MATH2421 Probability

Course Outline-Fall 2026

1. Instructor

Name: Yip, Chi Hoi (Kyle)

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2. Teaching Assistants

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T1B CHEONG, Kha Man kmcheong@connect.ust.hk

T1C ZHANG, Bowei bzhangce@connect.ust.hk

3. Meeting Time and Venue

Lectures:

Date/Time: MoWe 10:30AM - 11:50AM.

Venue: Rm 2502, Lift 25-26

Tutorials:

Section/Date/Time/Venue:

T1A	Mo 06:00PM - 06:50PM	G009B, CYT Bldg
T1B	Th 06:00PM - 06:50PM	Rm 4502, Lift 25-26
T1C	We 03:00PM - 03:50PM	Rm 2504, Lift 25-26

4. Course Description

Credit Points: 4

Pre-requisite: MATH 1014 OR MATH 1020 OR MATH 1024

Exclusion: EDA 2510, IEDA 2520, MATH 2431, EEC 2600, ELEC 2600H, ISOM 3540

Brief Information/synopsis: The course covers the basic principles of probability theory. Topics include combinatorial analysis used in computing probabilities, the axioms of probability, conditional probability and independence of events, discrete and continuous random variables; joint, marginal, and conditional densities, moment generating function; binomial, Poisson, gamma, exponential, Gamma, Beta, Cauchy, univariate, and bivariate normal distributions; laws of large numbers; central limit theorem.

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Recognize and use appropriately important technical terms and definitions.
2	Use axioms of probability to calculate various probabilities.
3	Understand discrete and continuous random variables and associate them with various random experiments.
4	Solve real and hypothetical problems using the laws of large numbers and central limit theorem.

6. Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date (if applicable)
Homework	15%	TBA
Midterm	30%	Oct 24, exact time TBA
Final Exam	55%	TBA

Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework	ILO1, ILO2, ILO3, ILO4	The homework assesses students' ability of understanding the concepts and the logic, and distilling the abstract setting from examples.
Midterm	ILO1, ILO2, ILO3, ILO4	The mid-term exam assesses students' ability of understanding the

		concepts and the logic, and distilling the abstract setting from examples.
Final Exam	ILO1, ILO2, ILO3, ILO4	The final exam assesses students' ability of understanding the concepts and the logic, and distilling the abstract setting from examples.

Grading Rubrics

Marks for each problem will be specified. Full marks will be awarded for completely correct answers. Partial credit will be given for answers that are on the right track but not fully complete.

Final Grade Descriptors:

Grades	**Short Description**	**Elaboration**
A	**Excellent Performance**	**The student demonstrates excellent mastery of the main concepts and methods of probability, can formulate and solve both standard and unfamiliar problems accurately, and can clearly explain the reasoning behind the solutions.**
B	**Good Performance**	**The student demonstrates good understanding of most concepts and methods and can solve standard probability problems correctly, though some more challenging concepts or applications may not be fully mastered.**

C	**Satisfactory Performance**	**The student demonstrates satisfactory understanding of the basic concepts and methods and can solve routine probability problems, but has noticeable gaps in understanding or in applying the ideas to less familiar problems.**
D	**Marginal Pass**	**The student demonstrates only a limited understanding of the course material, but can recall some basic concepts and carry out some of the simplest probability calculations.**
F	**Fail**	**The student does not demonstrate sufficient understanding of the basic concepts and methods of the course and is unable to solve many elementary probability problems.**

7. Course AI Policy

Students are allowed to consult any person (including the instructor, TA, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves. You are required to **list the persons and references** you have consulted in every homework.

The use of ChatGPT or other generative AI is allowed, and they are regarded as "persons" you have consulted, and therefore must be listed in your homework.

However, please be warned that at the current stage of development of AI, the response to problems in advanced courses – especially those in pure mathematics – is not quite reliable. Students should be critical of the response generated by AI and do not blindly copy the generated responses to your homework.

8. Student Learning Resources

Recommended Reading:

Textbook:

Sheldon M. Ross, "A First Course in Probability", Pearson.

9. Teaching and Learning Activities

Scheduled activities: 4 hrs (lecture + tutorial)

10. Tentative Course Schedule

Week 1	Chapter 1: Principle of counting, permutations
Week 2	Chapter 1: Combinations, number of integer solutions
Week 3	Chapter 2: Sample spaces and events, Operations on events, axioms of probability, properties of probability, Sample
Week 4	Chapter 3: Conditional probability, total probability, Bayes' Theorem, independence
Week 5	Chapter 4: Definition of random variables, discrete random variables, expected values, expectation of a function of a random variable, variance and standard deviation
Week 6	Chapter 4: Discrete random variables arising from repeated trials, Poisson random variable, hypergeometric random variable, expected value of sum of random variables
Week 7	Chapter 5: Continuous random variables, probability density function, expectation and variance
Week 8	Chapter 5: uniform distribution, normal distribution, exponential distribution, Gamma distribution
Week 9	Chapter 5: Beta distribution, Cauchy distribution, approximations of binomial random variables, distribution of a function of a random variable
Week 10	Chapter 6: Joint distribution functions, independent random variables, sum of independent random variables, conditional distributions
Week 11	Chapter 6: Joint probability distribution function of functions of random variables Chapter
Week 12	Chapter 7: Conditional expectation, conditional variance, moment generating function, joint moment generating functions
Week 13	Chapter 8: Chebyshev's inequality and weak law of large numbers, strong law of large numbers, Central limit theorem

11. Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include [specific details, e.g., strengths, areas for improvement]. Students who have further questions about the feedback including marks should consult the graders within five working days after the feedback is received.

12. Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.