

**City University of Hong Kong
Course Syllabus**

**offered by Department of Computer Science
with effect from Semester A 2018/19**

Part I Course Overview

Course Title: Probability in Action: From the Unfinished Game to the Modern World

Course Code: GE2326

Course Duration: 1 semester

Credit Units: 3 credits

Level: A2, B2

Arts and Humanities

Proposed Area: Study of Societies, Social and Business Organisations

(for GE courses only)

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) CS2402 Introduction to Computational Probability Modeling

Exclusive Courses:
(Course Code and Title) Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

We live in an uncertain world, where many events occur unpredictably and beyond our control. Yet before the 17th century there was no systematic way to represent this uncertainty, reason with it, and make predictions about random events. Enter two French mathematicians, Pascal and Fermat, who worked out the problem of the “unfinished game” – how to fairly divide the pot between players in an interrupted game of chance. The resulting discovery fundamentally changed the way that we think about randomness and uncertainty, and along with other discoveries about probability, have shaped every aspect of our modern world, allowing us to plan our lives with extraordinary precision in spite of all its uncertainties.

This course aims to expose students to the historical development of probability, and enhance the students' understanding on how probability affects their lives, as well as society as a whole. In tutorials and course projects, students will conduct real world experiments to see concepts of probability in action. A previous course on probability and statistics is not required; the necessary concepts will be introduced in class, requiring only knowledge of secondary school mathematics.

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 historical developments in probability.		✓		
2.	Describe how probability is used in the real world.			✓	
3.	Evaluate the impact of probability on society.		✓		
4.	Develop critical thinking skills to use probability to explain real-world random phenomenon through independent investigation.			✓	
		100%			

* If weighting is assigned to CILOs, they should add up to 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/tutorial/laboratory mix: 2 hrs. lecture; 1 hr. tutorial.

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	The lecture will present selected materials on probability and its impact on the world. To motivate the students' understanding, concepts will be illustrated with both toy examples, demonstrations, and real-world case studies. The impact on society will also be discussed.	✓	✓	✓		2 hours
Tutorial	In the tutorials, students will conduct experiments to explore the concepts introduced in lecture. Students will examine and analyze their collected data.		✓		✓	1 hour
Assignments	Students will independently investigate a small case-study of a random phenomenon, and relate it to the concepts learned in class.		✓	✓	✓	
Group Project	Students will independently investigate their own case-study by conducting a hands-on experiment on a random phenomenon in the real world. Students will relate the results of their experiment to the learned concepts about probability. The impact on society will also be discussed. Each group can have at most 4 students.		✓	✓	✓	

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: <u>60%</u>						
Class participation	✓	✓	✓	✓	20%	tutorial exercises, and in-class exercises
Assignments		✓	✓	✓	20%	2 assignments
Group Project		✓	✓	✓	20%	
Examination [^] : <u>40%</u> (duration: 2 hours)						
					100%	

* The weightings should add up to 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. Class participation	1.1 CAPACITY for LEARNING about developments of probability. 1.2 CAPACITY for LEARNING how probability is used in the real world and its impact on society.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments	2.1 ABILITY to EXPLAIN probability and its impact on society. 2.2 ABILITY to CONDUCT an experiment, and INTERPRET and ANALYZE experiment results.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Group Project and Presentation	3.1 ABILITY to EXPLAIN probability and its impact on society. 3.2 ABILITY to CONDUCT an experiment, and INTERPRET and ANALYZE experiment results. 3.3 ABILITY to EXPLAIN how probability is used in the real world and its impact on society.	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.)

- Frequentist probability and its impact on society
 - games of chance, casinos
 - mortality rates / failure rates
 - DNA tests and the birthday paradox
 - entropy and information

- Expectation and its impact on society
 - life expectancy, insurance, annuities

- Conditional probability and its impact on society
 - medical diagnosis
 - decision making
 - the unfinished game, Monty hall, “deal or no deal”, the “hot hand”

- Subjective probability and its impact on society
 - Bayes' theorem
 - forecasting and prediction
 - probability as a measure of belief

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.)

2.2 Additional Readings

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

1.	<i>The Unfinished Game – Pascal, Fermat, and the Seventeenth-Century Letter that Made the World Modern.</i> Keith Devlin. Basic Books, 2008.
2.	<i>The Theory that Would Not Die -- How Bayes' Rule Cracked the Enigma Code, Hunted Down Russian Submarines, & Emerged Triumphant from Two Centuries of Controversy.</i> Sharon Bertsch McGrayne. Yale University Press Books, 2011.
3.	Additional reading material will be provided as needed.

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

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 and presentation on a case-study on probability and the real-world.