



**University of International Business and Economics
International Summer School**

STAT 205 Probability Theory

Term: May 25 – June 25, 2020

Instructor: Shen Fan

Home Institution: China University of Petroleum

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Class Hours: Monday through Thursday, 120 minutes each day

Office Hours: TBD

Discussion Session: 2 hours each week

Total Contact Hours: 66 contact hours (45 minutes each)

Credit: 4 units

Course Description:

Introducing probability and statistical inference. The course has a prerequisite of differential and integral calculus. We will use Chung and AitSahli for basic materials, and Tijms' book for examples.

Course Goals:

A student who satisfactorily completes this course will be able to:

- ✧ understand the basic rules of probability conditional probability. and expectation
- ✧ apply Bayes' theorem on changing conditional probabilities with new evidence;
- ✧ understand the difference between discrete and continuous random variables;
- ✧ work easily with several common distributions, discrete and continuous;
- ✧ understand the central limit theorem;
- ✧ understand the difference between point estimates and inference by confidence intervals, the strengths and limits of both;
- ✧ engage in critical evaluation of statistical evidence, and experimental design.

Required Textbook:

David F. Anderson, Timo Sepalainen and Benedek Valko, Introduction to Probability, Cambridge University Press, ISBN: 9781108415859.

Henk Tijms – Probability: A lively Introduction, Cambridge University Press, ISBN 9781108407847

Grading Policy:

Grading will be determined by a combination of class attendance and participation, and the results of your exams.

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|------------------------------|------|
| Attendance and Participation | 10%. |
| Midterm Exam | 30%. |
| Final Exam | 60%. |

Grading Scale:

Assignments and examinations will be graded according to the following grade scale:

| | | | |
|-----------|--------|-----------|----------|
| A | 90-100 | C+ | 72-74 |
| A- | 85-89 | C | 68-71 |
| B+ | 82-84 | C- | 64-67 |
| B | 78-81 | D | 60-63 |
| B- | 75-77 | F | below 60 |

Class Rules:

Students are expected to come to lecture having read the material assigned for the day, and prepared to engage in active discussion about those ideas.

Attendance Policy:

Summer school is very intense and to be successful, students need to attend every class. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. UIBE policy requires a medical certificate to be excused. Any unexcused absence may affect the student's grade. Moreover, UIBE policy is that a student who has more than 1/3 (6 times) of the class in unexcused absences will fail the course.

Course Schedule:

Week One.

Monday: Chapter one Axioms of probability, sampling, review of counting, infinitely many outcomes.

Tuesday: review of the geometric series, Rules of probability, random variables

Wednesday: Chapter two, conditional probability, Bayes formula, independence

Thursday: independent trials. birthday problem, conditional independence.

Week Two.

Monday, Chapter Three, probability distribution of a random variable, Cumulative distribution function

Tuesday: expectation and variance, Gaussian distribution,

Wednesday: Chapter four, normal approximation and law of large numbers for the binomial distribution, Applications of normal approximation,

Thursday: Poisson approximation, exponential.

Week Three:

Monday: Midterm Examination 30%.



Tuesday: Chapter five, Moment generating function, distribution of a function of a random variable

Wednesday: Chapter six, Joint distributions, Joint distributions and independence.

Thursday: Chapter seven, sums of independent random variables, exchangeability

Week Four:

Monday: Chapter eight, Expectations of sums and products, variance of sums.

Tuesday: Sums and moment generating functions, covariance and correlation.

Wednesday. Chapter nine, Markov's and Chebyshev's inequalities, law of large numbers,

Thursday. Central limit theorem

Week Five:

Monday, Chapter ten, Conditional Distributions

Tuesday, Conditional Distributions

Wednesday: Review

Thursday, **final, 60%**.