工程概率统计

Probability and Statistics for Engineering

期末复习

Final Review

Chapter 1

Basic Ideas In Probability

Basic Concepts

- Random experiment
- Sample space
- Random event
- Properties of probability, e.g., the addition law, the inclusion-exclusion principle

Computing Probabilities

- Classical model of probability
- Addition principle
- Multiplication principle
- Permutation
- Combination
- Geometric Model of probability

Conditional Probability and Independence

- Multiplicative law
- Law of total probability
- Bayes' Theorem
- Definition of independence
- Conditional independence

Chapter 2

Random Variables and Distributions

Basic Concepts

- Random variable: discrete and continuous
- PMF/PDF/CDF: definition and properties
- Expectation, variance, standard deviation of a random variable

Common Distributions

- $\text{Bernoulli}(p)$, $\text{Binomial}(n, p)$, $\text{Geometric}(p)$, $\text{Poisson}(\lambda)$
- Poisson Theorem
- $\text{U}(a, b)$, $\text{Exp}(\lambda)$, $\text{N}(\mu, \sigma^2)$
- Compute probabilities based on the common distributions

Transformation of Random Variables

- Discrete to discrete
- Continuous to discrete
- Continuous to continuous
- Jensen's inequality

Chapter 3

Joint Distributions

Basic Concepts

- Random vector
- Joint CDF and properties
- Joint and marginal PMF - discrete random vector
- Joint and marginal PDF - continuous random vector
- Conditional PMF/PDF

Relationship between two r.v.

- Independence of random variables
- Covariance: definition and properties
- Correlation coefficient

Function of multiple r.v.

- PMF/PDF of $X + Y$: discrete/continuous convolution formula
- Central Limit Theorem
- CDF of $\min\{X_1, \ldots, X_n\}$ and $\max\{X_1, \ldots, X_n\}$
- General method.

Multivariate Normal

- Definition
- Uncorrelated vs. independent
- Marginal and conditional dist.
- Linear combination

Chapter 4

Monte Carlo Methods

- Law of large number, converge in probability
- Inverse transformation sampling
- Rejection sampling
- Margin of error and Monte Carlo experiment size

Chapter 5

Basic Concepts in Statistics

Basic Concepts

- Population, parameter, sample.
- Simple random sample, sample observed values
- Commonly used statistics: sample mean and variance, order statistics, etc.

Point Estimation

- Unbiasedness, relative efficiency, consistency
- Chebyshev's inequality
- Method of moments
- Method of maximum likelihood

Confidence Interval

- Definition and interpretation of a $100(1-\alpha)\%$ CI.
- General method of constructing CIs.

Chapter 6

Hypothesis Testing

Basic Concepts

- Null and alternative hypotheses
- Rejection region
- Type I and Type II error
- Significance test with significance level α
- Test statistic
- p-value
- Statistical power

General process

- General method of choosing a test statistic
- One-sided and two-sided tests
- Computation of p-value
- Sample size determination

FAQ and Notes

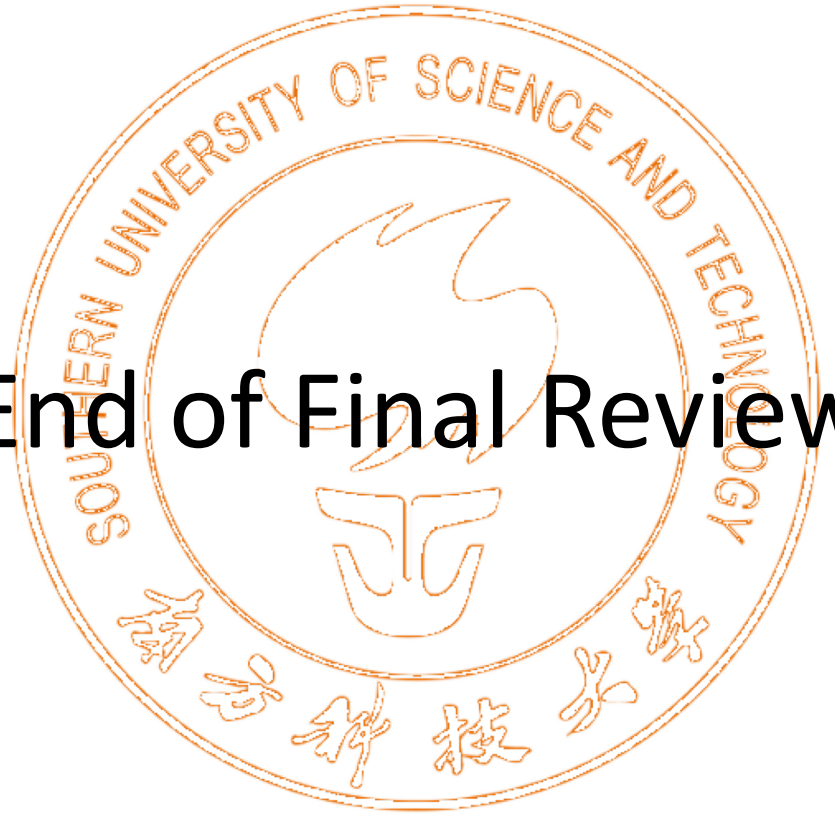
- **Question:** Is cheating paper allowed?
- **Answer:** No.

- **Question:** Will materials before the midterm exam covered in the final exam?
- **Answer:** Yes.

- **Question:** Will we be asked to write Python code in the exam?
- **Answer:** No.

- **Question:** Will the standard normal probabilities and quantiles be given in the exam?
- **Answer:** Yes.

- Remember to bring your **calculator** and **student ID**. Arrive on time!
- Cheating performance will be dealt with seriously once confirmed, please follow the principle of integrity.



End of Final Review