**City University of Hong Kong**
**Course Syllabus**

**offered by School of Data Science**
**with effect from Semester B 2020/21**

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## Part I Course Overview

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|---|---|
| **Course Title:** | **Data Visualization** |
| **Course Code**: | **SDSC2004** |
| **Course Duration:** | **One Semester** |
| **Credit Units**: | **3** |
| **Level**: | **B2** |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ 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)* | **GE2343** |
| **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: 70% | | | | | | | |
| Assignments | √ | √ | √ | √ | | 30% | |
| Group project | | √ | √ | √ | √ | 40% | |
| Examination: 30% (duration: 2 hours) | | | | | | | |
| Examination | √ | √ | √ | √ | √ | 30% | |
| **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 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.)*

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|---|---|
| 1. | Lecture notes |

### 2.2. Additional Readings

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

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