TQF 3 Course Specifications
Section 1 General Information

1. Course code and course title

Thai	ICCS๑๖๑	ศาสตร์ข้อมูลเบื้องต้น
English	ICCS161	Introduction to Data Science

2. Number of credits 4 (3-2-7) (Lecture/Lab/Self-study)
3. Program and type of subject
   - 3.1 Program Bachelor of Science (Computer Science)
   - 3.2 Type of Subject Required course
4. Course Coordinator and Course Lecturer
   - 4.1 Course Coordinator Boonyanit Mathayomchan, Ph.D.
   - 4.2 Course Lecturers Assoc. Prof. Rangsipan Marukatat, Ph.D.
5. Trimester/ Year of Study
   - 5.1 Trimester Once every academic year
   - 5.2 Course Capacity Approximately 30 students
6. Pre-requisite(s) ICMA251 Statistics for Science I
7. Co-requisite(s) -
8. Venue of Study Mahidol University, Salaya Campus

Section 2 Goals and Objectives

1. Course Goals

To provide students with the skills to process a wide variety of data and make data-driven decisions.

2. Objectives of Course Development/Revision

2.1 Course Objectives

This course is designed to fulfill the requirements of TQF1 and the recommendations from the Association for Computing Machinery (ACM).

2.2 Course-level Learning Outcomes: CLOs

By the end of the course, students will be able to (CLOs)

CLO1 Explain the concepts and use of data science, including logistical and ethical issues in its process.
CLO2 Use standard software to manipulate structured and unstructured data.
CLO3 Write programs or integrate available APIs to collect data, perform exploratory data analysis, and produce presentable information.
CLO4 Use suitable basic machine learning algorithms in data-driven applications.
CLO5 Carry out a data science workflow to provide statistically sound conclusions based on available data.

Section 3 Course Management

1. Course Description

Overview of data science; Software stack for data scientists; Acquiring data from online sources; Data cleansing and simple manipulation; Exploratory data analysis and visualization; Statistical inference and modeling; Basic machine learning algorithms; Classification and its applications; Clustering and its applications; Brief introduction to natural language processing; Data science and ethical issues

ภาพรวมของวิทยาศาสตร์ข้อมูล การเรียงลำดับซอฟต์แวร์ข้อมูลสำหรับนักวิทยาศาสตร์ การสืบค้นข้อมูลจากแหล่งข้อมูลออนไลน์ การทำความสะอาดข้อมูลและการถ่ายโอนอย่างง่าย การวิเคราะห์ข้อมูลเชิงสำรวจและการสร้างมโนภาพ การอ้างอิงและการสร้างรูปแบบทางสถิติ อัลกอริทึมการเรียนรู้ของจักรกลขั้นพื้นฐาน การจัดระดับชั้นและการประยุกต์ใช้การจัดระดับชั้น การประมวลผลภาษาทางธรรมชาติขั้นต้นอย่างสั้น วิทยาศาสตร์ข้อมูลและประเด็นทางจริยธรรม

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
36	24	84

3. Number of hours that the lecturer provides individual counseling and guidance.

1 hour/week

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to:

- CLO1 Explain the concepts and use of data science, including logistical and ethical issues in its process.
- CLO2 Use standard software to manipulate structured and unstructured data.
- CLO3 Write programs or integrate available APIs to collect data, perform exploratory data analysis, and produce presentable information.
- CLO4 Use suitable basic machine learning algorithms in data-driven applications.
- CLO5 Carry out a data science workflow to provide statistically sound conclusions based on available data.

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

ICCS161	Teaching methods	Evaluation Methods
CLO1	Interactive lecture, case studies	Examination
CLO2	Case studies, exercises, group activities	Homework
CLO3	Case studies, exercises, group activities	Homework
CLO4	Interactive lecture, case studies, group activities	Homework, Examination
CLO5	Interactive lecture, case studies, group activities	Homework, Examination

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Number of Hours		Online	On Campus	Teaching Activities/ Media	Lecturer
		Lecture Hours	Lab/Field Trip/ Internship Hours				
1	Overview of data science & data analysis tools	3	2	X		Interactive lecture, case studies, exercises, group activities	Rangsipan
2	Data exploration, visualization, manipulation	3	2	X			
3	Data cleansing	3	2	X			
4	Data modeling 1	3	2	X			
5	Data modeling 2	3	2	X			
6	Midterm review		2	X			
	Midterm exam	3			X		
7	Data modeling 3	3	2	X			
8	Clustering 1	3	2	X			
9	Clustering 2	3	2	X			
10	Text processing	3	2	X			
11	Text processing	3	2	X			
12	Emerging topics in data science	3		X			
	Final review		2	X			
	Final exam	3			X		
	Total	36	24				

2. Plan for Assessing Course Learning Outcomes

2.1 Assessing and Evaluating Learning Achievement

a. Formative Assessment

- Worksheet
- Class discussion

b. Summative Assessment

(1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Explain the concepts and use of data science, including logistical and ethical issues in its process.	Examination	20	20
CLO2 Use standard software to manipulate structured and unstructured data.	Homework	20	20
CLO3 Write programs or integrate available APIs to collect data, perform exploratory data analysis, and produce presentable information.	Homework	20	20
CLO4 Use suitable basic machine learning algorithms in data-driven applications.	Homework	5	20
	Examination	15	
CLO5 Carry out a data science workflow to provide statistically sound conclusions based on available data.	Homework	5	20
	Examination	15	
			100

(2) Grading System

Grade	**Achievement**	**Final Score (% Range)**	**GPA**
A	Excellent	90-100	4.0
B+	Very good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly good	75-79	2.5
C	Fair	70-74	2.0
D+	Poor	65-69	1.5
D	Very Poor	60-64	1.0
F	Fail	Less than 60	0.0

(3) Re-examination (If course lecturer allows to have re-examination)

N/A - (Not applicable with MUIC)

3. Student Appeals

N/A

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials
   - V. Kotu and B. Deshpande. Data Science: Concepts and Practice, Morgan Kaufmann Publisher
   - P.-N. Tan, M. Steinbach, and V. Kumar. Introduction to Data Mining, Pearson Addison Wesley

2. Recommended textbooks and/or other documents/materials
   Selected readings from pertinent scientific journals and textbooks or video clips, as posted on the course's e-learning site

3. Other Resources (If any)
   N/A

Section 7 Evaluation and Improvement of Course Management

1. Strategies for evaluating course effectiveness by students
   1.1 Student feedback of instructors, teaching methods and materials, and course content through MUIC student evaluation forms
2. Strategies for evaluating teaching methods
   2.1 Evaluation of effectiveness based on student evaluation scores and comments
   2.2 Evaluation through peer observations by co-instructor or other Division faculty
3. Improvement of teaching methods
   3.1 Adjustments based on student feedback, personal observations, comments from peer observations and discussions with supervisor and/or other Division faculty in one-on-one and/or group meetings as specified by MUIC guidelines
4. Verification process for evaluating students' standard achievement outcomes in the course
   4.1 Verification through student performance on assessments based on MUIC/Division standards
5. Review and plan for improving the effectiveness of the course
   5.1 Course instructors (and coordinator/supervisor) will meet to discuss results of student evaluations and student performance based on learning outcomes in order to identify point for improvement
   5.2 Strategy for improvement set according to MUIC/Division guidelines

Appendix
Alignment between Courses and General Education courses

Table 1 The relationship between course and Program Learning Outcomes (PLOs)

	Program Learning Outcomes (PLOs)					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
(ICCS161)	P	I	P			

Table 2 The relationship between CLOs and Program LOs (Number in table = Sub LOs)

ICCS161	Learning Outcomes in the Computer Science Program					
	1	2	3	4	5	6
CLO1 Explain the concepts and use of data science, including logistical and ethical issues in its process.	1.3	2.2				
CLO2 Use standard software to manipulate structured and unstructured data.			3.4			
CLO3 Write programs/integrate available APIs to collect data, perform exploratory data analysis, and produce presentable information.	1.3	2.2	3.4			
CLO4 Use suitable basic machine learning algorithms in data-driven applications.			3.4			
CLO5 Carry out a data science workflow to provide statistically sound conclusions based on available data.		2.2	3.4			

Table 3 The description of Program LOs and Sub LOs of the course

CS LOs	Sub LOs
PLO1 Demonstrate proficiency in scientific communication.	1.1 Understand the format of communication in computer science.
	1.2 Communicate inchoate ideas to others for further development and refinement.
	1.3 Describe computing concepts to members of the community with accuracy and clarity.
PLO2 Carry out work with scientific integrity and professionalism.	2.1 Recognize the concepts of intellectual property, copyright licenses, and law pertaining to information technology.
	2.2 Provide ethical reasoning and awareness of issues surrounding bias, fabrication, falsification, plagiarism, outside interference, censorship, and information privacy.
	2.3 Demonstrate good time management, self-regulation, autonomy, and professional code of conduct of the discipline.
PLO3 Appraise scientific information critically.	3.1 Apply quantitative reasoning using mathematical methods and scientific facts, taking into consideration multiple perspectives.
	3.2 Provide a succinct description of the issue (i.e., a problem, a question, or a hypothesis), separating facts and assumptions.
	3.3 Differentiate source, validity, objectives, key arguments, and consequences of a piece information.
	3.4 Create a response to the issue by synthesizing collected information critical to the assessment.
PLO4 Use a teamwork mindset in the context of computing.	
PLO5 Execute common computing methodologies appropriate for a problem scenario.	5.1 Carry out the process of converting a process/algorithm to a machine-executable program.
	5.2 Use suitable techniques for correctness and cost analysis of computer programs.
	5.3 Deconstruct a computer system to reveal its structure, components, and process of construction.
	5.4 Select common computing techniques (e.g., standard algorithms, data structures, design patterns, programing style, and computing paradigms) appropriate for a given problem scenario.
PLO6 Formulate computational solutions to novel situations grounded on the foundation of computer science.	6.1 Model a given problem using suitable abstractions, including problem decomposition, in the context of computing.
	6.2 Compare the relative strengths and weaknesses among multiple designs or implementations.

CS LOs	Sub LOs
	6.3 Assess the feasibility and efficacy of a computational solution based on its design and implementation.
	6.4 Devise computational solutions to novel situations using knowledge and experience in computer science.