

# PSTAT 194 Midterm

## Why the a midterm project?

One of the course goals is to prepare students to be able to discover, learn or extend and apply new computational techniques beyond what was covered in the class. Another goal is to prepare students to conduct research in statistics. This Project is aimed at developing such skills that are needed in industry or graduate school.

Chapter 3 covers three methods to generate random variables

1. Inverse CDF
2. Transformation of Random Variables
3. Accept-Reject methods

Each of these methods is an application of a clever trick by leveraging the existing Mathematical Statistics theory that you have learnt.

You have three options for the midterm.

Options 1 and 2 offer a project on RNG (Random Number Generation) methods (Chapter 3) and Option 3 offers a written exam tentatively in Week 6 Friday during class time.

Register your options by the following deadlines:

1. Option 1: No registration needed.
2. Option 2: Register groups with TA by Week 3 section end.
3. Option 3: Register with instructor by Week 3 Friday class end.

### Option 1: Individual Project

**Objective:** Demonstrate the application of RNG techniques to generate three random variables of your choice.

#### Steps:

1. **Select Random Variables:** Choose three random variables not covered in the course sections or in textbook examples. You may choose random variables appearing in textbook exercises. You may use course notes, text books and external resources to select your variables.
2. **Apply RNG Methods:** For each of the three random variables you select, apply a different RNG method: Inverse CDF, Transformations, and Accept Reject. Each random variable must be generated using a unique method from this list. However, you are encouraged to demonstrate the use of more than one method on the same random variable to deepen your understanding and showcase various techniques.
3. **Develop Code:** Write code implementing the three RNG methods for your chosen variables. Ensure your code is well-commented to explain the implementation process.
4. **Prepare Write-Up:** Provide a short write-up (1-2 pages) detailing:
  - Your choice of random variables and reasons for selection.
  - A description of each RNG method used.
  - How each method applies to your chosen variables.
  - Any challenges encountered and how you addressed them.

- Appendix:(not part of the 2 page limit) References and Code to generate your chosen random variables.
5. **Submission:** .Rmd and .pdf and .zip files on Gradescope by Week 6 Thursday 11:59pm. Present in class on Week 6 Friday

## Option 2: Group Project

**Objective:** Explore and understand an RNG-related article, and apply methods discussed to generate random variables.

**Group Formation and group formation deadline:** Groups of 3 students. Coordinate with your peers to form groups and register groups with TA as early as possible and by **Week 3 section**.

### Steps:

1. **Pick a random variable and pick an article Selection:** As a group, select an article that discusses RNG methods. If you pick gamma random variable as your random variable, then a google search may result in papers like **this**
2. **Understand and Discuss:** Read and discuss the article within your group to understand the RNG methods presented and their applications.
3. **Develop Code:** Implement the RNG methods described in the article to generate between 1-3 random variables of the group's choice. Ensure the code is collaborative and well-documented.
4. **Prepare Write-Up:** Create a short write-up (2-3 pages) that includes:
  - A summary of the article and its significance to RNG.
  - A detailed description of the RNG methods covered.
  - Explanation of how these methods were applied to generate the selected random variables.
  - Discussion of any challenges faced during implementation, how you addressed them and insights gained.
  - Appendix:(not part of the 3 page limit) References and Code to generate your chosen random variables
5. **Submission:** Submit the group's code and write-up on Gradescope by **Week 6 Thursday 11:59pm**. Ensure all group members' names are included in the submission documents. Present in class on Week 6 Friday.

**Evaluation Criteria:** Projects will be evaluated based on the clarity and depth of the write-up, the functionality and cleanliness of the code, and the creative application of RNG methods.

## Option 3: Written exam.

You have the option to demonstrate your understanding of course topics by taking a written exam during class time Week 6 Friday. The exam will focus on the theory and application of Monte Carlo Integration methods and Social Network Analysis as covered in the course up to the date of the exam.

### Exam Details:

- Date and Time: **Week 6 Friday**, during class hours.
- Content Covered: Monte Carlo Integration methods and Social Network Analysis.
- Tools Allowed: You may use RStudio studio during the exam but you should not refer to any notes or code on the server other than the one you write during the exam. A table with relevant named distribution formulas, parameters will be provided.
- Notes: You are permitted to bring one page of handwritten notes (front and back). You may write anything you please.
- Restrictions: No access to other sites, textbooks, or lecture notes is allowed during the exam.

### Registration:

You must register with the instructor to select this exam option by Week 3 Friday end of class.

Please ensure you are prepared and have registered by the deadline if you choose to take this midterm exam option.

### **Academic Integrity**

Ensure you adhere to all academic integrity guidelines during the completion of your midterm project or midterm exam, citing any external sources used.

Good luck with your midterm!