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| Problem 2 |  |
| a. The number of patients in an experimental drug trial that respond to treatment. | **Model**: **Binomial random variable**  **Reasoning**: Each patient can either respond to the treatment or not, which is a binary outcome. If there are n patients, and the probability of a response is p, this can be modeled by a binomial distribution, where the random variable counts the number of “successes” (patients responding to treatment) out of n trials.  **Assumptions**: Each patient’s response is independent of others, and the probability of responding, p, is the same for all patients. |
| b. The number of red cars you observe driving through an intersection between 10am and 11am. |  **Model**: **Poisson random variable**   **Reasoning**: The Poisson distribution is typically used to model the number of events (e.g., cars passing through an intersection) occurring in a fixed interval of time or space when events happen independently at a constant average rate.   **Assumptions**: Red cars pass through the intersection randomly and independently of each other, and the average rate of red cars passing through the intersection remains constant over time. |
| c. What the second hand reads on the clock when you wake up from a long nap (approximately). | ~~Exponential~~   **Model**: **Uniform random variable**   **Reasoning**: Assuming you wake up at a random time, the position of the second hand can take any value between 0 and 59 seconds with equal probability, suggesting a uniform distribution over this interval.   **Assumptions**: There is no reason to expect you wake up at any particular second more than any other, so all seconds are equally likely. |
| d. How many people you need to swipe right on Tinder before you get a match. |  **Model**: **Geometric random variable**   **Reasoning**: The geometric distribution models the number of Bernoulli trials (in this case, swiping right on someone) before the first success (a match). If the probability of getting a match on any given swipe is p, the number of swipes until the first match follows a geometric distribution.   **Assumptions**: Each swipe is independent, and the probability p of getting a match is constant for each swipe. |
| e. The length of time between mosquito bites a camper experiences while on a hike. |  **Model**: **Exponential random variable**   **Reasoning**: The exponential distribution is used to model the time between events in a Poisson process, where events (mosquito bites) occur continuously and independently at a constant average rate.   **Assumptions**: Mosquito bites occur randomly and independently over time, with a constant rate. |
| f. Whether the Eagles win the Superbowl this year. | ~~Binomial~~   **Model**: **Bernoulli random variable**   **Reasoning**: This is a binary outcome — either the Eagles win or they don’t. A Bernoulli random variable takes the value 1 (if the Eagles win) or 0 (if they lose), with probability p of success.   **Assumptions**: The probability p of the Eagles winning is fixed and known. |
| g. The GPA of a randomly selected UW-Madison graduate. |  **Model**: **Normal random variable**   **Reasoning**: GPA is a continuous variable that is likely to follow a normal distribution, as many academic performance measures tend to cluster around an average with variation.   **Assumptions**: GPAs are normally distributed, meaning most GPAs are near the mean with fewer values far from the mean (assuming large sample sizes and Central Limit Theorem considerations). |