For entrants in AY 2024

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)	データ　学プログラム
English	Data 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 "Intelligent 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 "Intelligent 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 "Intelligent Science," based on a hybrid background across the three major academic fields.

In this program, in the first year, all students take higher mathematics such as algebra and analysis, information mathematics, probability and statistics, and programming courses as the basis of information

This school educates students to become specialists with advanced capabilities in each of computer science, data science and intelligent 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 documentation and communication skills that contribute to active discussion.

The following are the achievement goals for awarding the specified degree in this programs.

Achievement target A. Skills related to the development of an information infrastructure, information processing techniques, and technology for producing new added value through data analysis.

Achievement target B. 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.

Achievement target 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, culture, etc.

Achievement target 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.

Achievement target 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.

Achievement target D2. Ability to develop strategies and plans for an organization based on statistical evidence by using a wide range of knowledge and skills related to data science.

Achievement target D3. Ability to examine social needs and issues which are interlinked in a complex manner, using a top-down view to solve the problems through quantitative and logical thinking based on data, diverse perspectives, and advanced skills in information processing and analysis.

Achievement target E. Creative and logical thinking ability for analyzing practical issues and challenges in order to provide rational solutions that match social needs, as well as the capability to realize these solutions.

4. Curriculum policy (policy for arranging and implementing the curriculum)

To enable students to achieve the targets that are defined for the school, the curricula are systematically organized as three educational programs, and implemented as advanced education based on the characteristics of each field. The curriculum policy of the department of information science, faculty of information science, which is common to all programs, is as follows.

In the first academic year, students take such subjects as peace science subjects and foreign language subjects in order to develop deep humanity, flexibility, and profound intelligence to foster the basic qualifications and abilit eda tce scea (s a)2.23 7p.5 (a)2. 8 0i2e5 (o)3 (r)3.8 (t)5. 8 0i2e3 (s.)(r)3.8 (t)

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 academic year, all students acquire the knowledge and skills that from foundation of data science, while taking programming subjects and fundamental statistics and informatics subjects (achievement target A, B, D1, D2, D3). Furthermore, students acquire the knowledge and skills for solving the social problems through practical subjects (achievement target C1).
- In the third academic year, students acquire the basic theories and applied techniques of data analysis by taking specialized subjects such as data mining, survey design, nonparametric analysis, big data, behavioral econometrics, econometrics, and bio/medical statistics as related the traditional foundation of statistics. (achievement target A, B, C2, D1, D2, D3). Furthermore, students acquire the more practical knowledge and skills for solving the social problems through practical, business-oriented subjects (achievement target C1, E).
- 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 data 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 which 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.

Achievement evaluation	Numerical

6. To develop presentation skills for delivering the research results clearly and orally, and communication skills for active discussion.

On the other hand, Students in Practical Model Course take the "Long-term fieldwork I" and "Long-term fieldwork II" instead of the graduation thesis, and participate in research and development projects and field surveys in companies which are specified by the department. This course cultivates the ability to understand practical issues that are being addressed in the real world and to solve those issues. Detailed objectives are as follows:

1. To acquire the ability to understand a given research question and to carry out their research according to research plan specified in the project.
2. To develop the knowledge and skills for solving the problems by understanding the materials and methodologies related to the research problem.
3. To develop capabilities for analyzing problems related to the research objective and providing solutions that match project needs.
4. To develop skills required for research activity related to reading, writing, and searching for information in English.
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.

○ Student allocation method and timing

Requirements for starting the research for graduation thesis are defined in the Student Handbook.

Students in their fourth or senior year, who satisfy the requirements for starting the research for their graduation thesis, are allocated to a laboratory according to their wishes. The allocation method will be explained to the students at a briefing session that will be held before the allocation process. For students to be allocated to laboratories, an assembly and/or open laboratory event is held in February or March to show the details of research topics.

10. Responsibility

(1) Responsibility for PDCA (plan, do, check, and act) cycle

This program is executed by faculty members who support the education in the School of Informatics and Data Science. The dean of School of Informatics and Data Science takes on the responsibility for implementation of the program. It is mainly the academic affairs committee of the Informatics and Data Science Program and academic affairs members elected by the program that reviews and makes decisions related to the processes of the PDCA cycle (plan, do, check, and act) in the council of the School of Informatics and Data Science (this is held, in principle, on the first Thursday of every month). In some cases, a working group may be organized according to direction by the dean of School in order to intensively work on a case. When it is required to consider and take

Sheet 1

Required subject (period of registration specified)
Compulsory elective subject (any of these subjects shall be registered)

				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																
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4	(Note 6)																		

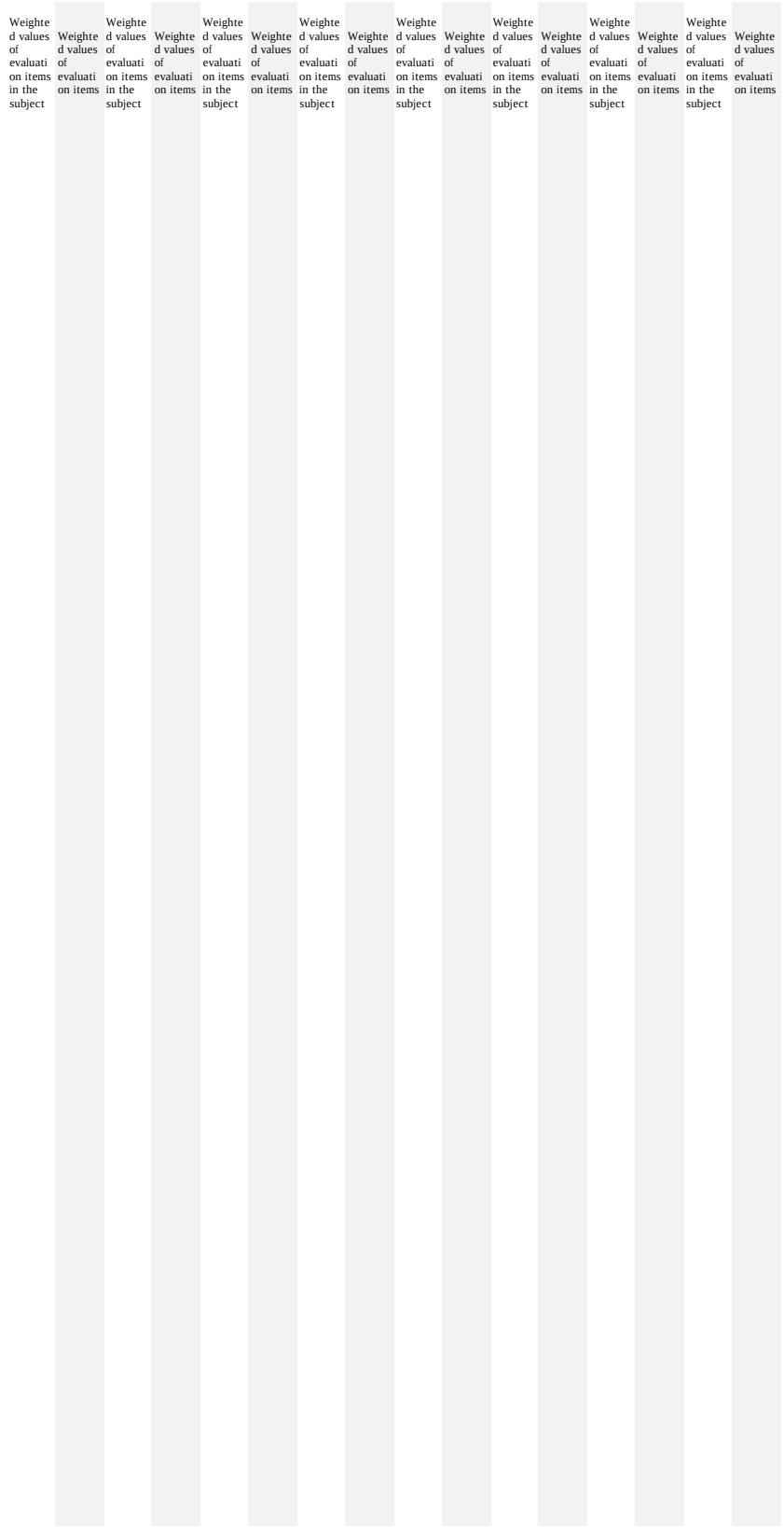
Academic Achievement in Educational Program for Computer Science Program
The Relationship between Evaluation Items and Evaluation Criteria

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.

Relationships between the Evaluation Items and Class Subjects



Curriculum Map of Data Science Program

Academic Achievement Evaluation Itemas	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 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 (○)			
(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.		(4T)Fundamentals of Probability Theory	(1T)Inferential Statistics(◎) (2T)Statistical Test(◎) (2T)Linear Regression Model(◎) (1T)Introduction to Artificial Intelligence	(3T)Multivariate Analysis( ) (3T)Machine Learning	(1T)Data Mining(○) (1T)Informatics and data science, Exercise I ❁ (2T)Nonparametric analysis (1T)Behaviormetrics(○) (2T)Informatics and data science, Exercise ❁ (2T)Reinforcement Learning (2T)Bioinformatics (1T)Sparse Estimation (1T)Bayesian Statistics	(3T)Informatics and data science, Exercise ❁ (4T)Informatics and data science, Exercise ❁ (3T)Mathematical Statistics	(1T)Data Science Seminar I(◎) (2T)Data Science Seminar II(◎)	
(1) A. Skills related to the development of an information infrastructure, information processing techniques, and technology for producing new added value through data analysis.	(1T)Elements of Calculus(○) (1T)Introductory Seminar for First-Year Students(◎) (1T)Linear AlgebraI(◎) (2T)CalculusI(◎) (2T)Introduction to Information and Data Sciences(◎) (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 II(◎) (4T)Fundamentals of Probability Theory(◎) Programming II(◎)	Programming (1T)Inferential Statistics(◎) (1T)Theory of Automata and Languages(△) (1T)Information Theory(△) (2T)Statistical Test(◎) (2T)Linear Regression Model(◎) (2T)Mathematical Analysis(○) (1T)Introduction to Artificial Intelligence	Programming (3T)Digital Circuit Design △ (3T)Algorithms and Data Structures ○ (3T)Operating Systems(△) (3T)System Optimization(○) (4T)Programming Languages (4T)Numerical Computation(○) (4T)Mechanism how programs run on computer(△) (4T)Databases(△) (3T)Machine Learning	(1T)Informatics and data science, Exercise I ❁ (1T)Theory of Computing △ (1T)Data Mining (2T)Software Engineering (1T)Digital Signal Processing(△) (2T)Informatics and data science, Exercise ❁ (2T)Nonparametric analysis (2T)Image Processing(△) (2T)Natural Language Processing(△) (2T)Software Management(△) (1T)Speech Recognition (2T)Reinforcement Learning (2T)Bioinformatics (1T)Sparse Estimation (1T)Neural Networks (1T)Bayesian Statistics (2T)Semiotic AI	(3T)Informatics and data science, Exercise ❁ (4T)Informatics and data science, Exercise ❁ (3T)Visual Computing(△) (3T)Human Computer Interaction(△) (3T)Parallel and Distributed Processing(△) (4T)Computer Network(△) (4T)Big Data (3T)Software Engineering (4T)Text Mining (4T)Introduction to IoT (3T)Biological Information Processing (4T)Advanced Programming (3T)Mathematical Statistics		
and Skills	(1T)Introductory Seminar for First-Year Students	(3T)Seminar in Mathematics	Programming	Programming	(1T)Informatics and data science, Exercise ❁	(3T)Informatics and data science, Exercise ❁		

[redacted]

Academic Achievement Evaluation Itemas	1st grade		2nd grade		3rd grade		4th grade	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall

Academic Achievement Evaluation Itemas	1st grade		2nd grade		3rd grade		4th grade	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Ex					Liberal Arts Education	Specialized Subjects	Graduation Thesis	Practical Subjects