**City University of Hong Kong**

**Course Syllabus**

**offered by Department of Information Systems**
**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:** | IS5336P |
| **Course Duration:** | Intensive mode: 3 days |
| **Credit Units:** | 1.5 |
| **Level:** | P5 |
| **Medium of Instruction:** | Putonghua supplemented by English |
| **Medium of Assessment:** | Chinese |
| **Prerequisites:** *(Course Code and Title)* | Nil |
| **Precursors:** *(Course Code and Title)* | Nil |
| **Equivalent Courses:** *(Course Code and Title)* | Nil |
| **Exclusive Courses:** *(Course Code and Title)* | Nil |

## Part II Course Details

### 1. Abstract

"A picture is worth a thousand words." The human race is wired to perceive pictorial messages and discover patterns using intuitions. In a data-driven business environment, the ability to convey hard messages with clever visualization is essential and valuable.

In this course, we will explore ways to organize and derive meaning from vast amounts of data by using visual presentation tools and techniques. Students will learn concepts, methods, and applications of data visualization methods. The course will introduce interesting examples in different application areas. Students will also learn a spectrum of Python visualization tools from static visualization ones such as matplotlib and seaborn to interactive visualization tools such as bokeh and plotly. They will be guided in creating engaging and interactive visualizations.

### 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 and gain insight into the theory of visual presentation and the use of visual report in business communication and analytics. | 20% | ✓ | ✓ | |
| 2. | Acquire and innovatively apply skills in using static visualization tools in Python to create compelling visual report and analysis. | 40% | ✓ | ✓ | ✓ |
| 3. | Acquire and innovatively apply skills in using interactive visualization tools (Python libraries) to create flexible visual presentations. | 40% | ✓ | ✓ | ✓ |
| | | 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 | |
| TLA1: Lecture | Lectures will introduce the basic design theory for visual presentation and cases of innovative visualization applications. Lectures will also cover the basic programming techniques and use of packages. | ✓ | ✓ | ✓ | 3 Hours/Week |
| TLA2: Tutorial | Tutorials will provide hands on experiences to use the visualization tools introduced in the lectures. | ✓ | ✓ | ✓ | 7 Hours/Week |
| TLA3: Group Project | Students apply the visualization tools to form an analytics report. They need to identify a data source and form a data driven story in the project. | ✓ | ✓ | ✓ | |

## 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 | | |
| ***Continuous Assessment: 100%*** | | | | | |
| **AT1: Continuous Assessment** Students are encouraged to discuss and reflect on the materials covered in lectures and tutorials. | ✓ | ✓ | ✓ | 10% | |
| **AT2: Assignments** Assignments will be given to assess student's ability to apply the tools learned. | ✓ | ✓ | ✓ | 40% | |
| **AT3: Group Project** A group project will be assigned. Students need to apply the visualization tools to form an analytics report. They need to identify a data source and form a data driven story in the project. | ✓ | ✓ | ✓ | 40% | |
| **AT4: Quizzes** Short quizzes will be given in class to assess students' competence level of the subjects covered in the course. | ✓ | ✓ | ✓ | 10% | |
| ***Examination: 0% (duration: N/A)*** | | | | | |
| | | | | 100% | |

## 5. Assessment Rubrics

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

| No. | Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F) |
|---|---|---|---|---|---|---|---|
| 1. | AT1: Continuous Assessment | CILO 1-3<br>Demonstrate evidence of active learning through participating in the class discussion, asking critical questions and completing extra-credit activities. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 2. | AT2: Assignments | CILO 1-3<br>Demonstrate good understanding of course content and capability to apply the skills learned to create visual presentations. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 3. | AT3: Group Project | CILO 1<br>Apply principle learned about the design theory of visual presentation. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| | | CILO 2-3<br>Demonstrate capability to apply the tools (menu-based and programmable) to explore data set and create data driven story. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 4. | AT4: Quizzes | CILO 1-3<br>Demonstrate good understanding of visualization design principle and master the skills required for effective visualization. | 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.)*

Big Data; Data Visualization; Python; Data Charts; Dashboard; Static Visualization; Interactive Visualization; Numpy; Matplotlib; SeaBorn; Pandas DataFrame; Bokeh; Plotly; Temporal Visualization; Geographical Visualization.

**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. 阿布哈 • 贝洛卡等, 基于Python的交互式数据可视化编程, 中国电力出版社, 2020

**2.2 Additional Readings**

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

1. Abha Belorkar, Sharath Chandra Guntuku, Shubhangi Hora, Anshu Kumar, Interactive Data Visualization with Python - Second Edition, Packt Publishing, 2020 (English version for the Compulsory Reading)
2. 屈希峰, Python数据可视化 基于Bokeh的可视化绘图, 机械工业出版社, 2020
3. AI Publishing, Data Visualization with Python for Beginners: Visualize Your Data using Pandas, Matplotlib and Seaborn, 2020
4. 刘大成, Python数据可视化之matplotlib实践, 电子工业出版社, 2018
5. 孙洋洋, Python数据分析基于Plotly的动态可视化绘图, 电子工业出版社, 2018
6. David I. Schneider, An Introduction to Programming Using Python, 1st edition, Pearson, 2016
7. 张杰, Python数据可视化之美专业图表绘制指南, 电子工业出版社, 2020