

# Math 339SP, Spring 2022 — Homework 8

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Due April 8 at 5:00 pm

**Instructions.** This problem set covers material from Week 10 of class, with a focus on Chapter 6 of the textbook.

**Problem 1.** Try the following exercises from Chapter 6.

1. Exercise 6.7
2. Exercise 6.8 Note that in part d it will be helpful to use the continuous law of total probability: if  $X$  is a continuous random variable with density  $f_X(x)$  taking on values in the interval  $I \subseteq \mathbb{R}$  and  $A$  is an event, then  $P(A) = \int_I P(A | X = x) f_X(x) dx$ .
3. Exercise 6.14 Note that the goal in this problem is to show that there is some  $p \in (0, 1)$  such that  $P(X = k) = (1 - p)^k p$  for any  $k \geq 0$ . Make sure to explicitly state the value of  $p$  in your solution. You should again use the continuous law of total probability. You may also use the following identity which comes from repeated application of integration by parts: for any  $a > 0$  and  $k \geq 0$

$$\int_0^{\infty} e^{-at} t^k dt = \frac{k!}{a^{k+1}}.$$

4. Exercise 6.15
5. Exercise 6.16