Instructive Cultivation Plan for the Program of Information and Computing Science

(Grade 2021)

Program Code: 070102

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I. Orientation

The program of Information and Computing Sciences aims to cultivate application-oriented technical talents who have a solid mathematical theoretical foundation, master the basic theories and methods in the field of information and computer science, and have strong mathematical logical thinking ability, as well as certain ability of algorithm analysis and design, mathematical modeling, information processing and calculation.

II. Cultivation Objectives

1. General cultivation objective

The program of Information and Computing Sciences aims to cultivate high-level application-oriented talents with all-round development of morality, intelligence, physique, aesthetics and labor, who have good scientific literacy, systematically master the basic theories and methods of mathematics, information and computer science, can skillfully apply mathematical knowledge and modern information technology for algorithm analysis and design, mathematical modeling, information processing and calculation, and can be engaged in algorithm design, data analysis, scientific calculation and system development and management in science and technology, education, information industry, finance and other sectors.

2. Objective of value guidance

The is program aims at cultivating applied talents who adapt to social development, takes model worker spirit and craftsman spirit as the value orientation, and school-enterprise cooperation and course teaching as the carrier, emphasis on cultivating students' spirit of innovation and strong sense of social responsibility, establishing rigorous and meticulous professional ethics and quality, as well as improving students' sense of social responsibility, team-work ability, lifelong learning ability, application innovation spirit.

III. Basic Requirements

1. Requirement on ideological, political and moral education

(1) Correct values and morality, patriotic, honest, law-abiding.

(2) Good sense of social responsibility and good team work spirit.

(3) Good cultural and scientific literacy, master the scientific world outlook and methodology.

(4) Healthy physique and superior psychological quality, may keep pace with the times and adapt

to the development and change of science and society.

2. Requirement on knowledge

(1) Have relatively solid mathematical foundation, firmly master the basic theory and application methods of mathematical analysis, advanced algebra, numerical analysis, discrete mathematics and other basic courses; Master the basic theory and application technology of information and computer science;

(2) Systematically master the basic knowledge and theory of algorithm design and analysis, and capable of quantitative analysis and mathematical modeling of various types of data;

(3) Proficient in computer and modern information technology, able to use modern information technology and database for literature retrieval, data processing, model design, research analysis and paper writing;

(4) Familiar with the guidelines, policies and corresponding laws and regulations of the development of the national information internet industry.

3. Requirement on ability

(1) Have the basic skills of computer application, data analysis and application ability, and have strong ability of algorithm design, algorithm analysis and programming;

(2) Able to apply the theories, methods and skills learned to solve some practical issues in the field of information or scientific computation;

(3) Receive preliminary training in scientific research, understand new developments in information science, big data and artificial intelligence, and have a certain ability to update knowledge, track technology and innovate;

(4) Have strong ability of foreign language application, able to read the foreign language materials of the major, have a certain international perspective and the ability of cross-cultural communication and cooperation;

(5) Have strong ability of independent learning and independent thinking;

(6) Have good communication skills and strong collaboration ability.

4. Type and name of vocational qualification certificate

Computer Software Proficiency Certification supervised by China Computer Federation(CCF CSP) and CDA Data Analyst Certificate.

5. Targeted employment

Graduates may be engaged in algorithm design, data analysis and processing, intelligent computing and application development and management in information industry or internet related industries; also can be engaged in information management, accounting, insurance actuarial, financial statistics and other related work in banking, securities, insurance and other financial industries.

IV. Schooling System

Four years

V. Length of Study

Flexible study period, generally four years, the minimum length of flexibility shall not be less than three years, the maximum thereof shall not be more than six years.

VI. Requirements for Graduation and Degree Conferring

Students of this program must complete the minimum credits required for each category of courses and complete all the content specified in extracurricular class according to the requirements of the instructional training plan, and the total credits must reach 150 credits for graduation; those who meet the requirements for bachelor's degree can be conferred Bachelor of Science.

VII. Major Disciplines

Mathematics, Computer Science

VIII. Core Courses

1. Mathematical Analysis

This course enables students to correctly understand and master the basic concepts and theories of Mathematical Analysis, to master the demonstration methods in mathematical Analysis, and to relatively master the basic calculation methods and abilities required by this course. Improve students' logical reasoning and demonstration ability, as well as abstract thinking ability, train students to have good mathematical literacy, enable students to receive the preliminary training of using mathematical analysis to solve practical problems. Enhance the ability to use mathematical means to solve practical problems, and lay a essential foundation for further study of subsequent courses. The teaching content includes concepts, theories and calculation methods of set, function, derivative, integral and series.

2. Advanced Algebra

This course enables students to master the basic knowledge and theory of unary polynomial and linear algebra, get familiar with and master abstract and strict algebraic methods, understand the dialectical relations between concrete and abstract, special and general, finite and infinite, and improve abstract thinking, logical reasoning and arithmetic capability. The teaching contents include polynomial, determinant, matrix, linear equations, vector space, quadratic form, linear space and linear transformation and other basic concepts and theories.

3. Fundamentals of Probability Theory

The teaching of this course enables students to master the basic theories and methods of dealing with random phenomena and to apply them to solve some simple practical engineering problems. Cultivate students' ability to analyze and solve practical problems with probability and statistics methods. The teaching contents include basic concepts of probability theory, random variable and its distribution, numerical characteristics of random variable, law of large numbers and central limit theorem, sample and sampling distribution, parameter estimation, hypothesis testing, etc.

4. Numerical Analysis

The teaching of this course enables students to master the commonly used numerical calculation methods and principles of the computer, to correctly select the appropriate numerical algorithm

according to the requirements of practical problems, to understand the processing of actual numerical values by computers through practical programming applications, and to proceed necessary analysis of numerical results, and master the skills of solving mathematical problems by using various numerical methods, which lays a good foundation for improving students' scientific computing ability. The teaching contents include the solution of nonlinear equations, numerical solution of linear equations, interpolation and polynomial approximation, numerical integration, numerical solution of ordinary differential equations, etc.

5. Discrete Mathematics

This course mainly teaches the structure and relationship of discrete quantities, is the basic theories in computer science, provides the method and basis for the analysis of subsequent related courses of this major. The main content of this course includes set theory, algebraic structure, mathematical logic, graph theory and so on.

6. Fundamentals of Programming Design

This course mainly teaches the basic concepts and basic techniques of programming. Taking structured programming language as an example, this course requires students to be fairly proficient in its grammar and semantics and master the basic methods of structured programming. The knowledge points of this course include data types, control structures, functions, arrays, files, operating mechanisms and preliminary debugging. Through the study of this course, students will master some common programming design skills, master programming techniques of top-down refinement, cultivate good programming habits and styles, and be able to master the basic process of computer programming operations, as well as the basic methods of eliminating grammatical and semantic errors.

7. Data Structures and Algorithms

This course mainly teaches data construction methods and algorithms for operating these data structures. The focus is on various typical data structures and their storage structures, related algorithms and basic spatiotemporal analysis, including linear tables and their derived structures (stacks, queues, strings, Multidimensional arrays), trees and graphs, and typical algorithms for search and internal sorting. The focus is to enable students to further master relatively standardized algorithm design skills and improve their thinking skills on the basis of their existing programming capabilities.

8. Design and Analysis of Algorithms

This course introduces the common non-numerical algorithm design strategies in computer programming, with a certain depth and breadth. The course mainly teaches the concept of time and space complexity of algorithms and their analysis methods. From the perspective of complexity analysis to teach the greedy method, divide-and-conquer method, backtracking method, dynamic programming, branch bound and other typical algorithms, enable students to master the solving algorithm of some practical problems that often appear in computer applications, to master the basic

principles and techniques of common algorithm analysis and design, and to possess the ability to design and implement algorithms and evaluate algorithms for practical problems.

9. Data Mining

Through the study of this course, enable students to understand the basic theory, basic technology and related mathematical tools of data mining, understand the development trend of data mining field, and understand the latest progress and achievements of data mining technology. Master the theory and technology of hotspots, understand the characteristics of mainstream data mining system, as well as installation, application and development technology, and able to use typical mining tools.

10. Applied Time Series Analysis

The main contents include the basic concept of time series analysis, stable time series model analysis, non-stable time series model analysis, seasonal time-series model analysis and others. Through the course, the students are able to master the theory and method of random time-series analysis commonly used in economics and management and does calculation or analysis with related statistic software.

IX. Main Practice

Program Design and Practice, Database Technology and Application, Mathematical Software Practice, Big Data Analysis Cases and Practice, Data Mining Technology Course Practice, Mathematical Modeling Practice, Graduation Practice and Graduation Project (Thesis).

X. Course Category and Course Hours (excluding extracurricular classes)

Category	Total Credit	%	Total Course Hours	Theory Learning	Practical Training
Public Course	34.5	23	688	624	64
Basic Course	43	28	688	644	36
Professional Course	32	23	512	446	66
Professional Practice	29.5	18	856	0	856
General Course	10	7	160	160	0
Total	149	100	2904	1880	1024
Theory : Practice（%）	**65 : 35**				

XI. Teaching Schedule (1)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
Public Course	Required	School of Marxism	b1080001	Basic Principles of Marxism	Test	3	48	42	6	Autumn 1
	Required	School of Marxism	b1080003	Ideological and Moral Cultivation and Basic Law Education	Non-test	3	48	42	6	Autumn 1
	Required	School of Marxism	b1080006	Outline of Modern Chinese History	Non-test	3	48	42	6	Spring 1
	Required	School of Marxism	b1080004	Introduction to the Thought of Mao Zedong and Theories of Socialism with Chinese Characteristics I	Test	3	48	42	6	Autumn 2
	Required	School of Marxism	b1080007	Introduction to the Thought of Mao Zedong and Theories of Socialism with Chinese Characteristics II	Test	2	32	28	4	Spring 2
	Required	School of Marxism	-----	Situation and Policy (Module 1-4)	Non-test	2	32	28	4	Autumn 1～spring 2
	Required	School of Marxism	b1080008	Labor Education A	Non-test	0.5	16	16		Spring 1
	Required	School of Arts and Sciences	b1020018	College Chinese	Non-test	2	32	32		Autumn 1
	Required	School of Physical Education	-----	Physical Education I ~ VI	Non-test	3	160	160		Autumn 1～autumn 4
	Required	Other	b1110003	Military Skills	Non-test	0.5	2W			Autumn 1
	Required	School of Arts and Sciences	b1110002	Military Theories	Non-test	0.5	32	32		Spring 1
	Required	Engineering Training Center	b1090001	Basic Engineering Training	Non-test	2	32		32	Autumn 1
	□ College English (Selective, 1 module, 10 credits)	Module A	b1020003	General English III	Test	3	48	48		Autumn 1
			b1020004	General English IV	Test	3	48	48		Spring 1
			b1020005	General Academic English A	Test	2	32	32		Autumn 2
			---	English Development	Non-test	2	32	32		Spring 2
		Module B	b1020002	General English II	Test	3	48	48		Autumn 1
			b1020003	General English III	Test	3	48	48		Spring 1
			b1020006	General Academic English B	Test	2	32	32		Autumn 2
			---	English Development	Non-test	2	32	32		Spring 2
		Module C	b1020001	General English I	Test	4	64	64		Autumn 1
			b1020002	General English II	Test	3	48	48		Spring 1
			b1020003	General English III	Test	3	48	48		Autumn 2
	□ College German	School of Arts and Sciences	b1020040	College German I	Test	3	48	48		Autumn 1
		School of Arts and Sciences	b1020041	College German II	Test	3	48	48		Spring 1
		School of Arts and Sciences	b1020042	College German III	Test	4	64	64		Autumn 2
	□ College Japanese	School of Arts and Sciences	b1020077	College Japanese I	Test	3	48	48		Autumn 1
		School of Arts and Sciences	b1020078	College Japanese II	Test	3	48	48		Spring 1
		School of Arts and Sciences	b1020079	College Japanese III	Test	4	64	64		Autumn 2
Sub-total (public courses)						**34.5**	**688**	**624**	**64**	
General Course	Required	Art Education Center	b0-----	Aesthetic Education	Non-test	2	32	32		Autumn, spring
	Selective	Every school	b0-----	Social Sciences and Humanities Literacy	Non-test	4	64	64		Autumn, spring
				Natural Science and Technological Innovation	Non-test	4	64	64		Autumn, spring
Sub-total (general courses)						**10**	**160**	**160**		

(□Notes: A total of 10 credits for the First Foreign Language, including College English, College German and College Japanese, students may choose one from the above-mentioned three foreign language according to needs; students who choose College English as their First Foreign Language, shall select one module from Module A, Module B and Module C to learn.)

XI. Teaching Schedule (2)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
Basic Course	Required	School of Arts and Sciences	b2022019	Mathematical Analysis I	Test	6	96	96		Autumn 1
	Required	School of Arts and Sciences	b2022140	Advanced Algebra	Test	4	64	64		Autumn 1
	Required	School of Engineering	b2012282	Fundamentals of Programming Design(Java-Data)	Test	5	80	64	16	Autumn 1
	Required	School of Engineering	b2012295	Data Structures and Algorithms(Java-Data)	Test	3	48	48		Spring 1
	Required	School of Arts and Sciences	b2022020	Mathematical Analysis II	Non-test	6	96	96		Spring 1
	Required	School of Arts and Sciences	b2022145	Space Analytic Geometry	Test	2	32	32		Spring 1
	Required	School of Arts and Sciences	b2022116	Fundamentals of Probability Theory	Test	4	64	64		Spring 1
	Required	School of Arts and Sciences	b2022146	Ordinary Differential Equation	Test	2	32	32		Autumn 2
	Required	School of Arts and Sciences	b2022164	Database Fundamentals and Applications	Test	2	32	26	6	Autumn 2
	Required	School of Engineering	b2012106	Design and Analysis of Algorithms	Test	3	48	42	6	Autumn 2
	Required	School of Arts and Sciences	b2022147	Discrete Mathematics	Test	4	64	64		Spring 2
	Required	School of Arts and Sciences	b2022148	Mathematical Modeling	Non-test	2	32	32		Autumn 3
	Sub-total(basic courses)					**43**	**688**	**660**	**28**	
Professional Course	Required	School of Arts and Sciences	b2022029	Operations Research	Test	2	32	32		Autumn 2
	Required	School of Engineering	b2012058	Object-oriented Analysis and Design	Test	2	32	22	10	Spring 2
	Required	School of Arts and Sciences	b2022149	Numerical Analysis	Test	4	64	52	12	Spring 2
	Required	School of Arts and Sciences	b2022150	Fundamentals of Python Language	Non-test	2	32	20	12	Spring 2
	Required	School of Engineering	b2012270	Distributed Computing	Test	3	48	32	16	Autumn 3
	Required	School of Arts and Sciences	b2022151	Data Analysis	Non-test	3	48	48		Autumn 3
	Required	School of Engineering	b2012093	Data Mining Technology	Test	3	48	48		Spring 3
	Required	School of Arts and Sciences	b2022152	Information Theory	Non-test	2	32	32		Spring 3
	Required	School of Arts and Sciences	b2022153	Combinatorial Mathematics and Graph Theory	Test	2	32	32		Spring 3
	Required	School of Arts and Sciences	b2022126	Applied Time Series Analysis	Test	3	48	32	16	Autumn 4
	Sub-total(required professional courses)					**26**	**416**	**350**	**66**	
	□ Selective by module 6 credits	Module A	b2022154	Mathematical Statistics	Test	2	32	32		Spring 2
			b2022155	Information Security	Non-test	2	32	32		Autumn 3
			b2022136	Machine Learning	Non-test	2	32	32		Autumn 3
			b2022156	Optimization Methods	Non-test	2	32	32		Spring 3
			b2022157	Fundamentals of Data Visualization	Non-test	2	32	32		Spring 3
			b2022158	Design and Analysis of Algorithms B	Non-test	2	32	24	8	Autumn 4
			b2022159	Fundamentals of Control Theory	Non-test	2	32	32		Autumn 4
			b1020098	Functions of Complex Variables	Test	2	32	32		Spring 2

		Module B	b2022023	Statistical Prediction and Decision-making	Test	2	32	32		Autumn 3
			b2022160	Differential Geometry	Test	2	48	32		Autumn 3
			b2022161	Equation of Mathematical Physics	Test	2	32	32		Spring 3
			b2022162	Numerical Solution of Differential Equations	Non-test	2	32	24	8	Spring 3
			b2022135	Statistical Computing	Non-test	2	32	32		Autumn 4
			b2022163	Nonlinear Programming Theory	Non-test	2	32	24	8	Autumn 4
	Sub-total(professional modules)					**6**	**96**	**80**	**16**	
Sub-total(professional courses)						**32**	**512**	**430**	**82**	

XI. Teaching Schedule (3)

Category	Type	Provided by	Course Code	Course Name	Assessment	Credit	Course Hour	Theory Learning	Practical Training	Recommended Semester
Professional Practice	Required	School of Arts and Sciences	b4022048	Fundamentals of R Language	Non-test	2	48		48	Summer 1
	Required	School of Arts and Sciences	b4022002	Mathematical Software	Test	2	48		48	Summer 1
	Required	School of Arts and Sciences	b4022057	Database Technology and Application	Non-test	3	72		72	Summer 2
	Required	School of Arts and Sciences	b4022053	Python Language and Artificial Intelligence Applications	Non-test	3	72		72	Summer 2
	Required	School of Arts and Sciences	b4022058	Program Design and Practice	Non-test	2	48		48	Spring 2
	Required	School of Arts and Sciences	b4022059	Data Mining Technology Practice	Non-test	3	72		72	Summer 3
	Required	School of Arts and Sciences	b4022051	Advanced R Language	Non-test	2	48		48	Summer 3
	Required	School of Arts and Sciences	b4020002	Labor Education B	Non-test	0.5	16		16	Spring 3
	Required	School of Arts and Sciences	b4000044	Innovation and Entrepreneurship of Information and Computing Science	Non-test	2	48		48	Spring 3
	Required	School of Arts and Sciences	b4022061	Big Data Analysis Cases and Practice	Non-test	2	48		48	Autumn 4
	Required	School of Arts and Sciences	b4022062	Mathematical Modeling Practice	Non-test	2	48		48	Autumn 4
	Required	School of Arts and Sciences	b4022063	Graduation Practice and Graduation Project (Thesis) of Information and Computing Science	Non-test	6	288		288	Spring 4
	Sub-total(professional practice)					**29.5**	**856**		**856**	
Extracurricular Class	Required	Other	b5110001	Extracurricular Class	Non-test	**1**	-	-	-	Autumn, spring, summer
Total						**150**	**2904**	**1880**	**1024**	

Elective instructions for module courses:

1. Module A(Big Data Analysis and Mining): Based on the ability of comprehensive basis, emphasis on algorithm design, data analysis, mathematical modeling and application.

2. Module B(Numerical Calculation and Optimization): Based on the ability of comprehensive basis, emphasis on optimization and operation research, information calculation, etc.

XII. Prerequisite for Course Study

No.	Course Name	Prerequisite Course	No.	Course Name	Prerequisite Course

1	Mathematical Analysis II	Mathematical Analysis I	15	Information Theory	Data Structures and Algorithms Fundamentals of Programming Design
2	Data Structures and Algorithms	Fundamentals of Programming Design	16	Statistical Methods	Mathematical Analysis, Fundamentals of Probability Theory
3	Fundamentals of Probability Theory	Mathematical Analysis	17	Applied Time Series Analysis	Fundamentals of Probability Theory
4	Discrete Mathematics	Mathematical Analysis	18	Machine Learning	Fundamentals of Programming Design Data Structures and Algorithms
5	Ordinary Differential Equation	Mathematical Analysis Advanced Algebra	19	Data Visualization	Fundamentals of Programming Design Database Fundamentals and Applications
6	Operations Research	Mathematical Analysis Advanced Algebra	20	Statistical Prediction and Decision-making	Fundamentals of Probability Theory
7	Numerical Analysis	Mathematical Analysis Ordinary Differential Equation	21	Data Mining	Design and Analysis of Algorithms A Data Structures and Algorithms
8	Mathematical Modeling	Ordinary Differential Equation, Operations Research Fundamentals of Probability Theory	22	Equation of Mathematical Physics	Mathematical Analysis Ordinary Differential Equation
9	Database Fundamentals and Applications	Fundamentals of Programming Design	23	Functions of Complex Variables	Mathematical Analysis
10	Design and Analysis of Algorithms A	Fundamentals of Programming Design Database Fundamentals and Applications Data Structures and Algorithms	24	Optimization Methods	Ordinary Differential Equation Operations Research
11	Object-oriented Analysis and Design	Fundamentals of Programming Design	25	Design and Analysis of Algorithms B	Database Fundamentals and Applications Design and Analysis of Algorithms A
12	Combinatorial Mathematics and Graph Theory	Mathematical Analysis, Advanced Algebra Operations Research	26	Numerical Solution of Differential Equations	Ordinary Differential Equation Numerical Analysis
13	Data Analysis	Data Structures and Algorithms Fundamentals of Probability Theory Database Fundamentals and Applications	27	Fundamentals of Control Theory	Fundamentals of Programming Design Advanced Algebra
14	Distributed Computing	Object-oriented Analysis and Design Data Structures and Algorithms	28	Information Security	Information Theory

XIII. Credits for Extracurricular Class

Through taking extracurricular classes, students are encouraged to take part in academic lectures, social practice activities, campus cultural and sports activities, innovative and entrepreneurial activities, voluntary service activities, etc. to improve their social adaptability and enhance the competitiveness in the job market. Please refer to the Students' Manual for details of regulations on *Implementation Measures(Trial) of the Credits for Extracurricular Classes of Shanghai Polytechnic University*.