

Day #1: 7.1 Sampling Distributions

★ Show sampling distr.
video

Read 414-417

What is a parameter? What is a statistic? How is one related to the other?

(Revised notes
used for Feb vaca)

Statistic-any qty that can be calculated from a sample

Parameter-describes some characteristic of a population

Remember S = sample & statistic and P =population & parameter!

Examples: \bar{x} vs. μ , \hat{p} vs. p , s vs. σ , n vs. N

**Statistics have distributions since they vary from sample to sample but parameters do not.

Alternate Example:

Identify the population, the parameter, the sample, and the statistic in each of the following settings.

(a) A pediatrician wants to know the 75th percentile for the distribution of heights of 10-year-old boys, so she takes a sample of 50 patients and calculates $Q_3 = 56$ inches.

(b) A Pew Research Center Poll asked 1102 12- to 17-year-olds in the United States if they have a cell phone. Of the respondents, 71% said Yes.

Read 417-420

What is sampling variability?

The value of a statistic varies from sample to sample. See p.420 diagram.

What is a sampling distribution?

The sampling distribution of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the sample population.

What is the difference between the distribution of the population, the distribution of the sample, and the sampling distribution of a sample statistic?

— See figure 7.3 on p.420

Read 421-428

What is an unbiased estimator?

Unbiased doesn't mean perfect! Unbiased means not consistently too high or consistently too low when taking random samples.

If sampling process is biased (undercoverage, response, non-response), no guarantees!

* A statistic used to estimate a parameter is an unbiased estimator if the mean of the sampling distribution is equal to the true value of parameter being estimated.

How can you reduce the variability of a statistic?

By taking a larger sample, but a larger sample does not fix bias. Remember even a very large voluntary response sample or convenience sample is still worthless because of bias.

* See figure p. 426 bias vs. variability

What effect does the size of the population have on the variability of a statistic?

Not much, assuming the population is at least 10 times the sample.

HW #1: page 428 (1-13 odd, 17, 19)

** We want no or low bias & minimum variability!

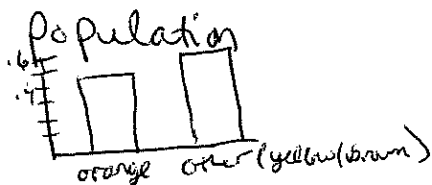
Day #2: 7.2 Sampling Distribution of a Sample Proportion

* Show proportions
Cheese Lover Ex.
Video

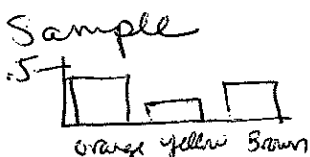
Read 432-435

see p. 433

In the context of the Candy Machine Activity, explain the difference between the distribution of the population, the distribution of a sample, and the sampling distribution of the sample proportion.



$p = .45$ orange candies



$\hat{p} = .48$

Beads

Sampling distribution



Based on the Candy Machine Activity and the Penny Activity, describe what we know about the shape, center, and spread of the sampling distribution of a sample proportion.

Sampling Dist. of \hat{p}

Shape = roughly symmetric, unimodal and Bell shaped

Centered = approx. p

Std. dev (spread) = Larger sample gives a smaller spread

When is it OK to say that the distribution of \hat{p} is approximately Normal?

When $np \geq 10$ and $n(1-p) \geq 10$

* as n increases, the sampling dist. of \hat{p} becomes approx. normal

Read 436-437

yes under Binomial diste.

What is the mean and the standard deviation of the sampling distribution of a sample proportion? Are these formulas on the formula sheet? Are there conditions that need to be met for these formulas to work?

$$\mu_{\hat{p}} = p$$

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

* as long as 10% condition is satisfied

$$n \leq \frac{1}{10} N \quad \text{OR} \quad 10n \leq N$$

Read 437-439

4 step process

Alternate Example: The superintendent of a large school district wants to know what proportion of middle school students in her district are planning to attend a four-year college or university. Suppose that 80% of all middle school students in her district are planning to attend a four-year college or university. What is the probability that an SRS of size 125 will give a result within 7 percentage points of the true value?

HW #2: page 430 (18, 20, 21-24), page 439 (27, 29, 33, 35, 37, 41)

★ Show CLT video
& weight limit (means) video

Day #3: 7.3 Sampling Distribution of a Sample Mean

- Based on the penny activity and the applet activity, what do we know about the shape, center, and spread of the sampling distribution of a sample mean?



Read 444-445

What are the mean and standard deviation of the sampling distribution of a sample mean? Are these formulas on the formula sheet? *YES!* Are there any conditions for using these formulas? (10% condition $n < 1/10 N$)

$$\mu_{\bar{x}} = \mu$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \quad * \text{ as long as 10\% condition is met}$$

$n \leq \frac{1}{10} N \quad \text{OR} \quad N \geq 10n$

Read 445-448

What is the shape of the sampling distribution of a sample mean when the sample is taken from a Normally distributed population? Does the sample size matter?

⇓
approx. Normal

→ NO

Alternate Example: At the P. Nutty Peanut Company, dry-roasted, shelled peanuts are placed in jars by a machine. The distribution of weights in the jars is approximately Normal, with a mean of 16.1 ounces and a standard deviation of 0.15 ounces.

(a) Without doing any calculations, explain which outcome is more likely: randomly selecting a single jar and finding that the contents weigh less than 16 ounces or randomly selecting 10 jars and finding that the average contents weigh less than 16 ounces.

(b) Find the probability of each event described above.

Read 449-453

What is the shape of the sampling distribution of a sample mean when the sample is NOT taken from a Normally distributed population? Does the sample size matter? Does this concept have a name?

↳ yes $n \geq 30$

↳ Central

When n is "large", the sampling
distrib. of sample mean \bar{x}
is approx. Normal

Limit Theorem
(CLT)

Alternate Example: Suppose that the number of texts sent during a typical day by a randomly selected high school student follows a right-skewed distribution with a mean of 15 and a standard deviation of 35. Assuming that students at your school are typical texters, how likely is it that a random sample of 50 students will have sent more than a total of 1000 texts in the last 24 hours?

HW #3 page 454 (49-63 odd, 65-68)

FRAPPY-Rock n Roll

Take-home Quizzes - 7.1, 7.2, 7.3