Statistical_Inference1

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Statistical Inference for Data Science: Chapter 4 Exercises

1. A standard die takes the values 1:6 with equal probability. What is the expected value?

- **The expected value of a fair die may be calculated as** $E[X] = \sum_x xp(x) = \frac{1}{6}(1+2+3+4+5+6) = 3.5$

2. Consider a density that is uniform from -1 to 1 (i.e. has height equal to 1/2 and looks like a box starting at -1 and ending at 1). What is the mean of this distribution?

- **The mean of a continuous probability distribution may be found as** $\int p(x)x$**. Thus, the mean of this probability density is given as** $\int_{-1}^{1} \frac{1}{2} \cdot x = \left[\frac{1}{4}x^2\right]_{-1}^{1} = \left(\frac{1}{4} - \frac{1}{4}\right) = 0$

3. If a population has a mean μ, what is the mean of the distribution of averages of 20 observations from this distribution?

- **As you obtain more samples, the mean of the distribution of averages should approach the population mean** μ

4. You are playing a game with a friend where you flip a coin and if it comes up heads you give her X dollars and if it comes up tails she gives you Y dollars. The odds that the coin is heads is d. What is your expected earnings?

- **Given that** $E[X] = \sum xp(x)$ **and the odds of you winning is given as** d**, your expected earnings may be found as** $E[earnings] = Y(p) - X(1-p)$**. Odds is related to probability s.t.** $d = \frac{p}{1-p} \rightarrow p = \frac{d}{1+d}$**; therefore, your expected earnings is** $E[earnings] = Y\left(\frac{d}{1+d}\right) - X\left(1 - \frac{d}{1+d}\right)$

5. If you roll ten standard dice, take their average, and repeat this process over and over and construct a histogram, what would it be centered at?

- **As with the single die in question 1, the average of this distribution would be 3.5.**