Learning Objectives

Chapter 3: Distributions of random variables

- **LO 1.** Define the standardized (Z) score of a data point as the number of standard deviations it is away from the mean: $Z = \frac{x-\mu}{\sigma}$.
- LO 2. Use the Z score
 - if the distribution is normal: to determine the percentile score of a data point (using technology or normal probability tables)
 - regardless of the shape of the distribution: to assess whether or not the particular observation is considered to be unusual (more than 2 standard deviations away from the mean)
- LO 3. Depending on the shape of the distribution determine whether the median would have a negative, positive, or 0 Z score.
- LO 4. Assess whether or not a distribution is nearly normal using the 68-95-99.7% rule or graphical methods such as a normal probability plot.
 - * Reading: Section 3.1 and 3.2 of OpenIntro Statistics
 - * Video: Normal Distribution Finding Probabilities Dr. Çetinkaya-Rundel, YouTube, 6:04
 - * Video: Normal Distribution Finding Cutoff Points Dr. Çetinkaya-Rundel, YouTube, 4:25
 - * Additional resources:
 - Video: Normal distribution and 68-95-99.7% rule, YouTube, 3:18
 - Video: Z scores Part 1, YouTube, 3:03
 - Video: Z scores Part 2, YouTube, 4:01
 - * Test yourself: True/False: In a right skewed distribution the Z score of the median is positive.
- LO 5. Determine if a random variable is binomial using the four conditions:
 - The trials are independent.
 - The number of trials, n, is fixed.
 - Each trial outcome can be classified as a success or failure.
 - The probability of a success, p, is the same for each trial.
- **LO 6.** Calculate the number of possible scenarios for obtaining k successes in n trials using the choose function: $\binom{n}{k = \frac{n!}{k! (n-k)!}}$.
- **LO 7.** Calculate probability of a given number of successes in a given number of trials using the binomial distribution: $P(k = K) = \frac{n!}{k! \ (n-k)!} \ p^k \ (1-p)^{(n-k)}$.
- LO 8. Calculate the expected number of successes in a given number of binomial trials $(\mu = np)$ and its standard deviation $(\sigma = \sqrt{np(1-p)})$.
- **LO 9.** When number of trials is sufficiently large $(np \ge 10 \text{ and } n(1-p) \ge 10)$, use normal approximation to calculate binomial probabilities, and explain why this approach works.
 - * Reading: Section 3.4 of OpenIntro Statistics
 - * Video: Binomial Distribution Finding Probabilities Dr. Cetinkaya-Rundel, YouTube, 8:46
 - * Additional resources:

- Video: Binomial distribution, YouTube, 4:25
- Video: Mean and standard deviation of a binomial distribution, YouTube, 1:39

* Test yourself:

- 1. True/False: We can use the binomial distribution to determine the probability that in 10 rolls of a die the first 6 occurs on the 8th roll.
- 2. True / False: If a family has 3 kids, there are 8 possible combinations of gender order.
- 3. True/False: When n = 100 and p = 0.92 we can use the normal approximation to the binomial to calculate the probability of 90 or more successes.