

LESSON #16 (new) week 8

Central Limit Theorem

EXAMPLE: If I throw a die 6 times
 Population = 1, 2, 3, 4, 5, 6
 $\mu = 2.875$

2) takes different samples of size 4 ($n=4$)

Sample 1 (S_1) = {1, 1, 3, 6} $\Rightarrow \bar{x} = \frac{1+1+3+6}{4} = 2.75$

Sample 2 (S_2) = {3, 4, 3, 6} $\Rightarrow \bar{x} = \frac{3+4+3+6}{4} = 4$

Sample 3 (S_3) = {6, 1, 3, 4} $\Rightarrow \bar{x} = \frac{6+1+3+4}{4} = 3.5$

Sample 4 (S_4) = {3, 4, 3, 1} $\Rightarrow \bar{x} = 2.75$

Sample n (S_n) = ... $\Rightarrow \bar{x} = 2.75$

$\mu = \mu_{\bar{x}}$
 $\sigma = \frac{\sigma_{\text{pop}}}{\sqrt{n}}$

Let's plot the sample mean (\bar{x}) $n=4$
 $S_1 (\bar{x}=2.75)$ $S_2 (\bar{x}=4)$ $S_3 (\bar{x}=3.5)$
 $S_4 (\bar{x}=2.75)$

$S_{1,000}$ Sampling Distribution

Note: 2 factors that approximate the Bell curve
 1) # of samples
 2) n gets bigger ($n > 30$)

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Which of the following statements about the sampling distribution of the sample mean, \bar{x} , is not true?

A) The distribution is normal regardless of the shape of the population distribution.
 B) The distribution is normal regardless of the sample size, as long as the population distribution is normal.
 C) The distribution's mean is the same as the population mean.
 D) The distribution's standard deviation is smaller than the population standard deviation.
 E) All of the above statements are correct.

Choice A
 Choice B
 Choice C
 Choice D
 Choice E

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True statements

The sampling distribution of \bar{x} has standard deviation $\frac{\sigma}{\sqrt{n}}$ even if the population is not normally distributed.
 The sampling distribution of \bar{x} is normal if the population has a normal distribution.
 When n is large, the sampling distribution of \bar{x} is approximately normal even if the population is not normally distributed.

I and II
 I and III
 II and III
 I, II, and III
 None of the above gives the complete set of true responses.

$\mu = \mu_{\bar{x}}$
 $\sigma = \frac{\sigma}{\sqrt{n}}$ true

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Which of the following is true about the sampling distribution of means?

Shape of the sampling distribution of means is always the same shape as the population distribution, no matter what the sample size is.
 Sampling distributions of means get closer to normality as the sample size increases.
 Sampling distributions of means are always nearly normal.
 Sampling distribution of the mean is always right skewed since means cannot be smaller than 0.

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Suppose that a random sample of size 64 is to be selected from a population with mean 40 and standard deviation 5.

(a) What is the mean of the star sampling distribution? 40

What is the standard deviation of the star sampling distribution? 0.625

(b) What is the approximate probability that the star will be within 0.5 of the population mean μ ?

(c) What is the approximate probability that the star will be more than 0.7?

Population: $\mu = 40$, $\sigma = 5$, $n = 64$

Sample Dist: $\mu_{\bar{x}} = 40$, $\sigma_{\bar{x}} = \frac{5}{\sqrt{64}} = 0.625$

within 0.5: 39.5 to 40.5
 $P = 0.5168$

more than 0.7: 39.3 to 40.7
 $P = 0.7572$

Area in between: 39.3 and 40.7
 $P = 0.7572 - 0.5168 = 0.2404$

The graph says more than 0.7

more than 0.7
 $\Delta = 0.73 - 0.625 = 0.105$

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2) Population $n = ?$

$S_1, S_2, S_3, S_4, \dots, S_n$

μ (PARAMETERS)
 P (percentage/Proportion)
 σ

(STATISTICS)
 \bar{x} (mean)
 \hat{p} (percentage)
 S (STAND. DEV.)

take out S_2

Statistics - are the best point estimates

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