



Program Bachelor of Science Program in Mathematics Degree
Course Title Introduction to Data Science
Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
Faculty of Science
Department of Mathematics

Course Specification

Section 1 General Information

1. Course Code and Title

In Thai	วทศณ ๒๔๘ การแนะนำวิทยาการข้อมูล
In English	SCMA 248 Introduction to Data Science

2. Number of Credits 3 (3-0-6) (Theory 3 hours Practice 0 hours Self-study 6 hours/week)

3. Curriculum and Course Type

3.1 Program of Study	Bachelor of Science Program in Mathematics
3.2 Course Type	Specific Courses

4. Course Coordinator and Instructor

4.1 Course Coordinator

1) Pairote Satiracoo, Ph.D.

Department of Mathematics, Faculty of Science, Mahidol University

Contact: 02-201-5340 E-mail : Pairote.sat@mahidol.edu

4.2 Instructor Pairote Satiracoo, Ph.D.

5. Semester/Class Level

5.1 Semester	2 (2021) / Class Level 2nd Year
--------------	---------------------------------

5.2 Number of Students Allowed	Approximately 40 Students
--------------------------------	---------------------------

6. Pre-requisite none

7. Co-requisites none

8. Study Site Location Faculty of Science, Mahidol university, Phaya thai campus

9. Date of Preparation/Latest Revision of the Course Specifications December 5, 2021



Program Bachelor of Science Program in Mathematics Degree
Course Title Introduction to Data Science
Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
Faculty of Science
Department of Mathematics

Section 2 Aims and Objectives

1. Course Goals

This course will provide a broad introduction to four key aspects of data science: data retrieval and manipulation, data visualization, statistical computation and machine learning, and presentation and communication. Students will use data from a variety of sources, be introduced to contemporary computing and database environments such as R and SQL, and be exposed to case studies from outside the classroom. Through this unit, students will become acquainted with the challenges of contemporary data science and gain an appreciation of the foundational skills necessary to turn data into information. Finally, students will have the opportunity to practice a presentation about data science group projects.

2. Objectives of development/revision

2.1 Course Objectives

The instructor expects students to acquire skills and knowledge as follows. Students should:

- 1) Understand the concepts of data science.
- 2) Use computer programming and tools for data science purposes.
- 3) Search for the information and use it to solve the assigned problems.

2.2 Course-level Learning Outcomes (CLOs)

After successful completion of this course, students should be able to:

- 1) CLO1: Comply with the regulations of the curriculum and the university. Have academic and professional ethics, do not copy or bring the work of others to be their own.
- 2) CLO2: Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.
- 3) CLO3: Use computer programming concepts or computer tools to solve data science problems
- 4) CLO4: Use appropriate information technologies to search for data and use it to solve assigned problems.



Program Bachelor of Science Program in Mathematics Degree
 Course Title Introduction to Data Science
 Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
 Faculty of Science
 Department of Mathematics

Section 3 Course Description and Implementation

1. Course Description

(In Thai) การแนะนำสู่แง่มุมสำคัญของวิทยาการข้อมูล การดึงข้อมูล และการจัดการข้อมูล การแสดงข้อมูล การคำนวณเชิงสถิติ การเรียนรู้ด้วยเครื่อง การนำเสนอและการสื่อสาร การคำนวณร่วมสมัย สิ่งแวดล้อมด้านฐานข้อมูล เช่น อาร์ และ เอสคิวแอล กรณีศึกษาจากนอกห้องเรียน ทักษะพื้นฐาน สำหรับ การเปลี่ยนข้อมูล เป็นความรู้ การฝึกทักษะการสืบค้นข้อมูล เพื่อทำงานกลุ่มและ นำเสนอในห้องเรียน

(In English) An introduction to key aspects of data science: data retrieval and manipulation, data visualization, statistical computation and machine learning, presentation and communication; an introduction to contemporary computing and database environments such as R and SQL; case studies from outside the classroom; foundational skills necessary to turn data into information; practicing of information searching skill for working on group assignments and doing presentation in the classroom

2. Number of hours per semester

Theory (hours)	Practice (hours)	Self-study (hours)
45 hours/semester (3 hours x 15 weeks)	None	90 hours/semester (6 hours x 15 weeks)

3. Number of Hours per Week for Individual Advice

Instructors provide academic counseling and guidance to individual at least 1 hour/week or upon request during office hours (Monday-Friday).



Section 4 Development of the Expected Learning Outcomes

1. A brief summary of the knowledge or skills expected to develop in students; the course-level expected learning outcomes (CLOs)

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

- 1) CLO1: Comply with the regulations of the curriculum and the university. Have academic and professional ethics, do not copy or bring the work of others to be their own.
 - 2) CLO2: Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.
 - 3) CLO3: Use computer programming concepts or computer tools to solve data science problems
 - 4) CLO4: Use appropriate information technologies to search for data and use it to solve assigned problems.
- ### 2. How to organize learning experiences to develop the knowledge or skills stated in number 1 and how to measure the learning outcomes

Course Code	Teaching strategies				Learning outcomes measurements	
	Interactive lecture	Effective questioning	problem solving activities	Brainstorm	Individual assignment	Written exam
CLO1		✓		✓	✓	
CLO2	✓	✓	✓	✓	✓	✓
CLO3	✓	✓	✓	✓	✓	✓
CLO4		✓	✓	✓	✓	✓

Section 5 Lesson Plan and Evaluation



Program Bachelor of Science Program in Mathematics Degree
 Course Title Introduction to Data Science
 Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
 Faculty of Science
 Department of Mathematics

1. Lesson Plan

Week	Topic/Details	Number of hours		Teaching activities/ media	Instructors
		Class- room ses- sions	Practice sessions		
1	Introduction to data science and tools	3	0	Teaching method: Interactive lecture, effective questioning, formative assessment, problem solving, problem based activities Media: lecture notes, slides, individual assignments	Dr. Meechoke
2-3	Data retrieval and manipulation	3	0		Dr. Meechoke
4-5	statistical computation and machine learning	3	0		Dr. Meechoke
6	Data presentation and Communication	3	0		Dr.Tanapon
7-8	Data visualization	3	0		Dr.Tanapon
9	Midterm examination				
10-11	Introduction to contemporary computing and database envi- ronments such as R and SQL	3	0	Teaching method: Interactive lecture, effective questioning, formative assessment, problem solving, problem based activities Media: lecture notes, slides, individual assignments	Dr.Tanapon
12	Case studies from outside the classroom	3	0		Dr.Tanapon
13	foundational skills necessary to turn data into information	3	0		Dr.Tanapon
14	practicing of information search- ing skill for working on group as- signments	3	0		Dr.Tanapon
15-16	Group Presentation	3	0		Dr.Tanapon
17	Final examination				
	Total	45	0		



2. Evaluation of the CLOs

2.1 Measurement and Evaluation of learning achievement

a. Formative assessment

During a lesson, instructor keeps the question going and monitors students' progress in general. There are also quick quizzes to check the current understanding of individual students.

b. Summative assessment

(1) Tool and weight for measurement and evaluation

Learning Outcomes	Measurement Method			Weight (Percentage)
	Individual assignment	Project	Written exam	
CLO1: Comply with the regulations of the curriculum and the university. Have academic and professional ethics, do not copy or bring the work of others to be their own.	5	5		10
CLO2: Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.		5	20	25
CLO3: Use computer programming concepts or computer tools to solve data science problems.	2	3	20	25
CLO4: Use appropriate information technologies to search for data and use it to solve assigned problems	8	12	20	40
Total	15	25	60	100

(2) Measurement and evaluation



Program Bachelor of Science Program in Mathematics Degree
 Course Title Introduction to Data Science
 Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
 Faculty of Science
 Department of Mathematics

Learning Outcomes	Measurement Method			Weight (Percentage)
	Individual assignment	Project	Written exam	
CLO1: Comply with the regulations of the curriculum and the university. Have academic and professional ethics, do not copy or bring the work of others to be their own.	5%	5%		10%
CLO2: Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.		5%	20%	25%
CLO3: Use computer programming concepts or computer tools to solve data science problems.	2%	3%	20%	25%
CLO4: Use appropriate information technologies to search for data and use it to solve assigned problems	8%	12%	20%	40%
Total	15%	25%	60%	100%

Students are evaluated their performance using assessment rubric according to course objectives and learning outcomes. Rubric scores for a single piece of individual assignment

Score	Description
5	Demonstrates the required work for all questions.
4	Demonstrates the required work for most questions with lower than 25% mistakes.
3	Demonstrates the required work for many questions with lower than 50% mistakes.
2	Demonstrates the required work for some questions with more than 50% mistakes.
1	Demonstrates the required work for few questions with more than 75% mistakes.
0	No response

The percentage of individual work is the average rubric scores of all pieces of individual work.



Program Bachelor of Science Program in Mathematics Degree
Course Title Introduction to Data Science
Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
Faculty of Science
Department of Mathematics

Grading system

After completion of the evaluation process each student is assigned a criterion-referenced grade (as shown in the table below). Evaluation and achievement will be justifying according to Faculty and University code, conducted by grading system of A, B+, B, C+, C, D+, D and F. To pass this course, student must earn a grade of at least D.

Total percentage of evaluation	Grade
80 – 100	A
75 – 79	B+
70 – 74	B
65 – 69	C+
60 – 64	C
55 – 59	D+
50 – 54	D
0 – 49	F

(3) Re-exam (if any)

None

3. Students' Appeal

Students may submit formal complaint or academic appeal directly to
International Education And Administration Unit, Division of Salaya Campus
Room SC1-116, SC1-Building, Faculty of Science (Salaya Campus), Mahidol University
999 Phuttamonthon 4 Road, A. Phuttamonthon, Nakhon Pathom 73170, Thailand
E-mail: scsim@mahidol.ac.th; Phone: + 66 2 4419820 ext. 1199.

If it is considered that a case exists, the matter will be investigated in accordance with the procedures, and the complainant informed of the outcome.



Program Bachelor of Science Program in Mathematics Degree
Course Title Introduction to Data Science
Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
Faculty of Science
Department of Mathematics

Section 6 Teaching Resources

1. Required Texts

1) Beginning data science in R [electronic resource]: data analysis, visualization, and modelling for the data scientist / Thomas Mailund, Berkeley, CA : Apress, c2017.

2) Python data science essentials: become an efficient data science practitioner by thoroughly understanding the key concepts of Python/ Alberto Boschetti, Luca Massaron, Birmingham : Packt, c2015

2. Suggested Materials

- 1) Handouts
- 2) PowerPoint presentations

3. Other Resources (if any)

- 1) Available through MU Library-subscribed databases
- 2) <https://www.edx.org>
- 3) <https://www.coursera.org>



Program Bachelor of Science Program in Mathematics Degree
Course Title Introduction to Data Science
Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
Faculty of Science
Department of Mathematics

Section 7 Evaluation and Improvement of Course Implementation

1. Strategy for Course Effectiveness Evaluation by Students

- 1.1. *Evaluation of instructors*
- 1.2. *Course evaluation*

2. Strategy for Teaching Evaluation

- 2.1. *Students evaluation and students record*
- 2.2. *Instructors evaluation*

3. Teaching Improvement

Study for more information e.g., study the further education requirement, brainstorming, and criticizing course.

4. Verification of Standard of Learning Outcome for the Course

Analysis of students learning outcomes using scores from class attendance, class attendance and assignment.

5. Revision Process and Improvement Plan for Course Effectiveness

After obtain the course evaluation, students' needs and comments will be developed by course responsible faculty member and instructors.



Program Bachelor of Science Program in Mathematics Degree
 Course Title Introduction to Data Science
 Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
 Faculty of Science
 Department of Mathematics

Relations between the course and the program

Table 1 Relations between the course and the PLOs

Database Management	PLOs							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
(Course Code) SCIM 231		I	R					

Table 2 Relations between CLOs and PLOs

(Course Code) SCIM 231	PLOs				
	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1: Comply with the regulations of the curriculum and the university. Have academic and professional ethics, do not copy or bring the work of others to be their own.		2.1			
CLO2: Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.		2.3	3.2 3.3		
CLO3: Use computer programming concepts or computer tools to solve data science problems.		2.3	3.2 3.3		
CLO4: Use appropriate information		2.1			



Program Bachelor of Science Program in Mathematics Degree
 Course Title Introduction to Data Science
 Course Code SCMA 248

☒ Bachelor ☐ Master ☐ Doctoral
 Faculty of Science
 Department of Mathematics

technologies to search for data and use it to solve assigned problems					
---	--	--	--	--	--

Table 3 PLOs that the course is responsible for

PLOs	SubPLOs
PLO2: Apply data analysis and data science strategy for trend prediction to support making data driven decision with the regard to data privacy, ethics, and protection..	2.1 Collect quantitative and qualitative data related to the situation by using of information technology and ethics.
	2.2 Determine the domain of the problem that needs to be transformed into an appropriate mathematical model.
	2.3 Use the appropriate Statistical and computational techniques to solve problem about interpret meaning of information from the given big data.
PLO3: Create an independent project in industrial mathematics and data science based on related-concepts with professional code of conduct.	3.1 Describe the structure of input and output data, statements and conditions in algorithms.
	3.2 Analyze and define the scope of the problem. Design a sequence of statements in the program that fit the given problem.
	3.3 Use appropriate computer programming language and statements to make the processing according to the designed results.
	3.4 Test the integrity of the output from the written computer program and modify the program codes for the better results.