City University of Hong Kong
Course Syllabus

offered by School of Data Science
with effect from Semester B 2021 /22

Part I   Course Overview

Course Title:	Data Visualization
Course Code:	GE2343
Course Duration:	One semester
Credit Units:	3
Level:	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)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	SDSC2004
Exclusive Courses: *(Course Code and Title)*	Nil

Part II   Course Details

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

Data visualization refers to the techniques used to communicate data or information by encoding it as visual objects (e.g., points, lines or bars) contained in graphics. The capability to interpret data in a visual way has become an essential skill. Effective visualization helps users analyze and reason about data and evidence. It makes complex data more accessible, understandable and usable. This course introduces practical methods and tools to visualize data to communicate complex information clearly and efficiently. Students will learn how to present, visualize, and communicate data in various forms clearly and concisely. The ideas and principles in both aesthetic form and functionality will be emphasized.

The one mainstream data visualization tool will be covered in this class such as: Tableau, Qlikeview, Power BI, d3.js, Gephi, Weka, etc. The visualization in this course is mainly static graphics. The format of animation or video for data visualization is a plus, but only optional.

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.	**Understand** the fundamental characteristics of effective graphical displays	10%	√		
2.	**Familiarize with** the type of diagrams and their functionality for expressing insights from the data.	20%	√		
3.	**Understand** design principles of data visualization	20%	√	√	
4.	**Develop** effective visualization for diverse types of datasets by using the software	30%	√	√	√
5.	**Apply** data visualization tools to real big datasets for clear communication and efficient stimulation of users' engagement	20%	√	√	√
	* If weighting is assigned to CILOs, they should add up to 100%.	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.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Formal lectures	√	√	√	√		26 hours/Semester including group projects.
Two group projects	Student groups will be asked to complete two group projects: one project is in form of web visualization (online use), and another is in the format of poster form (print use). In both, the "storytelling" text (or report) for the visualization is a mandate to deliver a complete project.		√	√	√	√	6 hours/Semester (included in the lecture hours)
Tutorial	Teach the use of software tools in computers		√	√	√	√	13 hours/Semester

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	5		
Continuous Assessment: <u>70%</u>							
Assignments	√	√	√	√		30%	
Group project		√	√	√	√	40%	
Examination: <u>30%</u> (duration: 2 hours)							
Examination	√	√	√	√	√	30%	
*The weightings should add up to 100%.						100%	

Note: For a student to pass the course, at least 30% of the maximum mark for the examination should 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	Based on **submitted written work** to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Group projects	Based on **presentation and submitted written work** to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Based on **submitted written work** to evaluate understanding of subject matter, evidence of knowledge base, capacity to analyse and synthesize, and evidence of original and critical thinking.	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**
   (An indication of the key topics of the course.)
   - Describing and summarizing data
   - Data analysis, data analytics, big data analytics
   - Principles of visual design, perception and color theory
   - Basic charts and plots, multivariate data visualization, text rendering,
   - Examples of effective visualization for diverse types of datasets, e.g. matrices, graphs, trees, scalar fields, vector fields, high-dimensional data, etc.
   - Annotation in data visualization
   - Applications and case studies of and data visualizations
   - Software:
     - ✓ Plotting data in Python: the use of library *matplotlib*
     - ✓ One of professional software for data visualization: Tableau, Qlikeview, Power BI, d3.js, Gephi, Weka, etc.
     - ✓ Video presentation for data is a plus but not necessary.

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.)

1.	Lecture notes

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

1.	Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master By Ryan Sleeper (Author), Publisher: O'Reilly Media; 1 edition (April 30, 2018)
2.	https://www.tableau.com/learn online learning resource
3.	Visualizing Data: Exploring and Explaining Data with the Processing Environment By Ben Fry, O'Reilly Media, 2007.
4.	The Visual Display of Quantitative Information By Edward R. Tufte, 2001

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	4, 5
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	1, 2, 3, 5
PILO 3: Demonstrate critical thinking skills	3, 4, 5
PILO 4: Interpret information and numerical data	1, 2, 3, 4, 5
PILO 5: Produce structured, well-organised and fluent text	4, 5
PILO 6: Demonstrate effective oral communication skills	1, 2, 5
PILO 7: Demonstrate an ability to work effectively in a team	4, 5
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	3, 4, 5
PILO 9: Value ethical and socially responsible actions	1, 2, 3, 4, 5
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	4, 5

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
Group project report and product.