Pre-class preparation

Please read the following textbook sections from Blitzstein and Hwang's *Introduction to Probability* (second edition) OR watched the indicated video from Blitzstein's Math 110 YouTube channel:

- Textbook: Sections 4.7-4.8, 4.11
- Video:
  - Lecture 11: Poisson Distribution
  - Read Section 4.11 (R coding isn't discussed in the lecture)

Objectives

By the end of the day's class, students should be able to do the following:

- State the definition of a Poisson random variable both in terms of its OMF and a story model.
- Show that the expected value for a Poisson variable with parameter λ is λ.
- Describe the shape of the Poisson distribution for both small and large values of the parameter λ.
- Summarize and provide examples of the "Poisson paradigm".
- Explain how to obtain a binomial variable by conditioning on values of a Poisson variable, and conversely, explain how to obtain a Poisson variable by taking limits of binomial variables.

Reflection Questions

Please submit your answers to the following questions to the corresponding Canvas assignment by 7:45AM:

1. In the "Poisson paradigm", we say that $X = \sum_{i=1}^{n} \mathbf{1}_{A_i}$ is approximately Poisson distributed with rate $\lambda = \sum_{j=1}^{n} P(A_i)$, provided that the events A_i are at most *weakly dependent*. However, it would not be appropriate to say that X is approximately Poisson when the A_i are *highly dependent*. Explain why a collection of disjoint/mutually exclusive events would be considered highly dependent, and then demonstrate that the Poisson paradigm indeed fails when the A_i are all disjoint.
2. Suppose $X \sim \text{Binomial}(n, p)$. In your own words, explain what is meant by the following statement: "The distribution of X is *approximately* Poisson(λ), where $\lambda = np$.

3. In the video and reading, we used the fact that the *Taylor Series* for e^x is

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

   To help Prof. Tang prepare for class, please let me know the following:

   - In a previous class, have you seen Taylor Series before?
   - In a previous class, have you seen this equation before?

4. (Optional) Is there anything from the pre-class preparation that you have questions about? What topics would you like would you like some more clarification on?