

Math 1700: Elementary Statistics

5th and 6th Weeks Summary (10/02/25)

- **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 mound 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**. $z = \frac{x - \mu}{\sigma}$

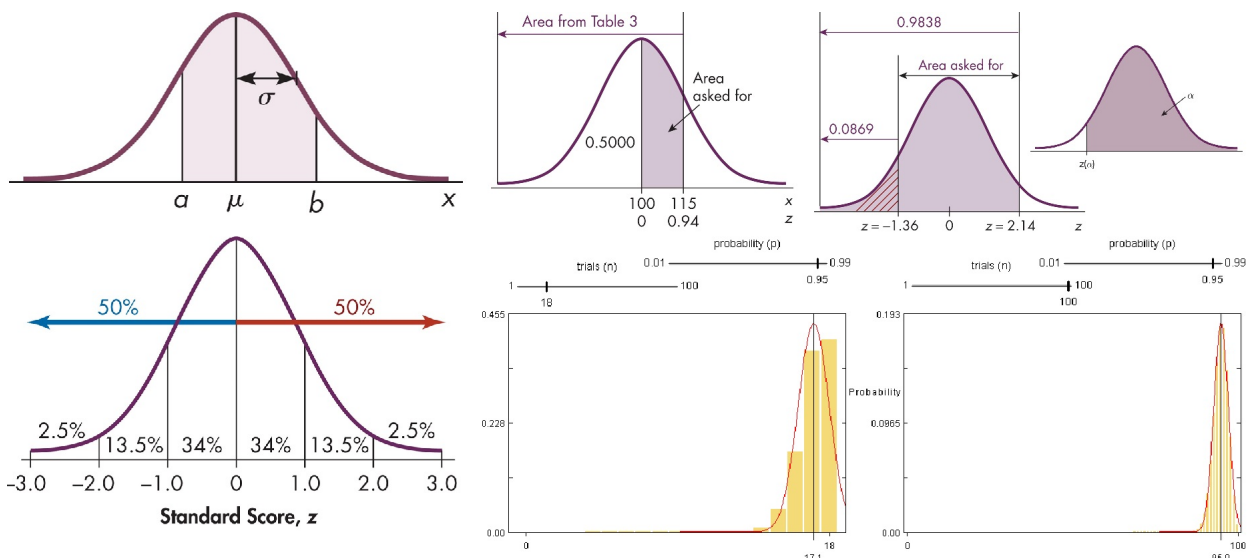
- Finding Normal Probabilities :

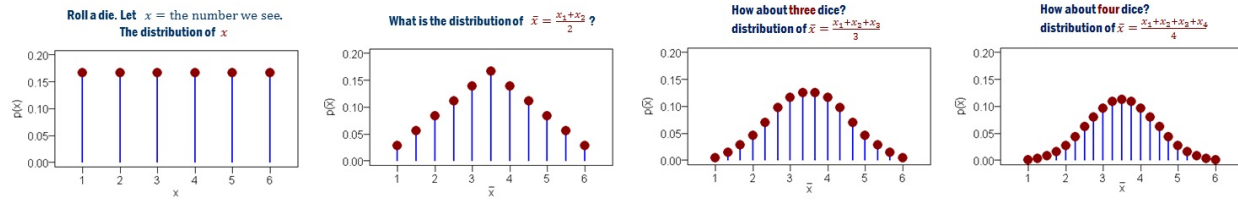
$$\text{Less than: } P(x < a) = P\left(\frac{x - \mu}{\sigma} < \frac{a - \mu}{\sigma}\right) = P(z < z_a)$$

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

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

- 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 (σ/\sqrt{n}):

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

