Math 1700: Elementary Statistics

5^{th} and 6^{th} Weeks Summary (10/05/23)

- **Continuous Random Variable**: A quantitative random variable that can assume an uncountable (continuum of values).
- The **normal distribution** is considered the single most important probability distribution.
- All normal distributions are related to one distribution, called **standard normal distribution**.
- Properties of the **standard normal distribution**:

  The total area under the normal curve is equal to 1.

  The distribution is mounded and symmetric; it extends indefinitely in both directions.

  The distribution has a mean of 0 and a standard deviation of 1.

  The mean divides the area in half, 0.50 each side.

  Nearly all the area is between $z = -3.00$ and $z = 3.00$.

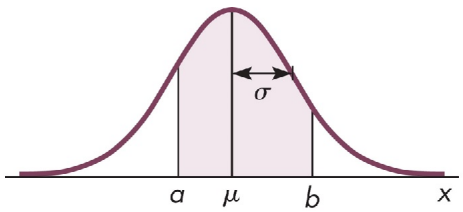
- **Probability distribution**: A formula or a list that provides the probability for a continuous random variable having a value falling within a specified interval. $P(a < x < b) = ?$
- The standardized value is called a **z-score**. $z = \dfrac{x - \mu}{\sigma}$
- Finding Normal Probabilities :

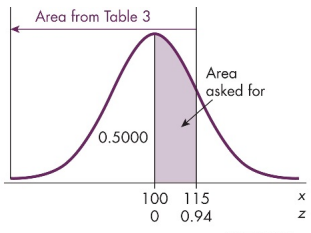
  Less than: $P(x < a) = P\Big(\dfrac{x - \mu}{\sigma} < \dfrac{a - \mu}{\sigma}\Big) = P(z < z_a)$

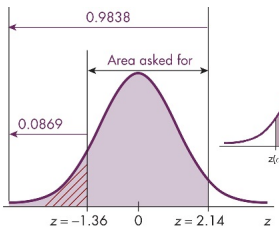
  Greater than: $P(x > b) = P(z > z_b) = 1 - P(z < z_b)$

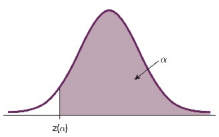
  Between two numbers: $P(a < x < b) = P(z_a < z < z_b) = P(z < z_b) - P(z < z_a)$

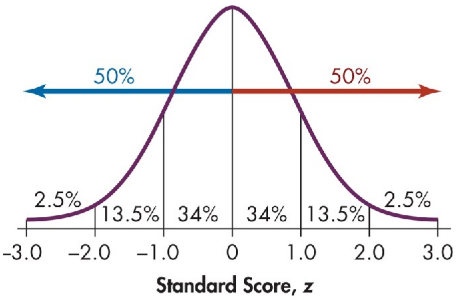
- The convention that we will use is **notation** $z(\alpha)$ for a specific z-score, where α represents the **"area to the right"** of the being named.
- The probabilities associated with a **binomial distribution** with n trials and probability of success$= p$, can be reasonably **approximated** by using the **normal probability** distribution with mean: $\mu = np$ and $\sigma^2 = np(1-p)$.
- **Rule of thumb:** normal distribution provides a reasonable approximation to a binomial probability distribution whenever the values of np and $n(1-p)$ both **equal** or **exceed** 5.
- Normal Approximation to Binomial Applet

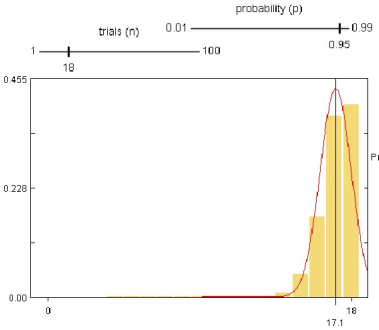


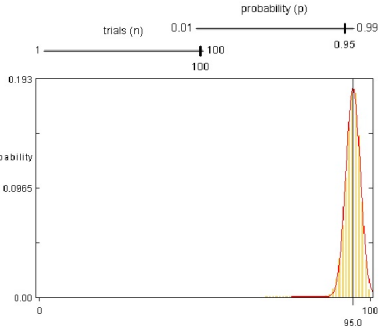


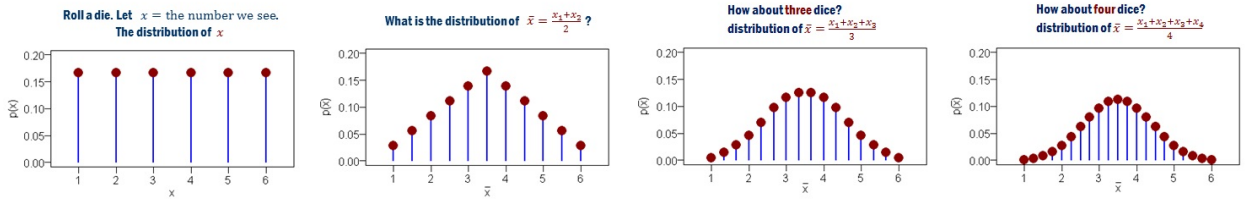












- What is the relationship between distribution of x and $\bar{x}$?
- Sampling distribution of a sample statistic

  The distribution of values for a **sample statistic** obtained from repeated samples, all of **the same size** and all drawn from the same population.

- Sampling distribution applet
- Random sampling

  A sample obtained in such a way that each possible sample of fixed size n has an equal probability of being selected.

- Sampling distribution of sample means (**SDSM**)

$$\mu_{\bar{x}} = \mu$$
$$\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$$
$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

- Central limit theorem (**CLT**)

  The sampling distribution of sample means will more closely resemble the normal distribution as the **sample size increases**.

- Standard error of the mean ($\sigma/\sqrt{n}$):

  is used to denote to the standard deviation of the sampling distribution of sample means.