MATH2421 Probability

Course Outline- 2023-2024 Spring

1. **Instructor(s)**

Name: Ke Wang

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2. **Teaching Assistant(s)**

Name: LIN Hangyu (T1A)

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Name: ZENG Yeqin (T1C)

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Name: Tan Ziyue (T1D)

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3. **Meeting Time and Venue**

Lectures:

Date/Time: Monday (03:00PM - 04:20PM) and Friday (10:30AM - 11:50AM)

Venue: LTC

Tutorials:

Section/Date/Time/Venueß:

T1A, Fri 12:30 - 13:20, Rm 4504

T1B, Thu 18:00 - 18:50, Rm 2302

T1C, Tue 18:00 - 18:50, Rm 1410

T1D, Mon 18:00 - 18:50 M, Rm 2463

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 Scheme

a. Examination duration: Midterm exam 80mins; final exam 2 hrs.

b. Percentage of coursework, examination, etc.:

Assessment	Assessing Course ILOs
15% by coursework	1, 2, 3
35% by midterm exam	1, 2
50% by final exam	1, 2, 3, 4

c. The grading is assigned based on students' performance in assessment tasks/activities.

7. Student Learning Resources

Recommended Reading:

Textbook:

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

8. Teaching and Learning Activities

Scheduled activities: 4 hrs (lecture + tutorial)

9. Course Schedule

Week 1 (Feb 02)	Chapter 1: Principle of counting, permutations
Week 2 (Feb 05/Feb 09)	Chapter 1: Combinations, Multinomial coefficients, number of integer solutions Chapter 2: Sample spaces and events
Week 3 (Feb 16)	Chapter 2: Operations on events, axioms of probability, properties of probability, Sample spaces having equally likely outcomes
Week 4 (Feb 19/Feb 23)	Chapter 3: Conditional probability, total probability, Bayes' Theorem,

	independence
Week 5 (Feb 26/Mar 01)	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 (Mar 04/Mar 08)	Chapter 4: Discrete random variables arising from repeated trials, Poisson random variable, hypergeometric random variable, expected value of sum of random variables
Week 7 (Mar 11/Mar 15)	Chapter 5: Continuous random variables, probability density function, expectation and variance, uniform distribution, normal distribution, exponential distribution, Gamma distribution
Week 8 (Mar 18/Mar 22); Week 9 Midterm (Mar 25)	Chapter 5: Beta distribution, Cauchy distribution, approximations of binomial random variables, distribution of a function of a random variable
Week 10 (Apr 08/Apr 12)	Chapter 6: Joint distribution functions, independent random variables, sum of independent random variables, conditional distributions
Week 11 (Apr 15/Apr 19)	Chapter 6: Joint probability distribution function of functions of random variables
Week 12 (Apr 22/Apr 26)	Chapter 7: Expectation of sum of random variables, covariance/variance of sums and correlation
Week 13 (Apr 29/May 03)	Chapter 7: Conditional expectation, conditional variance, moment generating function, joint moment generating functions
Week 14 (May 06/May 10)	Chapter 8: Chebyshev’s inequality and weak law of large numbers, strong law of large numbers, Central limit theorem