Part I   Course Overview

Course Title:	The Art and Science of Data
Course Code:	GE2324
Course Duration:	1 semester
Credit Units:	3 credits
Level:	A2, B2

Proposed Area:
(for GE courses only)

☐ Arts and Humanities
☐ Study of Societies, Social and Business Organisations
☑ Science and Technology

Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	None
Precursors: *(Course Code and Title)*	None
Equivalent Courses: *(Course Code and Title)*	None
Exclusive Courses: *(Course Code and Title)*	None

Part II   Course Details

1.   Abstract
(A 150-word description about the course)

"The future belongs to the companies and people that turn data into products". Data are related to every aspect of our life and we use data products every day. Some well-known examples include Google, Yahoo, Twitter, LinkedIn, Reddit, and Baidu. This course is to introduce interesting cases, findings, and techniques on the analysis of data.

The course will mainly focus on different aspects of data analysis from diverse disciplines such as geography, ecommerce, finance, medicine, and social networks. Students will have chances to manipulate those data, and perform simple yet interesting discoveries. Students will get familiarized with a number of computational tools; for instance, Infographics, Weka, Tanagra, R Language, Octave, and Gephi to manipulate, visualize, and understand data. Very limited programming skills are required in the course. Instead, students will be taught to think scientifically and creatively about data. The aim is for students to not only analyse data, but also develop interesting applications out of the findings.

2.   Course Intended Learning Outcomes (CILOs)
(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe the basic concepts and techniques for analyzing data from diverse disciplines.		✓		
2.	Use computational tools to manipulate, analyze, and visualize data, in order to infer interesting findings from the data.		✓		
3.	Create basic protocols for practical problems by combining the data analysis tools learnt and create data visualization for effective communication and presentations.			✓	
4	Propose ideas for interesting applications for knowledge discovery from the data and design detailed steps to realize and verify those ideas.			✓	
	If weighting is assigned to CILOs, they should add up to 100%.	100%			

* If weighting is assigned to CILOs, they should add up to 100%.
 # Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1:   Attitude
    Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.
A2:   Ability
    Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.
A3:   *Accomplishments*
    Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)
(TLAs designed to facilitate students' achievement of the CILOs.)

Teaching pattern:

Suggested lecture/tutorial/laboratory mix: 2 hrs. lecture; 1 hr. tutorial

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lectures	Lectures focus on the introduction of basic concepts of data and tools, knowledge discoveries and findings from the data, and the utilization of the tools to analyse and visualize data.	✓	✓	✓	✓	2 hrs/wk
Tutorials	Tutorial sessions allow students to get first-hand experiences on data and tools. They can also access tools of similar functions, to critically evaluate the suitability of each tool to the task at hand.	✓	✓	✓	✓	1hr/wk
One Project	Students can apply the tools to study some new datasets. Also, students will choose suitable tools to create new solutions to verify simple yet interesting conjectures about our daily life activities. In addition, students are expected to work in group project to propose and develop data-based applications. For example, students who are working on social network data may study the network dynamics. Students who are working with geographical data may incorporate building information system. Students who are working with media data may distinguish between the direct and indirect correlations.		✓	✓	✓	2 hr/wk
Two Assignments	Assignments allow students to review the technical content taught in the lectures and tutorials. They also have the chance to explore potential applications by applying the concepts taught in the lectures.	✓	✓	✓		2 hr/wk

4. Assessment Tasks/Activities (ATs)
(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: <u>60%</u>						
Assignments	✓	✓	✓		20%	
Project	✓	✓	✓	✓	40%	
Examination^: <u>40%</u> (duration: 2 Hours)						
The weightings should add up to 100%.					100%	

^ For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Answer questions precisely and concisely.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Project	1. Collect data sets independently. 2. Apply the tools from the course and perform an interesting study. 3. Combine the tools to form new data analysis protocols. 4. Present and organize the results coherently.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Answer questions precisely and concisely.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III   Other Information (more details can be provided separately in the teaching plan)

1. **Keyword Syllabus**

   Data Science, Knowledge Discovery, Data Visualization, Data Mining, Data Correlation, Data Similarity, Data Clustering, Association Rule Discovery, and Network Analysis.

2. **Reading List**
2.1 **Compulsory Readings**
     (Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)
     None.

2.2 **Additional Readings**
     (Additional references for students to learn to expand their knowledge about the subject.)

1.	Bramer, Max. Principles of Data Mining. Springer London, 2016.
2.	Roiger, Richard J. Data Mining: a tutorial-based primer. CRC Press, 2017.
3.	Han, Jiawei et al. Data Mining: concepts and techniques. Elsevier, 2011.
4.	http://en.wikipedia.org/wiki/Data_science
5.	http://radar.oreilly.com/2010/06/what-is-data-science.html
6.	http://datascienc.es/
7.	http://www.cytoscape.org

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	**Please indicate which CILO(s) is/are related to this PILO, if any** *(can be more than one CILOs in each PILO)*
PILO 1: Demonstrate the capacity for self-directed learning	CILO1,2,4 Students need to practice the tools themselves to become familiar
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	CILO1,2,3 The techniques and tools learnt will be useful for various subjects and area.
PILO 3: Demonstrate critical thinking skills	
PILO 4: Interpret information and numerical data	CILO2,3,4 Need to compare difference tools
PILO 5: Produce structured, well-organised and fluent text	CILO3,4 Proposed solution need to be well documented.
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	CILO3,4 Group projects will be conducted
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task
Several groups obtained interesting results from their projects.   One group found the competitive patterns for tea and coffee trading.   Another group analyzed the social network of a particular website.   The third group studied the food networks using network analysis.