

SYLLABUS

MATH 407 - Probability Theory

Fall 2018

Prof. Baxendale

TEXT: Introduction to Probability, by David Anderson, Timo Seppäläinen and Benedek Valkó, published by Cambridge University Press.

CHAPTER 1: EXPERIMENTS WITH RANDOM OUTCOMES. Sections 1.1 to 1.5, plus material on combinatorics from Appendix C. Sample spaces and probabilities. Random sampling. Consequences of the axioms. Random variables. (5 lectures)

CHAPTER 2: CONDITIONAL PROBABILITY AND INDEPENDENCE. Sections 2.1 to 2.5. Definitions. Bayes' formula. Independence and independent trials. Binomial and geometric random variables. Examples. (4 lectures)

CHAPTER 3: RANDOM VARIABLES. Sections 3.1 to 3.5. Probability distributions for discrete and continuous random variables. Expectation and variance. Gaussian (normal) distribution. (5 lectures)

CHAPTER 4: APPROXIMATIONS OF THE BINOMIAL DISTRIBUTION. Sections 4.1 to 4.6. Law of large numbers. Normal approximation to the binomial. Poisson approximation to binomial. Exponential random variables and the Poisson process. (6 lectures)

CHAPTER 5: TRANSFORMS AND TRANSFORMATIONS. Section 5.2. Distribution of a function of a random variable. Simulation of random variables. (2 lectures)

CHAPTER 6: JOINT DISTRIBUTION OF RANDOM VARIABLES. Sections 6.1 to 6.4. Joint distribution functions. Marginal distributions. Independent random variables. Bivariate normal distribution. (4 lectures)

CHAPTER 7: SUMS AND SYMMETRY. Sections 7.1 and 7.3. Sums of independent random variables. Poisson process revisited. (2 lectures)

CHAPTER 8: EXPECTATION AND VARIANCE IN THE MULTIVARIATE SETTING. Sections 8.1, 8.2 and 8.4. Linearity of expectation. Method of indicators. Expectation and independence. Covariance and correlation. (3 lectures)

CHAPTER 9: TAIL BOUNDS AND LIMIT THEOREMS. Sections 9.1 to 9.3. Markov's inequality. Chebyshev's inequality. Law of large numbers. Central limit theorem. (4 lectures)

CHAPTER 10: CONDITIONAL DISTRIBUTION. Sections 10.1 to 10.4. Conditional distributions for discrete and continuous random variables. Conditional expectation. Prediction. (4 lectures)