

# Math 339SP, Fall 2025 — Homework 7

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Due October 30 at 5:00 pm

**Instructions.** This problem set contains problems mostly from Weeks 7 and 8 of class. The problem numbers refer to our textbook, *Introduction to Stochastic Processes with R* by Robert P. Dobrow.

**Problem 1.** Please do the following textbook problems: 4.2, 4.12, 4.13, 4.14, 4.15, 4.16, 4.24, 6.4, 6.5, 6.13a.

*Remark 1.* In Exercise 4.2, it will be helpful to remember that the function  $e^x$  can be expressed as a power series for any  $x \in \mathbb{R}$ :

$$e^x = \sum_{k=0}^{\infty} \frac{x^k}{k!}.$$

You should also read about using the probability generating function to find moments of a random variable on page 167.

*Remark 2.* In Exercise 4.12, you should find the extinction probability exactly, not an approximation.

*Remark 3.* In Exercises 4.13 and 4.15, you should modify the R code in `extinction.Rmd` to approximate the extinction probability. Note that in R the function  $e^x$  is expressed as `exp(x)`.

*Remark 4.* When we derived the relation  $G_n(s) = (G \circ \dots \circ G)(s)$  we started from the assumption that  $Z_0 = 1$ . Exercise 4.16 is asking you to think about the general case when  $Z_0 = k$  for any  $k \in \mathbb{N}$ .