

S&DS 241/541  
Problem Set 8  
due Nov. 6, 2024, 11:00 pm via Gradescope

## Guidelines

- Please write legibly and explain your reasoning. For full credit, your answer and your reasoning need to be not only correct, but clear to the grader.
- Late problem sets will not be accepted unless there are extenuating circumstances (e.g., an illness or family emergency). Undergraduates must obtain a Dean's excuse for any late submission. Graduate students must obtain permission before the deadline. (As mentioned in the syllabus, we'll drop your lowest homework score.)
- You're encouraged to discuss the homework with classmates (this can be a good way to learn), but you must write your solutions independently and in your own words.

## Problems

1. Chapter 5, Exercise 37. Hint: For part (c), you can apply the result from Example 5.6.3 (Minimum of independent Expos).
2. Chapter 6, Exercise 15. Hint: For part (b), the "famous distribution" is one of those whose MGFs are shown in section 6.4.
3. Chapter 6, Exercise 18. Note: You don't need to rederive the MGF of the Geometric distribution. You can use the formula from Example 6.4.3.
4. Chapter 6, Exercise 24.
5. Use moment generating functions to answer these questions:
  - (a) Suppose  $X_1$  and  $X_2$  are independent random variables,  $X_1 \sim \text{Binomial}(n_1, p)$ , and  $X_2 \sim \text{Binomial}(n_2, p)$ . Does  $X_1 + X_2$  follow a Binomial distribution? If so, what are the parameters?
  - (b) Suppose  $Y_1$  and  $Y_2$  are independent random variables,  $Y_1 \sim \text{Exponential}(\lambda_1)$ , and  $Y_2 \sim \text{Exponential}(\lambda_2)$ . Does  $Y_1 + Y_2$  follow an Exponential distribution? If so, what's the parameter?
6. (Not graded) On a separate page, please write your name and acknowledge anyone who helped you or discussed the problem set with you (other than the instructor, TFs, and ULAs), as well as any written resources you consulted (other than the textbook and other resources on Canvas). If you don't have any acknowledgments to make, please write "I worked independently."