Math3810 - Probability
Section 001 - Fall 2025
Introductory Homework #9

University of Colorado Denver / College of Liberal Arts and Sciences

Department of Mathematics - Dr. Robert Rostermundt

Name: **Student Number:**

Instructions

Show all reasoning clearly. All simulation results should be reproducible and clearly labeled. You may use R for all computations.

Problems

1. **Poisson Random Variable**
   (a) Simulate 100, 500, 1000, 50000 Poisson($\lambda = 4$) random variables.
   (b) Plot histograms and compare with theoretical PMF.
   (c) Compute empirical mean and variance; compare to λ.
2. **Exponential Random Variable**
   (a) Simulate Exponential($\lambda = 0.5$) random variables.
   (b) Plot histogram with theoretical density overlay.
   (c) Compute sample mean and variance; compare to theory.
3. **Transformation**
   (a) If $Y = 3X + 2$ where $X \sim$ Poisson(4), simulate and compare mean/variance.
   (b) Plot histogram of Y and overlay X histogram scaled.
4. **Empirical CDF**
   (a) Compute empirical CDFs of X and Y from above simulations.
   (b) Compare to theoretical CDF.
5. **Discussion**
   - Explain how sample size affects the empirical distribution.
   - Discuss the difference between discrete and continuous distributions.