱ	2	Lecture on the paradigm called Cultural Manifold Analysis (CULMAN) for the analyses of social survey data. This presents the padradimn called CULMAN for the studies charactercross-national comparability of social survey data on national character, gathered under different languages and different statistical random sampling.	Ryozo Yoshino
	20DSSb16	Special Topics in Survey Data Analysis Ⅱ	2	This course covers exploratory data analysis methods for data obtained from surveys in the fields of social sciences. Exercises using statistical software package are also carried out.	Yoosung Park
	20DSSb19	Biostatistics	2	We study the application of statistical methods to problems concerning the medical and biological sciences.	Koji Kanefuji
	20DSSb20	Environmental Statistics	2	We study the application of statistical methods to problems concerning the environment.	Koji Kanefuji
	20DSSb21	Financial Statistics Ⅰ	2	The course provides students with necessary knowledge and techniques in control and evaluation of credit financial risks. Also, the course introduces leading-edge technology in banks and other financial agencies.	Satoshi Yamashita
	20DSSb22	Financial Statistics Ⅱ	2	The course provides students with necessary case studies and techniques in control and evaluation of financial market risks. Also, the course introduces investment statistical models in pension funds and other financial agencies.	Satoshi Yamashita
	20DSSb23	Statistics in Medicine Ⅰ	2	The aim of this course is to study the statistics in medicine and public health focusing on statistical models such as linear mixed effects models in longitudinal data analysis.	Ikuko Funatogawa
	20DSSb24	Statistics in Medicine Ⅱ	2	The aim of this course is to study the statistics in medicine and public health focusing on the design such as randomization and also statistics in actual health problems.	Ikuko Funatogawa

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Statistical Data Science	20DSSb27	Special Topics in Biostatistics	2	This course deals with recent relevant topics on biostatistics, especially, (i) Biostatistical methodology on clinical and epidemiologic studies, (ii) Designs and analyses of clinical trials, (iii) Evidence synthesis methods, and (iv) statistical analyses of large-scale genomic data.	Hisashi Noma
	20DSSb28	Applied Statistics Ⅰ	2	This course deals with practical data analysis methods widely applied in scientific investigation and research, involving practices using statistical software R.	Hisashi Noma
	20DSSa13	Communication Information Processing	2	Spoken language is a crucial component of human communication. In this course, we study algorithms to process and analyze the information contained in this medium.	Tomoko Matsui
	20DSSa14	Multimedia Information Processing	2	The digital age has fostered the broadcasting of an ever increasing quantity of complex multimedia documents, be it through the internet or more versatile electronic channels. These evolutions have called for new tools and technologies to classify and analyze multimedia contents. We study in this course algorithms which are useful for these tasks.	Tomoko Matsui
	20DSSa25	Biological System Analysis Ⅰ	2	This course covers a range of statistical methods in bioinformatics and materials informatics. Starting from a brief overview of machine learning and R language programming, the essence of statistical modeling and inference is illustrated through applications in DNA sequence analysis, bioimage informatics, material design problems, and so on.	Ryo Yoshida
	20DSSa26	Biological System Analysis Ⅱ	2	As the second course of "Biological System Analysis Ⅰ", this course conducts studies of more practical and advanced machine learning techniques in bioinformatics and materials informatics.	Ryo Yoshida
	20DSSb29	Medical statistics Ⅰ	2	In this course, I will give lectures on basic analytical methods of medical statistics and practices using the statistical analysis software JMP.	Yoichi M. Ito
	20DSSb30	Medical statistics Ⅱ	2	In this course, I will lecture on advanced analysis method in medical statistics based on the textbook "Applied Medical Statistics Using SAS". By actually executing the SAS program, you can analyze the data by yourself.	Yoichi M. Ito
	20DSSb31	Survey Design	2	This course covers systematic explanations of practical methodologies of survey design for organizations or regions.	Yoosung Park
	90DSSb01	Statistical Data Science Research Ⅰ	2	This is a general course on statistical science consisting of seminars, special lectures and drills. Special emphasis is given to methodologies on survey and sampling, data analysis and statistical software.	All the teaching staff in the field of Statistical Data Science
	90DSSb02	Statistical Data Science Research Ⅱ	2		
	90DSSb03	Statistical Data Science Research Ⅲ	2		
	90DSSb04	Statistical Data Science Research Ⅳ	2		
	90DSSb05	Statistical Data Science Research Ⅴ	2		

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Statistical Inference and Mathematics	20DSSc03	Theory of Statistical Inference	2	Robust inference against outlier, including robust estimation, test and model selection.	Hironori Fujisawa
	20DSSc04	Special Topics in Data Analysis Ⅰ	2	Statistical methods for analysis of data, especially for analysis of medical data.	Hironori Fujisawa
	20DSSc05	Special Topics in Data Analysis Ⅱ	2	This course discusses modeling of probability measures and methods and practices in data analysis.	Shuhei Mano
	20DSSc06	Statsitical Machine Learning	2	This course discusses machine learning methods for analyzing large and high dimensional data.	Kenji Fukumizu
	20DSSc07	Statistical Natural Language Processing	2	We discuss basic statistical methods for natural language or similar discrete data, and related problems for inference and learning.	Daichi Mochihashi
	20DSSc08	Bayesian Modeling and Sequential Monte Carlo Methods	2	Advanced modeling and scientific computing to combine a wide variety of information sources within a framework of Bayesian approach. A special focus is laid on the statistical modeling for time-series analysis in geoscience, marketing, and bioinformatics.	Daichi Mochihashi
	20DSSc09	Multivariate Statistical Inference Ⅰ	2	One of the topics below will be chosen: (1) Contingency table and graphical model (2) Distribution theory and statistical inference (3) Differential and integral geometric approach to statistics (4) Algebraic statistics.	Satoshi Kuriki
	20DSSc10	Multivariate Statistical Inference Ⅱ	2	Seminar on a particular topic related to multivariate analysis, categorical data analysis, graphical models, asymptotic inference, distribution theory, random field, algebraic statistics, and relevant mathematics such as differential geometry, convex analysis, combinatorics and measure theory.	Satoshi Kuriki
	20DSSc11	Statistical Learning Theory Ⅰ	2	The theory and applications are lectured through examples of boosting method, support vector machine, kernel space method, Bayesian network.	Shinto Eguchi
	20DSSc12	Statistical Learning Theory Ⅱ	2	This course discusses theory and methodology for automatic knowledge acquisition from data, based on mathematical methods such as probability, functional analysis, geometry, and discrete mathematics.	Kenji Fukumizu
	20DSSc13	Information Geometry	2	A framework on an information space is introduced for deeper understanding on uncertainty from a geometric viewpoint.	Shinto Eguchi
	20DSSc14	Special Topics in Signal Processing Ⅰ	2	This course introduces the basic theory of signal processing including the Principal Component Analysis and Independent Component Analysis.	Shiro Ikeda
	20DSSc15	Special Topics in Signal Processing Ⅱ	2	This course introduces how to apply signal processing methods to real data analysis including speech signals and biological data.	Shiro Ikeda

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Statistical Inference and Mathematics	20DSSc23	Regression Analysis	2	This course deals with some topics on the theory of regression analysis, especially, generalized linear models. In addition, applications of the theory of regression analysis to real problems are discussed.	Shogo Kato
	20DSSc24	Distribution Theory	2	This course provides an overview of the theory of probability distributions which are commonly used in statistics. Statistical models related to these distributions are also discussed.	Shogo Kato
	20DSSc18	Systems Optimization Ⅰ	2	This course is intended to serve an introduction to systems design and analysis, and focuses on the theoretical aspects of convex optimization based on convex analysis, duality theory and numerical linear algebra.	Satoshi Ito
	20DSSc19	Systems Optimization Ⅱ	2	We will discuss several specific topics in continuous optimization, including hierarchical optimization, robust optimization and infinite-dimensional optimization, with some applications in control, signal processing and other systems design.	Satoshi Ito
	20DSSc22	Stochastic Models	2	This course is on random combinatorial models, especially partition structures, and the statistical inferences.	Shuhei Mano
	20DSSb07	Topics of Statistical Inference Ⅰ	2	The aim of this course is to study the theory and application of statistical inference based on semiparametric models with infinite-dimensional nuisance parameters.	Masayuki Henmi
	20DSSb08	Topics of Statistical Inference Ⅱ	2	The aim of this course is to study statistical methods for data that is sampled with bias from a population of interest, focusing on methods for statistical analysis with missing data.	Masayuki Henmi
	20DSSc27	Special Topics in Statistical Asymptotic Theory	2	After outlining statistical asymptotic theory for regular statistical models, the one for locally conic models is introduced and a geometrical approach for its evaluation is explained.	Yoshiyuki Ninomiya
	20DSSc28	Change-Point Analysis	2	After outlining change-point analysis, a textbook is read to learn about statistical asymptotic theory for change-point models. In addition, information criteria for the change-point models are explained.	Yoshiyuki Ninomiya
	20DSSc29	Probability theory and its applications Ⅰ	2	This course serves systematic lecture on Lévy processes and its statistical applications.	Takaaki Shimura
	20DSSc30	Probability theory and its applications Ⅱ	2	This course deals with extreme value theory and its statistical applications.	Takaaki Shimura

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Statistical Inference and Mathematics	90DSSc01	Statistical Inference and Mathematics Ⅰ	2	This is a general course on statistical science consisting of seminars, special lectures and drills. Special emphasis is given to mathematical/inferential/computational aspects of statistical science.	All the teaching staff in the field of Statistical Inference and Mathematics
	90DSSc02	Statistical Inference and Mathematics Ⅱ	2		
	90DSSc03	Statistical Inference and Mathematics Ⅲ	2		
	90DSSc04	Statistical Inference and Mathematics Ⅳ	2		
	90DSSc05	Statistical Inference and Mathematics Ⅴ	2		
Common	90DSSd01	Statistical Science Study Ⅰ	2	This is a general research course of statistical science. Students are requested to present progress of their research by giving seminars and talks.	All the teaching staff of Department of Statistical Science
	90DSSd02	Statistical Science Study Ⅱ	2		
	90DSSd03	Statistical Science Study Ⅲ	2		
	90DSSd04	Statistical Science Study Ⅳ	2		
	90DSSd05	Statistical Science Study Ⅴ	2		
	90DSSd06	Statistical Science Ⅰ	2	This is a general course on statistical science consisting of seminars and special lectures. Emphasis is laid on important advanced topics in statistical science.	All the teaching staff of Department of Statistical Science
	90DSSd07	Statistical Science Ⅱ	2		
	90DSSd08	Statistical Science Ⅲ	2		
	90DSSd09	Statistical Science Ⅳ	2		
	90DSSd10	Statistical Science Ⅴ	2		
	90DSSd11	Statistical Mathematics Seminar Ⅰ	1	This is a general course of statistical science. Students are requested to attend the statistical mathematics seminar held at the institute of statistical mathematics to learn various recent developments in statistical science.	All the teaching staff of Department of Statistical Science
	90DSSd12	Statistical Mathematics Seminar Ⅱ	1		
	90DSSd13	Statistical Mathematics Seminar Ⅲ	1		
	90DSSd14	Statistical Mathematics Seminar Ⅳ	1		
	90DSSd15	Statistical Mathematics Seminar Ⅴ	1		