Dec. 7 and 9 Chapter 1: Set theory

- Sample spaces, events, outcomes (identify the sample space of a probability experiment) apply set notation to simplify expressions involving events; apply Venn diagrams to the same;
- Unions, intersections of sets (apply set notation to simplify expressions involving events; apply Venn diagrams to the same)
- mutually exclusive events

Dec. 7 and 9 Chapter 1: Probability axioms

- Axioms of probability, simple consequences (prove simple facts based on the three axioms of probability; use set notation or Venn diagrams for certain probability problems; use the inclusion-exclusion rule)
- equally likely out comes

Dec. 7 and 9 Chapter 1: Conditional Probability

- Conditional probability (define the conditional probability of A given B using a formula; understand intuitively what $P(A \mid B)$ means; solve conditional probability problems using formulas or Venn diagrams)
- state and use multiplication rule of conditioning
- Law of total probability
- Bayes's theorem (formula)

Dec. 7 and 9 Chapter 1: Independent events

- Independence of two events
- Independence of three or more events
- Independent trials
- Reliability problems

Dec. 7 and 9 — Chapter 1: Counting

- multiplication rule
- permutations
- combinations
- multinomial coefficients
- exploit the multiplication principle when outcomes are equally likely; define a permutation on n elements and understand $n!$ notation; know $\binom{n}{r}$ formulas; recognize multinomial coefficient situations and know the multinomial coefficient formula.

Dec. 7 and 9 — Chapter 2: Discrete r.v., PMF

- Random variables (discrete)
- list the properties of a probability mass function for a discrete r.v.;
- find the constant multiplier for a PMF by setting the sum of probabilities to 1;
- Expected value
- Expectation of a function of a random variable
- Define mean, variance and standard deviation
- evaluate the mean, variance, and standard deviation for discrete RVs;
- know that $\mathrm{Var}\,(aX+b) = a^2\,\mathrm{Var}\,(X)$, $E(aX+b) = aE(X)+b$.

Dec. 7 and 9 — Chapter 2: Discrete distributions

- Know PMF, mean and variance of Bernoulli and Binomial r.v.
- Know PMF, mean and variance of Poisson r.v.
- Geometric, negative binomial and hypergeometric r.v.
- Memorize these discrete probability mass functions
- Cumulative distribution function CDF
- conditional probability mass function

Dec. 7 and 9 — Chapter 3: Continuous r.v.

- list the properties of a density function for a continuous r.v.;
- find the constant multiplier for a density by setting the integral to 1;
- give formulas for mean and variance of a continuous RV;
- differentiate the CDF of a continuous r.v. to find the p.d.f;
- integrate the PDF of a continuous r.v. to find the c.d.f.;

Dec. 7 and 9 Chapter 3: Continuous distributions

- Know mean, variance, p.d.f. of uniform and exponential r.v.
- memory-less property of exponential r.v.
- understand the relationship between a Poisson process and exponential wait times;
- recognize the gamma function and know its definition;
- know that a chi-square distribution is a special case of a gamma distribution.

Dec. 7 and 9 Chapter 3: Normal/Gaussian r.v.

- memorize the density function for a Gaussian (μ, σ) r.v.
- identify the mean, variance of a Gaussian random variable.
- evaluate probabilities of Gaussian (normal) variables using tables.

Dec. 7 and 9 Chapters 3: Probability models of Derived r.v.

CDF method to find the distribution of a function of a r.v.

Dec. 7 and 9 Chapters 4: Pairs of r.v.

- 4.1 Joint cumulative distribution function (CDF), and 4.2 joint probability mass function (PMF);
- 4.3 Marginal PMF;
- 4.4 Joint probability Density Function (PDF);
- 4.5 Marginal PDF;

Dec. 7 and 9 Chapters 4: Pairs of r.v.

- 4.6 Functions of two random variables;
- 4.7 Expected values (mean and variance of sums of r.v., covariance, correlation coefficient);
- 4.9 Conditioning by a random variable (conditional density, conditional mass function, correlation coefficient lies between -1 and 1);
- 4.10 Independent random variables;
- 4.11 Bivariate Gaussian random variables.

Dec. 7 and 9 Chapter 5: Random Vectors

- 5 Random vectors (multivariate PMF, PDF, CDF);
- 5 Vector notation, and marginal probability functions (Covariance matrix of multivariate normal distribution);
- 5 Independent random variables and random vectors.

Dec. 7 and 9 Chapter 6: Sums of Random Vectors

- 6.1 Expected values of sums of random variables (variance);
- 6.2 CDF and PDF of sum of two r.v.;
- 6.3 Moment generating function;
- 6.4 MGF of sum of independent r.v.;
- 6.5 Random sums of independent r.v;
- 6.6 Central Limit Theorem;
- 6.7 Application of the CLT;
- 6.8 The Chernoff Bound.

Dec. 7 and 9 Chapter 10: Stochastic Processes

- 10.2 Types of Stochastic Processes
- 10.4 I.I.D. random sequences
- 10.5 Poisson Process
- 10.6 Properties of Poisson Process
- 10.7 Brownian Motion Process
- 10.8 Expected value and correlation
- 10.9 Stationary Processes
- 10.10 Wide Sense Stationary Stochastic Processes
- 10.12 Gaussian Processes

- 12.1 Discrete-Time Markov Chains
- 12.2 Discrete-Time Markov Chain Dynamics;
- 12.3 Limiting state probabilities for a finite Markov chains.