Shanghai University of Finance & Economics

2021 Summer Program

STAT 400 Probability Theory

Course Outline

Term: June 14 – July 09, 2021

Class Hours: 08:00-09:50 (Monday through Friday)

Course Code: STAT 400

Instructor: Dr. Calistus Ngonghala

Home Institution: University of Florida

Office Hours: TBA

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Credit: 4

Class Hours: This course will have 52 class hours, including 32 lecture hours, 8 lecturer office hours, 8-hour TA discussion sessions, 4-hour review sessions.

Pre-requite: Differential and integral calculus are strongly recommended.

Course Description: This course provides a thorough exploration of concepts and applications probability with examples drawn from the physical, biological, and social sciences. Topics to be covered include discrete and continuous distributions, e.g., the binomial, hypergeometric, multinomial, Poisson, uniform, exponential and normal, definitions and properties of random variables, independence, sums of independent random variables, e.g., the law of large numbers and the central limit theorem, conditional probability, and the bivariate normal distribution.

Course Objectives: The main objective of this course is to build a solid critical and creative probability thinking background that can be used in other probability and statistics courses and in solving practical

or applied problems in different disciplines such as the sciences, engineering, business, etc. Students will be expected to understand the concepts and applications of probability well enough to be able to decide when, how, and why to apply them to real-world phenomena and to be able to interpret and communicate the results succinctly.

Required Textbooks: A First Course in Probability (10th Edition) by Sheldon Ross; Pearson, 2018

Grading System (1 ~ 100)

A : 94 - 100 A- : 90 – 93

B : 83 - 89 B- : 80 – 82

C : 73 - 79 C- : 70 – 72

D : 63 - 69 D- : 60 – 62

F : Fail

Detailed Course Schedule and Outline:

Week	Chapter	Topic
1	**1**	1.2 Basic principle of counting 1.3 Permutations 1.4 Combinations 1.5 Multinomial coefficients
	2	2.2 Sample spaces and events 2.3 Axioms of probability 2.4 Simple propositions 2.5 Sample spaces of equally likely events 2.6 Probability as a continuous set function 2.7 Probability as a measure of belief
	3	3.2 Conditional probability 3.3 Bayes formula 3.4 Independent events 3.5 P(.|F) is a probability
	4	4.1 Random variables (RVs) 4.2 Discrete random variables 4.3 Expected value 4.4 Expectation of a function of a random variable 4.5 Variance

	4	4.6 Bernoulli & Binomial random variables 4.7 Poisson random variables 4.9 Expectation of sums of random variables 4.10 Cumulative distribution functions
2	**5**	5.1 Continuous random variables 5.2 Expectation and variance of continuous random variables 5.3 Uniform variables 5.4 Normal random variables 5.5 Exponential random variables 5.7 Distribution of a function of a random variable
		Revision for midterm exam
		Midterm exam
		Discussion of midterm exam
	6	6.1 Joint Distribution Functions, 6.2 Independent random variables 6.3 Sums of independent random variables 6.4 Conditional distributions (discrete)
3	**6,7**	6.5 Conditional distributions (continuous) 6.7 Joint probability distribution of functions of random variables 7.2 Expectation of sums of random variables 7.3 Moments of the number of events that occur
	7	7.4 Covariance, variance of sums and correlation 7.5 Conditional expectation 7.6 Conditional expectation and prediction 7.7 Moment generating functions 7.8 Additional properties of Normal random variables
4	**8**	8.2 Markov's inequality, Chebyshev's inequality, and the Weak Law of Large Numbers 8.3 The Central Limit Theorem 8.4 The Strong Law of Large Numbers, 8.5 Other Inequalities (One-sided Chebyshev Inequality, Chernoff Bounds)
		Revision
		Final Exam
		Discussion of final exam

Student responsibilities/expectations: The main course material will be presented through lectures. A discussion session, to be held every Friday will offer an opportunity for students to discuss course material and assigned problems with a teaching assistant (TA). Students are advised to keep pace with the course material as it is being presented. Consequently, students should endeavor to attend all class meetings and discussion sessions, be early for class, and spend sufficient time working on assigned homework problems. If for any reason a student misses a class, he/she should endeavor to obtain the

notes and learn the missed material before the next class meeting. Students should not hesitate to ask questions or seek additional assistance to ensure that they are staying on pace with the class. Students will be expected to come to class prepared and ready to participate actively. Please, turn off your cell phones and put aside any unrelated material before class begins. Students should exhibit a sense of responsibility and respect towards fellow students. Late coming to class or early departure from class meetings will not be allowed.

Examinations: There will be one midterm exam plus one cumulative final exam. Each exam will consist of a multiple choice and a problem (free response) section. The free-response problem section will contain problems to solve and definitions, brief explanations of concepts, and simple proofs.

Quizzes: Quizzes will be administered periodically throughout course period. Quizzes are meant to test the understanding of covered topics, and to give a benchmark prior to the exams.

Homework: The purpose of homework is to develop more skills in the material covered. It will be the student's responsibility to solve the assigned homework problems in a timely manner. Students who intend to do well in the course are advised to solve the homework problems. Students should feel free to approach the instructor with difficulties from homework problems. Problems in which students encounter difficulties may also be discussed in class.