

V13 - Sampling

Distribution Theory - Part

8

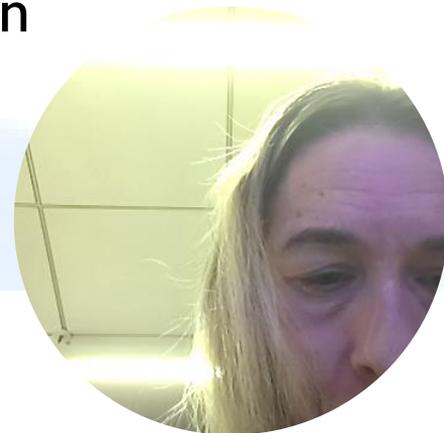
Course: Statistical Testing & Regression

Dr. Renee Clark

Swanson School of Engineering

Industrial Engineering

University of Pittsburgh



Descriptive Statistics – Part 8

- Central Limit Theorem



Shape of \bar{X}

- ❖ If parent population of X is normally distributed, then \bar{X} is:
normally distributed

- ❖ What if X is not normally distributed?

Q: Is \bar{X} normally distributed?

A: Possibly/maybe



Shape of \bar{X}

Q: Why is this relevant?

A: If \bar{X} normally distributed, can standardize and use Z table for probabilities

$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

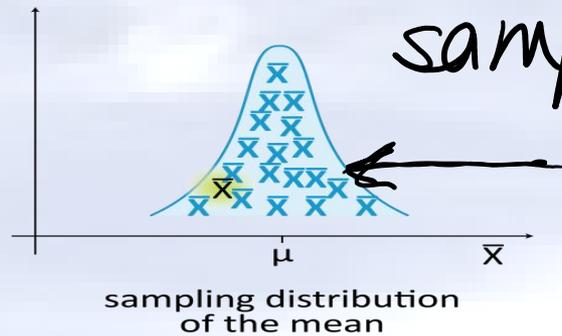
mean	variance	standard deviation*
$\mu_{\bar{X}} = \mu$	$\sigma_{\bar{X}}^2 = \frac{\sigma^2}{n}$	$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$

A: Possibly: \bar{X} will become normally distributed
even if parent population X not normally distributed
as sample size n increases



Central Limit Theorem

Sample means \bar{x} will be approximately **normally distributed** for sufficiently large sample sizes n



What sample size is this? $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$



Central Limit Theorem

❖ What is “sufficiently large” for $\bar{X} \sim N$?

◦ Statisticians say $n = \underline{30}$ sufficient for most parent populations X

◦ The more parent population of X differs from normality, the larger n will need to be.

◦ If parent population X is strongly skewed, may need $n \rightarrow 30$.





Acknowledgement

This material is based upon work partially supported by the National Science Foundation under Grant# 2335802. Any opinions, findings, and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.





You are free

- to **Share** – to copy, distribute, display and perform the work
- to **Remix** – to make derivative works

Under the following conditions

- **Attribution** — You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work).
- **Noncommercial** — You may not use this work for commercial purposes.
- **Share Alike** — If you alter, transform, or build upon work, you may distribute the resulting work only under the same or similar license to this one.





THE END

