Appended Form 1

Specifications for the Major Program

Name of School(Program) School of Informatics and Data Science(Informatics and Data Science

Program name (Japanese)	
English	Computer Science Program

1. Degree to be obtained:

Bachelor of Science in Informatics and Data Science

2. Overview

    Because the complexity of economics, society, and the environment is increasing due to rapid globalization, people with the ability to identify problems and find solutions on their own have become indispensable for various organizations. In addition, it is urgently required to develop people capable of efficiently processing and analyzing huge amounts of information and data, so-called "big data", and of developing strategies and plans for their organizations based on evidence.   The educational program in the School of Information Science consists of three programs, "Computer Science Program," "Data Science Program," and "Intelligence Science Program," and aims to develop specialists who have profound knowledge and understanding for each specialized area, in addition to the basic knowledge and skills in the three programs.

  The data/network environment in contemporary society has been rapidly developed. In particular, the amount of data is swelling rapidly (big data), data is becoming more heterogenic and increasing in variety (qualitative/quantitative data, audio, images, movies, documents, graph structures, etc.), and the travel distance and speed of data are dramatically expanding. In today's information science education, it is required to develop various abilities, such as advanced information processing technologies based on basic knowledge of computer science and programming, technologies for collecting, processing, and analyzing various data acquired through specialized knowledge of mathematics and statistics, and advanced technologies that lead to new knowledge creation and innovation to solve problems that mankind has not been able to solve in the past, as represented by artificial intelligence.

  However, it is difficult to develop specialists in information science, which is currently required in many fields, by providing only superficial knowledge and skills commonly required in "Computer Science", "Data Science", and "Intelligence Science". This program aims to develop specialists with diversity who can sufficiently exercise their profound understanding and abilities in areas of "Computer Science", "Data Science," and "Intelligence Science," based on a hybrid background across the

In this program, in the first year, all students take higher mathematics such as algebra and analysis,

3. Diploma policy (policy for awarding degrees and goal of the program)

This school educates students to become specialists with advanced capabilities in each of computer science, data science and intelligence science, as well as the basic abilities that consist of processing techniques based on the information technology, which are the basis of the information-intensive society of today, as well as advanced data analysis capabilities. In addition, this school aims to develop people who are capable of appropriately managing, processing, and analyzing information that has swelled significantly, and become complicated, due to such phenomena as the accumulation of big data, technological breakthroughs in fields related to artificial intelligence (AI), and the development of the IoT.

This school will award the degree of Bachelor of Science in Informatics and Data Science to students who have acquired the knowledge and abilities described below, and earned the required credits defined for the educational course. The diploma policy of the department of information science, faculty of information science, which is common to all program, is as follows.

To evenly acquire the skills related to the development of an information infrastructure, information processing techniques, and technology for producing new added value through data analysis.

To acquire the ability to identify and solve new problems on their own by quantitative and logical thinking based on data, diverse perspectives, and advanced skills for information processing and analysis.

To acquire the ability for reading and logical writing in English, capabilities required for giving a good, clear oral presentation,

and implemented according to the policies described below. Academic achievement is evaluated based on the grade scores for the subjects and the level of achievement against the target defined for this program.

In the first academic year, students take peace science courses (academic target C1), basic courses in university education (target C1 and E), common subjects (foreign languages and health and sports courses; target C1 and C2), basic subjects (mathematics, statistics, and programming; target A and B); as liberal arts education subjects and a part of specialized subjects.

In the second year, students mainly take subjects that are fundamental to computer science and information processing (achievement targets A, B, D1, D2, D3) and subjects that are fundamental to information processing (achievement targets A, D1, D2). The basic subjects of computer science consist of programming, automata and language theory, digital circuit design, and algorithms and data structures. The basic subjects of information processing consist of information theory, mathematical analysis, and mathematical programming.

In the third year, students take advanced courses related to computer science (achievement targets A, D1, D2, and D3), including computation theory, computer networks, security, various media information processing technologies, parallel and distributed computing, digital signal processing, software engineering, and artificial intelligence and machine learning. In addition, students take Information Science Exercise I, II, III, and IV (achievement targets A and D3) to develop practical skills in circuit and embedded system design, and to acquire skills related to computer science.

In the fourth academic year, students prepare their graduation thesis or engage in long-term fieldwork, using capabilities corresponding to the achievement targets A to E that they have acquired in the computer science program. The thesis or fieldwork is evaluated against the achievement targets A to E based on its degree of achievement and the presentation given at the presentation assembly.

5. Start time and acceptance conditions

In this program, students are assigned to a program at the end of the first year, and at the end of the second year, students are required to choose one of the following model courses: "Basic Model Course", "Integrated Model Course" or "Practical Model Course".

6. Obtainable qualifications

Educational personnel certification (Information teaching and Mathematics) is awarded to the students who earn the required credits.

7. Class subjects and their contents

For class subjects, refer to the subject table in Attachment 1. (The subject table is to be attached.)
For the details of the class subjects, refer to the syllabus that is published each academic year.

8. Academic Achievement

The evaluation criteria are specified for each evaluation item for academic achievement, and the achievement level against the criteria is designated at the end of the semester.

The evaluation score for each evaluation item is converted to a numerical value (S = 4, A = 3, B = 2, and C = 1) and the evaluation standard for academic achievement, from when the student entered the

university to the end of the last semester, is determined using these values while applying weightings. The evaluation standards consist of three levels, i.e. Excellent, Very Good, and Good.

Academic achievement	Evaluation standard
Excellent	3.00 - 4.00
Very Good	2.00 - 2.99
Good	1.00 - 1.99

Achievement evaluation	Numerical conversion
S (Excellent: 90 or more points)	4
A (Very good: 80 - 89 points)	3
B (Good: 70 - 79 points)	2
C (Passed: 60 - 69 points)	1

Refer to the relationship between evaluation items and evaluation criteria described in Attachment 2.

Refer to the relationship between evaluation items and class subjects described in Attachment 3.

Refer to the curriculum map in Attachment 4.

9. .Graduation thesis (graduation research) (meaning, student allocation, timing, etc.)

○ Meaning

Graduation Thesis is a comprehensive subject in which students utilize the specialized knowledge, skills, and abilities that they have acquired in the Computer Science Program to pursue an advanced research topic. To take this subject, therefore, they are required to have not only knowledge of the specialized area but also an ability for research planning, a positive attitude, a cooperative mindset, and the capacity for continuous effort. This program educates students in Basic Model Course or Integrated Model Course to comprehensively improve these capabilities in order to allow them to acquire the ability to identify and solve new problems on their own. Detailed objectives are as follows:

1. To acquire the ability to develop a research plan for their research objective on their own, and to carry out their research according to that plan.
2. To develop skills for collecting materials related to the research objective, understanding the objective, and identifying problems.
3. To develop capabilities for analyzing problems related to the research objective and providing

5. To develop documentation skills for organizing research results and describing the meaning and efficacy of the obtained results in logical and consistent text.
6. To develop presentation skills for delivering the research results clearly and orally, and communication skills for active discussion.

some action in either of the program, members which are mainly engaged in the concerned course will take responsibility. In such a case, the dean of the school designates the person in charge.

(2)　Evaluation of the program

○ Perspectives for evaluation of the program

Are class subjects arranged appropriately, while considering the aims of study and education in this program? Are the contents of classes appropriate?

Have students, on average, achieved the level that is required of them?

Is the system for achieving an upward spiral in the program functioning according to an appropriate cycle?

○ Evaluation method

Each subject in the program is evaluated based on student evaluation of the classes and achievement evaluation results.

For evaluation of the upward spiral in quality of the program, questionnaires for students are conducted in an appropriate cycle, and the opinions of ex-students and companies are collected.

○ Policy and method for feedback to students

For individual classes, the faculty member who is in charge of the class makes comments on the evaluation of the class and the achievement evaluation results.

Actions taken, such as changes to the lecture and program structure, are published on the web site of School of Informatics and Data Science and/or another medium stating also the reason for the changes.

Sheet 1

				1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
2	Peace Science Courses	2	Compulsory elective																
2	Introduction to University Education	2	Required																
2	Introductory Seminar for First-Year Students	2	Required																
0		1																	
4																			

Basic Specialized Subjects for Imformatics and Data Science
The Computer Science Program

Required subject
Compulsory elective subject
Free elective subject

Subject Type	Class Subjects	Credits	Type of model course — Basic	Integrated	Practical	1st year 1	2	3	4	2nd year 1	2	3	4	3rd year 1	2	3	4	4th year 1	2	3	4	Note
Specialized Subjects	Discrete Mathematics I						4															
	Discrete Mathematics							4														
	Programming I					2																
	Programming							2														
	Programming										2											
	Programming												3									
	Theory of Automata and Languages									4												
	Digital Circuit Design											4										
	Programming Languages												4									
	Algorithms and Data Structures											4										
	Fundamentals of Probability Theory								4													
	Inferential Statistics									4												
	Linear Regression Model										4											
	Statistical Test										4											
	Stochastic Modeling												4									
	Numerical Computation												4									
	Mathematical Programming									4												
	System Optimization											4										
	Mathematical Analysis										4											
	Multivariate Analysis											4										
	Basic and practice in Categorical data analysis												4									
	Mechanism how programs run on computer												4									
	Operating Systems											4										
	Databases												4									
	Information Theory									4	4											
	Practical English I													4								
	Practical English															4						
	Informatics and Data Science Exercise I													3								
	Informatics and Data Science Exercise II														3							
	Informatics and Data Science Exercise III															3						
	Informatics and Data Science Exercise IV																3					
	Software Engineering I														4							
	Software Engineering II															4						
	Theory of Computing													4								
	Image Processing														4							
	Visual Computing															4						
	Introduction to Artificial Intelligence									4						4						
	Computer Network																4					
	Human Computer Interaction															4						
	Parallel and Distributed Processing																					
	Software Management																					
	Natural Language Processing														4							
	Information Society and Security														4							
	Digital Signal Processing													4								
	Data Mining													4								
	Survey design													4								
	Nonparametric analysis														4							
	Big Data																4					
	Behaviormetrics													4								
	Econometrics														4							
	Time Series Analysis															4						
	Biostatistics																4					
	Stochastic Processes																4					
	Financial Engineering																4					
	Speech Recognition													4								
	Text Mining																4					
	Machine Learning											4										
	Reinforcement Learning														4							
	Decision-Making														4							
	Introduction to IoT																4					
	Biological Information Processing															4						
	Bioinformatics														4							
	Sparse Estimation													4								
	Advanced Programming																4					
	Neural Networks													4								
	Bayesian Statistics													4								
	Semiotic AI														4							
	Mathematical Statistics															4						
	FinTech														4							
	Quality Management																4					
	Computer Science Seminar I																	4				
	Computer Science Seminar II																		4			
	Data Science Seminar I																	4				
	Data Science Seminar II																		4			
	Intelligence Science Seminar I																	4				
	Intelligence Science Seminar II																		4			
	Graduation Thesis																			6		
Practical Subjects										4												
												4										
														4								
															4							

Academic Achievement in Educational Program for the Computer Science Program
The Relationship between Evaluation Items and Evaluation Criteria

Academic Achievements			Evaluation Criteria		
		Evaluation Items	Excellent	Very Good	Good
Knowledge & understanding	(1)	C1. Knowledge and ability to work on problem-solving after understanding that various issues existing in human beings, society, and individuals can be interpreted in multiple ways depending on social conditions and culture.	Have sufficient knowledge to fully understand the various problems and diversity of human beings, society, and individuals and how to address them.	Have standard knowledge for understanding various problems and the diversity of human beings, society, and individuals to a standard level and how to address them.	Understand various problems and diversity of human beings, society, and individuals to the minimum extent, and have the minimum knowledge to address them.
	(2)	D1. Knowledge and ability to understand the theoretical framework underlying computer science and to collect and process high-dimensional data through full use of information processing technology based on scientific logic.	Have sufficient knowledge to understand the theoretical framework of computer science and to collect and process high-dimensional data by making full use of information processing technology.	Have a standard understanding of the theoretical framework of computer science and the standard knowledge for collecting and processing high-dimensional data by making full use of information processing technology.	Understand the theoretical framework of computer science to a minimum extent, and have the minimum knowledge to collect and process high-dimensional data by making full use of information processing technology.
Ability & skills	(1)	A. Information infrastructure development technology, information processing technology, technology that analyzes data and creates new added value.	Have sufficient knowledge to fully acquire and utilize information infrastructure development technology, information processing technology, and technology that creates new added value by analyzing data.	Have standard knowledge to learn and utilize information infrastructure development technology, information processing technology, and technology that creates new added value by analyzing data.	Have minimum knowledge to learn and utilize information infrastructure development technology, information processing technology, and technology that creates new added value by analyzing data to the minimum extent.
	(2)	B. Ability to identify new problems independently and solve them through quantitative and logical thinking based on data, multifaceted perspectives, and advanced information processing and analysis.	Have sufficient knowledge to identify new problems independently and acquire sufficient abilities to solve problems through quantitative and logical thinking based on data, multifaceted perspectives, and advanced information processing and analysis.	Have standard knowledge to identify new problems independently and acquire standard abilities to solve problems through quantitative and logical thinking based on data, multifaceted perspectives, and advanced information processing and analysis.	Have minimum knowledge to identify new problems independently and acquire a minimum ability to solve problems through quantitative and logical thinking based on data, multifaceted perspectives, and advanced information processing and analysis.
	(3)	D3. Knowledge of hardware and software and programming ability to process data efficiently.	Have to fully acquire and utilize the knowledge of hardware and software and the programming ability to process data efficiently.	Have to acquire and utilize the knowledge of hardware and software and the programming ability to process data efficiently to the standard level.	Have to acquire and utilize the knowledge of hardware and software and the programming ability to process data efficiently to the minimum level.
Comprehensive capability	(1)	C2. English conversation, reading, and writing skills are necessary for conducting research, good oral presentation skills, documentation skills for open discussion, and communication skills.	Have sufficient knowledge to fully acquire and utilize the communication, presentation, and documentation abilities related to English necessary for conducting research efficiently.	Have standard knowledge to acquire and utilize the communication, presentation, and documentation abilities related to English necessary for conducting research to the standard level.	Have minimum knowledge to acquire and utilize the communication, presentation, and documentation abilities related to English necessary for conducting research to the minimum level.
	(2)	D2. Ability to derive optimal system solutions based on abundant cutting-edge information technologies for cross-sectoral issues in a diversified and complicated information society.	Have to acquire and utilize sufficient ability to guide optimal system solutions based on cutting-edge information technology for cross-sectoral issues in the information society.	Have to acquire and utilize standard abilities to guide optimal system solutions based on cutting-edge information technology for cross-sectoral issues in the information society.	Have to acquire and utilize the minimum ability to guide the optimum system solution based on the latest information technology for cross-sectoral issues in the information society.
	(3)	E. Creative and logical thinking ability to analyze practical problems/issues and derive rational solutions that meet the demands of society, and the ability to realize these solutions.	Have to acquire and utilize creative and logical thinking ability and sufficient ability to realize this solution to analyze practical problems and derive rational solutions that meet the demands of society.	Have to acquire and utilize creative and logical thinking ability and standard ability to realize this solution to analyze practical problems and derive rational solutions that meet the demands of society.	Have to acquire and utilize creative and logical thinking ability and the minimum ability to realize this solution to analyze practical problems and derive rational solutions that meet the demands of society.

Placement of the Liberal Arts Education in the Major Program

The liberal arts education in this program aims to build the academic foundation required for specialized education. Students take such subjects as a foreign language and disciplinary subjects to develop deep humanity, flexibility, and profound intelligence to foster the essential qualifications and abilities required for working globally in international society. In addition, they acquire the knowledge and skills that constitute the basis of specialized education in fundamental subjects such as Mathematics and Statistical data analysis.

Curriculum Map of Computer Science Program

Academic Achievement / Evaluation It23ems	1st grade Spring	1st grade Fall	2nd grade Spring	2nd grade Fall	3rd grade Spring	3rd grade Fall	4th grade Spring	4th grade Fall
Knowledge and Understandings — (1) C1. Knowledge and capabilities required for solving problems, while understanding that various problems of human beings, societies, and individuals can be interpreted in different ways according to social conditions, cultures, etc.	(1T)Introduction to University Education ◎ / (1T)Introductory Seminar for First-Year Students ◎ / (1T)Area courses / (1T)Health and Sports Courses / (2T)Peace Science Courses		(1T)Information Processing and Industry( ) ( ) ○ ( ) ○ (	(3T)Data Science and Management( ) (○ ((	(1T)Frontier of Informatics and Data Science( ) / (2T)Research Project ( ))))		)	
Knowledge and Understandings — (2) D1. Knowledge and skills required for understanding the theoretical system of statistics and data analysis, and for precisely and efficiently analyzing qualitative/quantitative information in big data.			(1T)Theory of Automata and Languages( ) / (1T Introduction to Artificial Intelligence / (1T)Information Theory( ) / (2T)Mathematical Analysis( )	(3T)Machine Learning / (4T)Databases( )	(1T)Theory of Computing( ) / (1T)Speech Recognition / (2T)Natural Language Processing( ) / (2T)Reinforcement Learning / (2T)Decision-Making / (1T)Neural Networks / (2T)Semiotic AI	(4T)Text Mining)	(1T)Computer Science Seminar I( ) / (2T)Computer Science Seminar II( ) ○	) △ △ △
and Skills — (1) A. Skills related to the development of an information infrastructure, information processing techniques, and technology for producing new added value through data analysis.	(2T)Introduction to Information and Data Sciences( ) / (1T)Elements of Calculus( ) / (1T)Introductory Seminar for First-Year Students( ) / (2T)CalculusI( ) / (1T)Linear AlgebraI( ) / (2T)Discrete Mathematics I( ) / Programming I( )	(3T)Seminar in Basic Mathematics I( ) / (4T)Seminar in Basic Mathematics II( ) / (3T)CalculusII( ) / (3T)Linear AlgebraII( ) / (3T)Ground zero programming( ) / (3T)Discrete Mathematics ( ) / (4T)Fundamentals of Probability Theory( ) / Programming ( )	Programming / (1T)Theory of Automata and Languages( ) / (1T)Inferential Statistics( ) / (2T)Mathematical Analysis( ) / (2T)Statistical Test( ) / (2T)Linear Regression Model( )	Programming III / (3T)Digital Circuit Design / (3T)Algorithms and Data Structures / (4T)Programming Languages / (4T)Stochastic Modeling( )	(1T)Informatics and data science, Exercise I / (1T)Theory of Computing / (1T)Data Mining / (1T)Survey design( ) / (2T)Informatics and data science, Exercise / (2T)Nonparametric analysis / (1T)Behaviormetrics( ) / (2T)Econometrics( ) / (2T)Bioinformatics / (1T)Sparse Estimation / (1T)Bayesian Statistics / (2T)FinTech	(3T)Informatics and data science, Exercise / (4T)Informatics and data science, Exercise / (4T)Computer Network / (4T)Big Data / (3T)Time Series Analysis( ) / (4T)Biostatistics( ) / (4T)Stochastic Processes( ) / (4T)Financial Engineering( ) / (4T)Introduction to IoT / (3T)Biological Information Processing / (3T)Mathematical Statistics	(III) / (IV ○) /) / (/) / (	( ) / ( ) / ○ (/) / (/ △○ / △ △ / △ △
and Skills — (2) B. Ability to identify and solve new problems on their	(1T)Introductory Seminar for First-Year Students / (2T)Introduction to Information and Data Sciences	(3T)Seminar in Mathematics / (4T)Seminar in Mathematics	Programming / (1T)Theory of Automata and Languages( )	Programming III / (3T)Digital Circuit Design	(1T)Informatics and data science, Exercise / (2T)Informatics and data science, Exercise	(3T)Informatics and data science, Exercise / (4T)Informatics and data science, Exercise	(III) / (IV	( ) /) ( )

Academic Achievement Evaluation Itemas	1st grade		2nd grade		3rd grade		4th grade	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Abilities a — solve new problems on their own by quantitative and logical thinking based on data, diverse perspectives, and advanced skills for information processing and analysis.	(1T)Elements of Calculus (2T)Calculus (1T)Linear Algebra (2T)Discrete MathematicsI Programming	(3T)Calculus (3T)Linear Algebra (3T)Ground zero programming( ) (3T)Discrete MathematicsII (4T)Fundamentals of Probability Theory Programming	(1T)Inferential Statistics( ) (2T)Statistical Test( ) (2T)Linear Regression Model( ) ◎ ◎ Ⅱ ◎	(3T)Algorithms and Data Structures (4T)Programming Languages (4T)Stochastic Modeling( ) (3T)Multivariate Analysis( ) (2T)Basic and practice(in Categorical data analysis( )	◎) (( )) ( )	((○ ( )) (	)) △)	))
(3)D3. Knowledge of hardware and software and programming ability to process data efficiently.				(3T)Digital Circuit Design (3T)Operating Systems( ) (4T)Programming Languages (4T)Mechanism how programs run on computer( )	(1T)Informatics and data science, Exercise (2T)Informatics and data science, Exercise (2T)Image Processing( ) (1T)Digital Signal Processing( )	(3T)Visual Computing( ) (3T)Human Computer Interaction( ) (3T)Parallel and Distributed Processing( ) (4T)Computer Network( ) (3T)Informatics and data science, Exercise (4T)Informatics and data science, Exercise (4T)Advanced Programming	(1T)Computer Science Seminar I( ) (2T)Computer Science Seminar II( ) Ⅲ Ⅳ	))) ( ) ( ) ○ (
(1) C2. Skills for communication, reading, and writing in English, capabilities required for giving a good, clear oral presentation, and documentation and communication skills that contribute to active discussion.	Basic English Usage Communication Communication (1T)Basic Foreign Languages (2T)Basic Foreign Languages	Basic English Usage Communication Communication I Ⅱ	Ⅱ ◎ Ⅱ ◎ Ⅱ ◎ ○ (○ (	((A B( ))	(1T)Practical English I (A B( ))	(3T)Practical English)))	) Ⅱ ◎))	Graduation Thesis (
(2)D2. Ability to derive optimal system solutions based on abundant cutting-edge information technologies for cross-sectoral issues in a diversified and complicated information society.			(1T)Mathematical Programming( )	(3T)Algorithms and Data Structures (3T)System Optimization( ) (4T)Numerical Computation( )	(2T)Software Management( ) (2T)Information Society and Security( ) (2T)Software Engineering( )	(3T)Software Engineering II (4T)Quality Management	(1T)Computer Science Seminar I( ) (2T)Computer Science Seminar II( )	△ △
(3) E. Creative and logical thinking ability for analyzing practical issues and challenges in order to provide rational solutions	(1T)Introductory Seminar for First-Year Students	◎	( )			Long-term Fieldwork I ( )		Graduation Thesis Long-term Fieldwork II( )

Academic Achievement Evaluation Itemas	1st grade		2nd grade		3rd grade		4th grade	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
provide rational solutions that match social needs, as well as the capability to realize these solutions.								

Ex Liberal Arts Educat Specialized Subjects Graduation Thesis Practical Subjects