

Homework 7: 10/24 - 10/28

STA 335

Due 11:59pm Monday, October 31

Name: _____

Instructions: Write-up complete solutions to the following problems and submit answers on Gradescope. Your solutions should be neatly-written, show all work and computations, include figures or graphs where appropriate, and include some written explanation of your method or process (enough that I can understand your reasoning without having to guess or make assumptions). A rubric for homework problems appears on the final page of this assignment.

- Unless otherwise noted, problem numbers are taken from the 2nd edition of Blitzstein and Hwang's *Intro to Probability*.

Monday 10/24

Chapter 6

7, 8, 10, 11

Wednesday 10/26

Additional Problems

AP1. Let p be a real number with $0 < p < 1$. Find the value of the following two series by using calculus and appealing to the formula for a geometric series.

(a) $\sum_{k=0}^{\infty} k(1-p)^k p$

(b) $\sum_{k=0}^{\infty} k^2(1-p)^k p$

AP2. Suppose X is a discrete random variable with PMF

$$P(X = k) = c \frac{p^k}{k} \quad k = 1, 2, 3, \dots$$

where c is a constant that doesn't depend on k .

- (a) Using the Taylor Series for $\log(1-x)$ to find the value of c .
- (b) Compute the mean and variance of X .

AP3. Use the Taylor Series for e^x to find the Taylor Series for $f(x) = e^{x^2/2}$. Write down an explicit formula for $f^{(n)}(0)$, the n th derivative of $f(x)$ evaluated at $x = 0$. Simplify your answer as much as possible.

Friday 10/28

Chapter 6

18, 21

Additional Problems

AP4. Let $X \sim \text{DUnif}(\{-1, 1\})$ (i.e. $P(X = 1) = \frac{1}{2} = P(X = -1)$). Find the MGF of X , and then use the Taylor series expansion for the MGF to find **all** moments of X .

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General Rubric

Points	Criteria
5	The solution is correct and well-written. The author leaves no doubt as to why the solution is valid.
4.5	The solution is well-written, and is correct except for some minor arithmetic or calculation mistake.
4	The solution is technically correct, but author has omitted some key justification for why the solution is valid. Alternatively, the solution is well-written, but is missing a small, but essential component.
3	The solution is well-written, but either overlooks a significant component of the problem or makes a significant mistake. Alternatively, in a multi-part problem, a majority of the solutions are correct and well-written, but one part is missing or is significantly incorrect
2	The solution is either correct but not adequately written, or it is adequately written but overlooks a significant component of the problem or makes a significant mistake.
1	The solution is rudimentary, but contains some relevant ideas. Alternatively, the solution briefly indicates the correct answer, but provides no further justification
0	Either the solution is missing entirely, or the author makes no non-trivial progress toward a solution (i.e. just writes the statement of the problem and/or restates given information)
Notes:	For problems with multiple parts, the score represents a holistic review of the entire problem. Additionally, half-points may be used if the solution falls between two point values above.