Statistics, Their Distributions, and the Central Limit Theorem

MATH 3342 Sections 5.3 and 5.4







| Review | |
|--|---|
| Parameters | Statistics |
| Describe Populations | Describe Samples |
| Fixed Values for a Given Population | Changes from Sample to Sample |
| Value Unknown in Practice | Value is Calculated for a Given Sample |



Random Sampling Error

- The deviation between the statistic and the parameter.
- Caused by chance in selecting a random sample.
- This includes only random sampling error.
 - NOT errors associated with choosing bad samples.

A Population Distribution

- For a given variable, this is the probability distribution of values the RV can take among all of the **individuals** in the *population*.
- IMPORTANT:
 - Describes the **individuals** in the population.

A Sampling Distribution

- The probability distribution of a *statistic* in all possible samples of the **same size** from the **same population**.
- IMPORTANT:
 - Describes a **statistic** calculated from **samples** from a given population.



















What the Law of Large Numbers Tells Us

- It tells us that our estimate of the population mean will get better and better as we take bigger and bigger samples.
- This means the variability of the sample mean decreases as *n* increases.
- However, it is often misused by gamblers and sports analysts, among others.



Example: Sodium Measurements

- Standard deviation of sodium content 10 mg.
- Measure 3 times and the mean of these 3 measurements is recorded.
- What is the standard deviation of the mean?
- How many measurements are needed to get a standard deviation of the mean equal to 5?























Summary

- Means of random samples are **less variable** than individual observations.
- Means of random samples are **more Normal** than individual observations.