2022 Admission Guide

Department of Mathematical Informatics

Graduate School of Information Science and Technology
The University of Tokyo

Master's Program

Doctoral Program

Contact
 Department Team (Department of Mathematical Informatics),
 Academic Affairs Group, Graduate School of Engineering / Information Science and Technology,
 The University of Tokyo,
 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, JAPAN.
 TEL: 03-5841-6889   E-mail: office@office.keisu.t.u-tokyo.ac.jp

Visit
 https://www.i.u-tokyo.ac.jp/index_e.shtml

In addition to this brochure, be sure to refer to the admission guide of the Graduate School of Information Science and Technology, the University of Tokyo.

(I) Master's Program

1. Outline

Selection will be conducted based on the "AY 2022 Admission Guide: Master's Program, Graduate School of Information Science and Technology, The University of Tokyo" (posted on https://www.i.u-tokyo.ac.jp/index_e.shtml), and on this admission guide of the Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common guide, so please be sure to refer to that document. This admission guide supplements the above common guide with explanations regarding examination procedures that are specific to the Department of Mathematical Informatics.

Based on the interdisciplinary nature of the Department of Mathematical Informatics, this department invites applicants from a wide range of fields, both inside and outside the University of Tokyo, with a fundamental understanding and knowledge of mathematics, informatics, and physics. Examination subjects have been selected to ensure that applicants with diverse backgrounds can take examinations under fair conditions.

2. Preference Card

On the "Preference card (for the Master's Program)" included with this guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card at the time of application.

Note: Regarding preferred faculty advisors, please select your preferred advisors from amongst those in the Department of Mathematical Informatics (listed on pages 10-13).

3. Examination Subjects

3.1. Document screening

Document screening will be conducted based on the submitted documents. Regarding the notification of the screening results, refer to the admission guide of the Graduate School of Information Science and Technology.

Applicants are required to submit essays at the time of application, following "Document Screening Assignment (for Master's Program)" on page 8 of this guide.

3.2. General education subjects

We will conduct a mathematics examination. The examination will be conducted only for applicants who have passed the document screening. Refer to the admission guide of the Graduate School of Information Science and Technology for details.

3.3. Foreign language (English)

TOEFL iBT/TOEFL iBT(SHE) scores will be used to evaluate the applicants' English skills. For details, refer to "Guidelines for Submission of TOEFL Scores (for AY2022 Entrance Examinations)" which is provided with the admission guide of the Graduate School of Information Science and Technology.

3.4. Specialized subjects and oral examination

The examination will be conducted only for applicants who have passed the document screening.

1) Essays

Applicants will be required to submit essays on Mathematical Informatics. The subjects of the essays will be related to mathematical methods for solving problems, including: algebraic methods, analytic

methods, geometric methods, discrete methods, stochastic methods, statistical methods, and algorithms, etc.

The subjects of the essays and the submission instructions will be announced directly to the applicants at 10 am on June 30 (Wednesday), 2021. Submissions are due by noon on July 28 (Wednesday), 2021.

2) Oral examination

We will conduct an oral examination concerning the submitted essays and specialized academic skills and knowledge on Mathematical Informatics. The oral examination will be held online between August 23 (Monday) and August 25 (Wednesday), 2021. Examinees will be notified directly regarding the instructions of the oral examination in early August. An optional online connection trial will be organized on August 12 (Thursday), 2021. The details on the connection trial will be announced in early August.

The oral examination will be conducted only for applicants who have taken the written examination on general education subjects and submitted the essays. Examinees will be notified directly regarding the detailed schedule of the oral examination by noon on August 19 (Thursday), 2021.

4. Important Notes

4.1. Those who are absent from one of the exams (the general education subjects and the oral examination) will be considered to have withdrawn from the entrance examination.

4.2. Persons wishing to enter the school in October who have not graduated from university by September 2021 are required to confirm their eligibility with the Department Team (the Department of Mathematical Informatics), Academic Affairs Group, the Graduate School of Engineering / Information Science and Technology, the University of Tokyo.

5. Contact

If you have any questions regarding this admission guide, please contact the Department Team as indicated on the cover.

(II) Doctoral Program [Summer and Winter Entrance Examinations]

1. Outline

Selection will be conducted based on the "AY 2022 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo" (posted on https://www.i.u-tokyo.ac.jp/index_e.shtml), and on this admission guide of the Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common guide, so please be sure to refer to that document. This admission guide supplements the above common guide with explanations regarding examination procedures that are specific to the Department of Mathematical Informatics.

2. Contact before the Submission of the Applications

Applicants are required to contact the following office prior to the submission of the applications and arrange a meeting with their preferred faculty advisor.

Contact:

Department Team (Department of Mathematical Informatics)
Academic Affairs Group
Graduate School of Engineering / Information Science and Technology, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
(TEL: 03-5841-6889, E-mail: office@office.keisu.t.u-tokyo.ac.jp)

3. Preference Card

On the "Preference card (for Doctoral Program)" included in this guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card at the time of application.

4. Documents for the Submission

Applicants are requested to write reports on the following themes, complete the checklist on the preference card, and submit all of the reports at the time of application.

Theme:

(1) Summarize your past research achievements and future research plans in a report in English or Japanese, comprising no more than ten A4-sized pages, including formulas, diagrams, etc. Applicants may use any format appropriate for this report.

(2) Provide an English summary of the above report on about one A4-sized page.

(3) Provide responses to the following questions regarding the content of the above report in English or Japanese, comprising no more than two A4-sized pages.

    (a) What is the goal of your research?

    (b) What is the specific content of this research and the methods used?

    (c) What is the current status of this field of research, in Japan and overseas?

    (d) What aspects of this research could be considered new in comparison to past researches in this field?

    (e) How will the results of this research contribute to the field in question?

5. Primary Examinations

5.1. Foreign language (English)

・TOEFL iBT/TOEFL iBT(SHE) scores will be used to evaluate the applicants' English skills. For details, refer to "Guidelines for Submission of TOEFL Scores (for AY2022 Entrance Examinations)" which is provided with the admission guide of the Graduate School of Information Science and Technology.

・Persons who have completed or are expected to complete a Master's Program in the University of Tokyo will not be required to submit TOEFL scores.

5.2. Written examination

・Applicants will take an examination on the specialized subject "Mathematical Informatics." Applicants will be required to write descriptive answers to questions that assess specialized academic skills and knowledge.

・In the Summer Entrance Examination, the written examination will be held online on August 25

(Wednesday), 2021. Applicants will be notified directly regarding the detailed schedule and the examination instructions in early August.

・In the Winter Entrance Examination, the written examination will be held between February 2 (Wednesday) and February 4 (Friday), 2022. Applicants will be notified directly regarding the detailed schedule and the examination instructions.

・Persons who have completed or are expected to complete a Master's Program of the University of Tokyo may be exempted from the specialized subject written examination. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 7 (Monday) in the case of the Summer Entrance Examination, and no later than November 24 (Wednesday) in the case of the Winter Entrance Examination.

5.3. Oral examination

・Applicants will be required to answer questions on the research plan and other materials submitted in advance.

・In the Summer Entrance Examination, the oral examination will be held online on August 26 (Thursday) or 27 (Friday), 2021. Applicants will be notified directly regarding the detailed schedule and the examination instructions in early August.

・In the Winter Entrance Examination, the oral examination will be held between February 2 (Wednesday) and February 4 (Friday), 2022. Applicants will be notified directly regarding the detailed schedule and the examination instructions.

6. Secondary Examination

In the case of the Summer Entrance Examination, persons who have passed the Primary Examinations shall take the Secondary Examination between late January and mid-February, 2022. Note, however, that persons who wish to enter the school in October and persons who have already completed a master's program by the time of application shall take the Secondary Examination on the same day as the Primary Examinations.

In the case of the Winter Entrance Examination, the Secondary Examination will be conducted on the same day as the Primary Examinations.

The oral examination will be conducted in the Secondary Examination. Applicants should send their Master's theses (or equivalent materials), with its summary written in one or two A4-sized pages to the office by e-mail before the examination date. Applicants will be notified later regarding the schedule and the instructions of the oral examination.

7. Contact

If you have any questions regarding this admission guide, please contact the Department Team as indicated on the cover.

(Ⅲ) Doctoral Program - Special Selection for Professionals [Summer and Winter Entrance Examinations]

1. Outline

Selection will be conducted based on the "AY 2022 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo" (posted on https://www.i.u-

tokyo.ac.jp/index_e.shtml), "AY 2022 Admission Guide: Doctoral Program [Special Selection for Professionals], Graduate School of Information Science and Technology, The University of Tokyo" and on this admission guide of the Department of Mathematical Informatics. All important items common to the graduate school, including requirements for eligibility and application procedures, are listed in the above common guides, so please be sure to refer to those documents. This admission guide supplements the above common guides with explanations regarding examination procedures that are specific to the Department of Mathematical Informatics.

2. Contact before the Submission of the Applications

Applicants are required to contact the following office prior to the submission of the applications and arrange a meeting with their preferred faculty advisor.

Contact:

Department Team (Department of Mathematical Informatics)
Academic Affairs Group
Graduate School of Engineering / Information Science and Technology, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
(TEL: 03-5841-6889, E-mail: office@office.keisu.t.u-tokyo.ac.jp)

3. Preference Card
On the "Preference card (for Doctoral Program)" included in this guide, fill in your preferences with regard to faculty advisors, fields, etc., and submit the card at the time of application.

4. Documents for the Submission

In their application documents, applicants shall include the documents consisting of the following five items regarding the applicant's research and work achievements in a field related to Mathematical Informatics. Applicants must complete the checklist on the preference card, and submit all of these documents at the time of application.

(1) List of achievements

Provide a list of academic papers, patents, products, and other examples of the applicant's achievements. In the case of collaborative achievements involving several persons, clearly indicate the part and the weight of the applicant's contributions.

(2) Outline of main achievements

Select three or fewer main achievements from the above list, and provide an outline of these achievements.

(3) Research plan

Provide a detailed description of the applicant's plan for research to be conducted in the Doctoral Program.

(4) Materials related to the main achievements

These materials may include reprints (or copies) of academic papers, detailed descriptions of patents, or product pamphlets.

(5) Recommendation letters

Select two individuals with a clear understanding of the applicant's achievements, and ask them to provide separate evaluations of those achievements by filling in the specified form found at (https://www.i.u-tokyo.ac.jp/edu/course/mi/pdf/gyouseki.doc). Evaluations should be sealed before being submitted. Regarding the submission of the recommendation letters, contact the Department

Team as indicated on the cover.

Note: Items (2) and (3) should be combined on about ten A4-sized pages.

5. Selection Methods

A few students will be selected based on research achievements and work achievements in fields related to Mathematical Informatics, and also on the examinations below.

5.1. Foreign language (English)

・TOEFL iBT/TOEFL iBT(SHE) scores will be used to evaluate the applicants' English skills. For details, refer to "Guidelines for Submission of TOEFL Scores (for AY2022 Entrance Examinations)" which is provided with the admission guide of the Graduate School of Information Science and Technology.

・Persons who have completed or are expected to complete a Master's Program of the University of Tokyo will not be required to submit TOEFL scores.

5.2. Written examination

・Applicants will take an examination on the specialized subject "Mathematical Informatics." Applicants will be required to write descriptive answers to questions that assess specialized academic skills and knowledge.

・In the Summer Entrance Examination, the written examination will be held online on August 25 (Wednesday), 2021. Applicants will be notified directly regarding the detailed schedule and the examination instructions in early August.

・In the Winter Entrance Examination, the written examination will be held between February 2 (Wednesday) and February 4 (Friday), 2022. Applicants will be notified directly regarding the detailed schedule and the examination instructions.

・Persons who have completed or are expected to complete a Master's Program of the University of Tokyo may be exempted from the specialized subject written examination. Applicants wishing to be exempted must contact the department via their preferred faculty advisor no later than June 7 (Monday) in the case of the Summer Entrance Examination, and no later than November 24 (Wednesday) in the case of the Winter Entrance Examination.

5.3. Oral examination

・Applicants will be required to answer questions on the research plan and other materials submitted in advance.

・In the Summer Entrance Examination, the oral examination will be held online on August 26 (Thursday) or 27 (Friday), 2021. Applicants will be notified directly regarding the detailed schedule and the examination instructions in early August.

・In the Winter Entrance Examination, the oral examination will be held between February 2 (Wednesday) and February 4 (Friday), 2022. Applicants will be notified directly regarding the detailed schedule and the examination instructions.

・Applicants should send their Master's theses (or equivalent materials) with their summaries written on one or two A4-sized pages to the office by e-mail before the examination date.

6. Contact

If you have any questions regarding this admission guide, please contact the Department Team as indicated on the cover.

[Preference card (for Master's Program)]

Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo

Program	Master's Program		
Examinee's name		*Examinee's number	
Graduated university (Graduate school if applicable)	University:_____ Faculty: _____ Department: _____ Graduation date (expected)　　　year　　　month Graduate School:_____Faculty: _____ Department: _____ Graduation date (expected)　　　year　　　month		
Contact address during the examination period	Address: TEL: E-mail:		
Names of the preferred faculty advisors	Preference 1		
	Preference 2		
	Preference 3		
	Preference 4		
	Preference 5		
	Preference 6		
Do you wish to enter the school in October 2021?	□ Yes		□ No
Residence Card (Please mark the appropriate item)	□ Retain Status: student／other (　　　　) Date of expiration of period of stay: ２０　　年　　月　　日		□ Not Retain
Language for the oral examination	□ Japanese		□ English
If you have any preferred faculty advisors other than those noted above, please indicate them here.			

・Submit this card along with your application.

・*Leave this box blank.

・Persons who will not have graduated from university by September 2021 and still wish to enter the school in October 2021 are required to confirm their eligibility with the Department Team (the Department of Mathematical Informatics), Academic Affairs Group, the Graduate School of Engineering / Information Science and Technology, the University of Tokyo, and mark the "Yes" box in the appropriate column above.

[Document Screening Assignment (for Master's Program)]

Submit essays on the following subjects at the time of application. Prepare your answers by using the template file found on the department web page. Follow the instructions on the same page in writing your answers. Keep the guidelines about the amount of answers, indicated in the parenthesis in each subject.

Subject 1. Briefly explain your motivation for applying to our department, presenting your concrete research topic. (0.5 pages)

Subject 2. Select one important tool in mathematical informatics (e.g., theorem, formula, methodology, and algorithm) that is related to the research topic you presented in Subject 1. About this tool, explain the following aspects in a concrete and precise manner by clarifying the relation to your research topic. (1.5 pages)

(1) Mathematical details

(2) Significance in mathematical informatics

(3) Example(s) of its application

Describe your answer to each of (1), (2), and (3) in a separate section.

[Preference card (for Doctoral Program)]

Department of Mathematical Informatics, Graduate School of Information Science and Technology, The University of Tokyo

Program	Doctoral Program		
Examinee's name		*Examinee's number	
Graduated university and graduate school	University:_____ Faculty: _____ Department: _____ Graduation date year month Graduate School:_____ Faculty: _____ Department: _____ Graduation date (expected) year month		
Contact address during the examination period	Address: TEL: E-mail:		
Name of the preferred faculty advisor			
	(Confirm the following statement and mark the check box.) □ I have made contact and held a meeting with the preferred faculty advisor prior to the submission of this application.		
Application Category (Please mark the appropriate item)	□ Summer Examination (Do you wish to enter the school in October 2021? □ Yes □ No)		
	□ Winter Examination		
	□ Special Selection for Professionals (Mark also either Summer Examination or Winter Examination.)		
Residence Card (Please mark the appropriate item)	□ Retain Status: student／other ( ) Date of expiration of period of stay: ２０ 年 月 日		□ Not Retain
Language for the oral examination	□ Japanese		□ English
Checklist of the documents to be submitted	Doctoral Program	Special Selection for Professionals	
	□ Research achievements & plans □ English summary □ Responses to questions (a)–(e)	□ List of achievements □ Outline of main achievements □ Research plan □ Materials of main achievements □ Recommendation letters	
Preferred field			

・Submit this card along with your application.

・*Leave this box blank.

・Please note that the period for acceptance of applications differs for the Summer Examination and the Winter Examination. Application documents that arrive outside of the specified periods for acceptance of applications shall be deemed invalid.

・Persons who will not have earned a Master's degree by September 2021 and still wish to enter the school in October via the Summer Examination are required to confirm the eligibility with the Department Team (the Department of Mathematical Informatics), Academic Affairs Group, the Graduate School of Engineering / Information Science and Technology, the University of Tokyo, and mark the "Yes" box in the appropriate column above.

Department of Mathematical Informatics

Graduate School of Information Science and Technology, The University of Tokyo

https://www.i.u-tokyo.ac.jp/edu/course/mi/members_e.shtml

Tsuyoshi Takagi (Professor)	(1) Mathematical Cryptography: Theoretical analysis and efficient implementation of post-quantum cryptography in the era of quantum computers. (2) Applied Cryptography: Security evaluation of Bitcoin system or cryptographic protocols such as SSL/TLS.
Kunihiko Sadakane (Professor)	(1) Algorithms and data structures: theory of algorithms for processing discrete data such as graphs and strings, theory of stream, external, and GPU algorithms, and theory of succinct data structures and graph decomposition. (2) Applications of those theories to efficient big data processing such as genome information and geographic information.
Takayasu Matsuo (Professor)	(1) Numerical algorithm: differential equation, function approximation, numerical linear algebra, tensor. (2) Theoretical numerical analysis: geometric numerical integration, discrete functional analysis, asymptotic behaviors of algorithms. (3) Applications: physical simulation, data analysis.
Fumiyasu Komaki (Professor)	(1) Theoretical statistics: inference theory, prediction theory, Bayesian theory, experimental design, model selection. (2) Statistical modeling: Bayesian networks, graphical models, point processes. (3) Information geometry: differential geometry of statistical inference.
Akiko Takeda (Professor)	(1) Continuous optimization: development of efficient algorithms for solving nonconvex optimization problems, robust optimization problems, etc. (2) Applications of optimization methods to optimization problems in machine learning, energy system. (3) Operations Research.
Kenji Yamanishi (Professor)	(1) Theory of machine learning: an information-theoretic or statistical approach to machine learning. (2) Data science: anomaly detection, change detection, network mining, latent dynamics. (3) Big data analysis: security, marketing, traffic risk analysis, medical data analysis, economic data analysis. (4) Symptomatics—Science of early warning signals of anomalies.
Satoru Iwata (Professor)	(1) Discrete optimization: Design of efficient algorithms for optimization problems related to matroids and submodular functions. (2) Discrete mathematical engineering: Discrete optimization techniques in numerical linear algebra and dynamical systems analysis. (3) Global optimization: Design of efficient algorithms for solving nonconvex optimization problems with geometric backgrounds. (4) Chemo-informatics: Information processing methods for assisting research in chemistry.
Hiroshi Hirai (Associate Professor)	(1) Discrete optimization: multicommodity flow, facility location, network design, etc. (2) Discrete mathematics: finite metric spaces, polyhedral combinatorics, graph theory, and their applications.

Ken'ichiro Tanaka (Associate Professor)	(1) Theoretical Numerical Analysis: numerical integration, function approximation, mathematical analysis of approximation formulas, design of accurate approximation formulas by optimization. (2) Numerical algorithm: accurate computation by variable transformation, fast and accurate computation of integral transforms, fast and accurate methods for functional equations. (3) Numerical methods for finance: option pricing, risk evaluation.
Tomonari Sei (Associate Professor)	(1) Theoretical statistics: inference theory, directional statistics, algebraic statistics, information geometry, Bayesian statistics. (2) Statistical modeling of rare events, time series data, etc. (3) Statistical modeling with optimal transport map.
Taiji Suzuki (Associate Professor)	(1) Machine learning, statistical learning theory: theory of generalization error, deep learning, kernel method, regularization, stochastic optimization. (2) Mathematical statistics, statistical modeling: high dimensional sparse estimation, Bayesian statistics, information geometry.
Shin-ichi Tanigawa (Associate Professor)	(1) Discrete and computational geometry: distance geometry, rigidity theory, matroids, graph embeddings. (2) Applications of discrete optimization techniques: graph algorithms, analysis of discrete engineering structures.
Kazuhiro Sato (Lecturer)	(1) Applications of optimization theory to control systems theory: Riemannian optimization, proximal algorithm, submodular optimization. (2) Applications of control systems theory to optimization theory: distributed optimization, accelerated gradient method, passivity. (3) Data-driven modeling for controlling systems: machine learning, optimization, numerical analysis.
Kumiko Tanaka-Ishii (Professor) [RCAST]	(1) Computational linguistics, statistical properties of natural language. (2) Study of language by using complex systems theory, chaotic properties of language: complexity, self-similarity, non-stationarity, power laws. (3) Mathematical modeling of natural language structures and sequences, embedding representations of linguistic entities. (4) Natural language processing using deep learning. (5) Study of social complex systems by using natural language processing. Analysis and prediction of financial markets and communication networks via texts.
Takashi Kohno (Professor) [IIS]	(1) Neuromorphic system: designing and construction of artificial system that mimics information processing scheme in nerve system and brain. (2) Modeling nerve system and brain: nonlinear model and bifurcation of neuronal cell, learning rule.
Tetsuya Kobayashi (Associate Professor) [IIS]	(1) Theory for stochastic biological phenomena: stochastic process, stochastic dynamical systems, and stochastic thermodynamics. (2) Systems biology: image analysis, data analysis, and modeling of biological phenomena. (3) Theory for biological information processing systems: searching, information coding, recognition, control, learning, and evolution.
Yoshihiro Kanno (Professor) [MI]	(1) Continuous optimization and applied mechanics: convex optimization, complementarity, duality and their applications to structural optimization, contact mechanics, plasticity, etc. (2) Robust optimization and its applications: Optimization with uncertain data, robust optimization of structures, robustness evaluation of uncertain systems, etc.

Teppei Ogihara (Associate Professor) [MI]	(1) Stochastic calculus and mathematical statistics: statistical analysis of stochastic processes (diffusion processes, jump diffusion processes, point processes, Malliavin calculus, maximum-likelihood-type estimation, asymptotic efficiency). (2) Statistical analysis of financial data: statistical inference of stock volatility and covariation, high-frequency financial data analysis, minimum variance portfolio.
Ryohei Hisano (Lecturer) [MI]	(1) Learning on networks (temporal, heterogeneous information, knowledge graph). (2) Empirical research on social and economic networks (transaction patterns, detecting malicious nodes, systemic risk). (3) Reliability of information (news, financial reports). (4) Big data analysis (data science, complexity science): financial markets, block chain, marketing.
Yasushi Kawase (Project Associate Professor) [RIISE]	(1) Discrete optimization: Design of algorithms for online optimization problems, robust optimization problems, etc. (2) Algorithmic game theory: Design and analysis of mechanisms in strategic behavior.
Hiromichi Nagao (Associate Professor) [ERI]	(1) Utilization of big data related to earthquakes: automatic detections of earthquakes based on machine learning, algorithm for hypocenter determinations, algorithm for earthquake and tsunami early warning. (2) Data assimilation: integration of large-scale numerical simulations and massive observation data, sequential Bayesian filters, four-dimensional variation method (fast automatic differentiation method), optimization of observational/experimental design, programming on parallel supercomputers.
Hiroshi Kori (Professor) [Frontier Science]	(1) Nonlinear physics: nonlinear phenomena, synchronization, oscillations, complex systems, pattern formation, dynamical systems, stochastic processes, complex networks. (2) Theoretical biology: modeling of biological phenomena, biological oscillations, neuroscience, collaboration with experimentalists.
Yuki Izumida (Lecturer) [Frontier Science]	(1) Nonequilibrium physics: nonequilibrium thermodynamics and statistical mechanics, stochastic thermodynamics, nonequilibrium theory of life phenomena, fusion study of nonlinear dynamics and thermodynamics (dynamical modeling of engines, energy harvesting technologies). (2) Nonlinear physics: coupled oscillators, synchronization phenomena, bifurcation analysis, noise and stochastic resonance phenomena, complex systems, etc.
Kengo Nakajima (Professor) [ITC]	(1) Parallel Numerical Algorithms: Parallel Linear Solvers (Iterative Methods, Preconditioning), Multigrid Methods. (2) High-Performance Computing (HPC): Parallel Programming Models, Problem Solving Environment (PSE). (3) Scientific Computing: Computational Mechanics, Finite Element Methods (FEM). (4) Large-Scale Data Processing: Adaptive Mesh Refinement (AMR), Visualization.
Gouhei Tanaka (Project Associate Professor) [IRCN]	(1) Complex systems dynamics: mathematical modeling, complex dynamics analysis, bifurcation phenomena, phase transitions, network robustness, epidemics, power networks, and social phenomena. (2) Energy-efficient information processing: neural computer, learning algorithms, reservoir computing, communication cost minimization, nano/micro systems.

Kantaro Fujiwara (Project Associate Professor) [IRCN]	(1) Computational neuroscience: mathematical modeling of single neuron, neural network modeling, learning, and adaptation. (2) Data analysis in neural systems: theory for neural spike train analysis and its application, prediction, brain network analysis. (3) Biological information processing: pancreatic beta cell modeling, modeling for diabetes.
Andrea Benucci (Professor) [RIKEN CBS]	(1) Computations in biological neural networks: encoding and decoding principles of sensory processing, sensory to decision transformations, linear and non-linear analyses of large-scale neuronal recordings. (2) Dynamical models of neural activity: deep recurrent neural networks (RNN), non-linear analysis of fitted RNN. (3) Predictive modeling and experiments: two-photon imaging, optogenetic perturbations of neural-network dynamics.
Taro Toyoizumi (Professor) [RIKEN CBS]	(1) Computational neuroscience: Neural coding, Bayes theorem, Chaotic neural networks, Mean-field theory. (2) Learning theorem of the brain: Synaptic plasticity, Associative learning, Information-optimization, Signal processing, Critical period. (3) Neural data analysis: Delay embedding theorem, Modeling brain/body/environment interaction.

[RCAST] means members belonging to the Research Center for Advanced Science and Technology. [IIS] means members belonging to the Institute of Industrial Science. [MI] means members belonging to the Mathematics and Informatics Center. [RIISE] means members belonging to the Research Institute for an Inclusive Society through Engineering. [ERI] means members belonging to the Earthquake Research Institute. [Frontier Science] means members belonging to the Graduate School of Frontier Sciences. [ITC] means members belonging to the Information Technology Center. [IRCN] means faculty members belonging to the International Research Center for Neurointelligence. [RIKEN CBS] means faculty members belonging to the RIKEN Center for Brain Science. For locations of offices of the faculty members, refer to their web pages.

Required Documents(Department of Mathematical Informatics)

	Summer Examination		Winter Examination	
	Documents to be Submitted	Who to Submit	Documents to be Submitted	Who to Submit
Master's Course	Preference Card (for Master's Program)	All Applicants		
	Document Screening Essays (for Master's Program)	All Applicants		
	TOEFL iBT/TOEFL iBT(SHE) Score	All Applicants		
	Transfer Application for the Online Written Examinations	Those who request the online examinations for the general education subjects written examination		
Doctoral Course	Preference Card (for Doctoral Program)	All Applicants	Preference Card (for Doctoral Program)	All Applicants
	(1)Research achievement & plans (written in Japanese or English, no more than 10 A4-sized pages) (2)English summary of (1) (1 A4-sized page) (3)Responses to questions (a)-(e) regarding (1) (written in Japanese or English, no more than 2 A4-sized pages)	All Applicants	(1)Research achievement & plans (written in Japanese or English, no more than 10 A4-sized pages) (2)English summary of (1) (1 A4-sized page) (3)Responses to questions (a)-(e) regarding (1) (written in Japanese or English, no more than 2 A4-sized pages)	All Applicants
	TOEFL iBT/TOEFL iBT(SHE) Score	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo	TOEFL iBT/TOEFL iBT(SHE) Score	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo
Doctoral Course ‹Special Selection for Professionals›	Preference Card (for Doctoral Program)	All Applicants	Preference Card (for Doctoral Program)	All Applicants
	(1)List of achievements (2)Outline of main achievements (3)Research plan (4)Materials related to main achievements (5)Recommendation letters (from 2 persons, in the specified form) ∗(2)(3) should be combined on about 10 A4-sized pages.	All Applicants	(1)List of achievements (2)Outline of main achievements (3)Research plan (4)Materials related to main achievements (5)Recommendation letters (from 2 persons, in the specified form) ∗(2)(3) should be combined on about 10 A4-sized pages.	All Applicants
	TOEFL iBT/TOEFL iBT(SHE) Score	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo	TOEFL iBT/TOEFL iBT(SHE) Score	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo