City University of Hong Kong
Course Syllabus

offered by Department of Computer Science
with effect from Semester A 2017/18

Part I   Course Overview

Course Title:	Design and Analysis of Algorithms
Course Code:	CS4335
Course Duration:	One semester
Credit Units:	3 credits
Level:	B4

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)*	CS2468 Data Structures and Data Management or CS3334 Data Structures or EE2331 Data Structures and Algorithms, or equivalent
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 the algorithms in various domains, and techniques for designing efficient algorithms.   It trains students the ability to analyse algorithms and the skills to design solutions to problems.

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.	Prove the correctness and analyse the running time and performance of the major algorithms for those classic problems in various domains.		✓	✓	
2.	Apply algorithmic paradigms and methods by using design techniques to solve problems.		✓	✓	
3.	Investigate the complexities of various problems in different domains.			✓	
4.	Propose new solutions for problems through independent study.				
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.)

Teaching pattern:

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

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	General techniques will be taught in the lecture.	✓	✓	✓	✓	
Tutorial	Exercises will be given in the tutorial and the lecturer (with the participation of students) will eventually give the answers.	✓	✓	✓	✓	
Assignment	Assignments contain problems that students should try to solve by adopting the best solutions.	✓	✓	✓	✓	

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: 30%						
Assignments	✓	✓	✓	✓	30%	
Examination^: 70% (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. Assignment	1.1 Each question is given a score	75% or above	60% or above	45% or above	40% or above	Below 40%
2. Examination	2.1 Each question is given a score	75% or above	60% or above	45% or above	40% or above	Below 40%

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.)

   Algorithm analysis.   Algorithm design: divide-and-conquer approach, greedy approach.   Graph algorithms: graph searching, topological sort, minimum spanning tree, shortest paths, backtracking and its applications in games.   String matching.   Dynamic programming and longest common subsequence. Theory of NP-completeness.   Turing machines and the halting problem.   Introduction to computational complexity.

   Syllabus

   1. Algorithm analysis
      Review on program correctness and complexities, and the mathematical tools for analysis.

   2. Graph algorithms
      Representation of graphs.   Algorithms for graph searching.   Topological sort.   Minimum spanning trees.   Greedy design approach.   Shortest paths, transitive closure and their relations with matrix multiplication.   Backtracking and applications in games.

   3. String algorithms
      String matching.   Longest common subsequence.   Dynamic programming.

   4. Theory of NP-completeness
      Problem reduction.   P and NP.   Some NP-complete problems.   Approximation algorithms.

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. | J. Kleinberg and E. Tardos (2005*). Algorithm design*. Addison-Wesley. |

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

| 1. | T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein (2009).   *Introduction to Algorithms*. MIT Press, 3rd edition. |