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

**offered by School of Data Science**
**with effect from Semester A 2019/20**

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## Part I Course Overview

| | |
|---|---|
| **Course Title:** | **Knowledge Graph and Cognitive Computing** |
| **Course Code**: | **SDSC3015** |
| **Course Duration:** | **One Semester** |
| **Credit Units**: | **3** |
| **Level**: | **B3** |
| **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)* | **CS3402 Database Systems** |
| **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 150-word description about the course)*

This course aims to introduce knowledge graphs, knowledge representations and reasoning, semantic web and ontologies, knowledge graph and its applications, and the cognitive computing technologies. Students will learn how to represent knowledge and process knowledge using programming skills. Students will master the basic ideas of ontologies, semantic web, reasoning, and cognitive computing. Students will be able to construct ontologies for real-world problems. Students will use ontologies to represent the knowledge and perform various reasoning tasks on ontologies. Students will be familiar with latest applications of knowledge graphs in cognitive computing, and state-of-the-art cognitive systems.

### 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. | Explain the basic concepts of knowledge representation, semantic web and knowledge graphs. | 20% | √ | | |
| 2. | Describe the relationship between knowledge graphs and cognitive computing. | 20% | √ | √ | |
| 3. | Master the basics of ontologies and the reasoning on ontologies. | 30% | √ | √ | |
| 4. | Use a variety of AI methods to construct a cognitive system. | 30% | √ | √ | √ |
| | ** 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 | |
| Lecture | Learning through **teaching** is primarily based on lectures. | √ | √ | √ | | 39 hours/semester |
| Take-home assignments | Learning through **take-home assignments** is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback. | √ | √ | √ | √ | after class |

## 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: 60% | | | | | | |
| Hand-in assignments | | √ | √ | √ | 30% | The assignments enable students to demonstrate their skills and understanding of concepts and methods for knowledge graphs and cognitive computing. |
| Course Project^ | | | √ | √ | 30% | The course project provides students the chance to demonstrate their achievements on practical use of knowledge graphs learned in this course for practical problems. |
| Examination: 40% (duration: 2 hours) | | | | | | |
| Examination | √ | √ | √ | √ | 40% | |
| **The weightings should add up to 100%.* | | | | | 100% | |

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

## 5. Assessment Rubrics

*(Grading of student achievements is based on student performance in assesswment 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. Hand-in assignments | 1.1 Ability to learn the basic concepts of knowledge graph and cognitive computing. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| | 1.2 Capability to apply knowledge graph technologies to develop cognitive systems. | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 2. Course Project | Ability to solve real-world AI problems using knowledge graphs and cognitive computing techniques. | 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.)*

- Introduction to knowledge representations
- Elements of ontologies
- Development and basics of semantic web, linked data, and knowledge graphs
- Reasoning on knowledge graphs
- Concepts and implementation of graph database
- Decision making with knowledge-enriched machine learning techniques
- Elements of cognitive computing
- Data-driven and knowledge-enriched cognitive computing techniques
- Introduction to the IBM Watson cognitive computing systems and various applications
- Introduction to the IBM Developer Cloud, an AI platform for business and other applications.
- Building simple cognitive computing applications using the free version of IBM Developer Cloud.

## 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. | R Brachman and H Levesque, Knowledge Representation and Reasoning, Elsevier, ISBN: 9781558609327 |
| 2. | Lecture notes and recent papers |

### 2.2. Additional Readings

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