research
General
Estimate
One-sided
confidence
Means
Proportions
estimates
samples
paired
outcome
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Example
errors
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Testing
Type
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two
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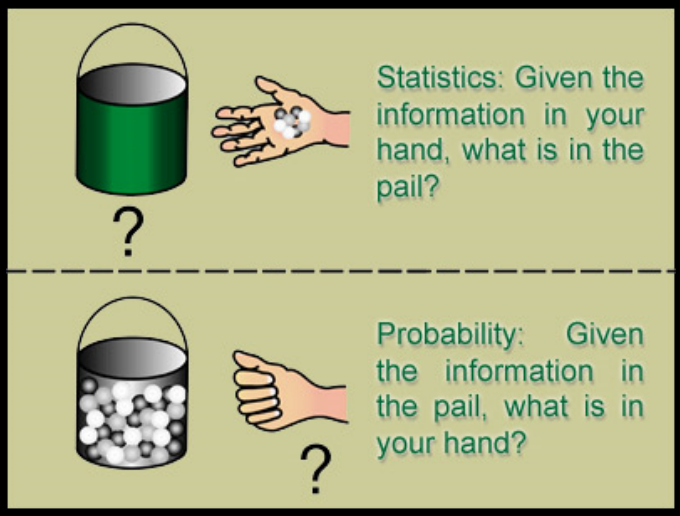
statistic
matched
interval
testing
Approach
Hypothesis

Sampling Variability in the Sample Proportion



Warm Up:

A recent poll stated that 40% of Americans pay "a great deal" or a "fair amount" of attention to the nutritional information that restaurants provide. This poll was based on a random sample of 2,027 adults living in the U.S.

The 40% corresponds to a proportion of .4, and .4 is called a sample proportion.

It's an estimate of all adults who would say they pay "a great deal" or a "fair amount" of attention to the nutritional information that restaurants provide.

Bean Activity

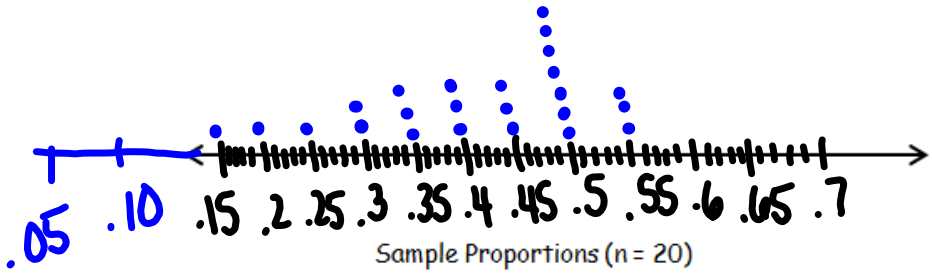
Purpose: Your teacher will give you and your partner(s) a container of dried beans. Some of the beans in the container are black. With your classmates, you are going to see what happens when you take a sample of beans from the container and use the proportion of black beans in the sample to estimate the proportion of black beans in the container (a population proportion).

1. Each person in the group should randomly select a sample of 20 beans from the container by carefully mixing all the beans and then selecting one bean and recording its color. Replace the bean, mix the bag, and continue to select one bean at a time until 20 beans have been selected. Be sure to replace each bean and mix the bag before selecting the next bean. Count the number of black beans in your sample of 20.

2. What is the proportion of black beans in your sample of 20? (Round your answer to 2 decimal places.) This value is called the **sample proportion** of black beans.

$$\hat{p} = \frac{\#\text{ of "black"}}{20} =$$

3. Write your sample proportion down. Tell your teacher your sample proportion. Sketch the class dot plot below.



Sample Proportions (n = 20)

*The graph of all the students' sample proportions is called a sampling distribution of sample proportion. This sampling distribution is an approximation of the actual sampling distribution of all possible samples of size 20.

4. Describe the shape of the distribution.

Ours → skewed left

Theoretical → mound with .4 at center

5. What was the smallest sample proportion observed?

.15

6. What was the largest sample proportion observed?

.55

7. What sample proportion occurred most often?

.5

Stat-Calc-1 L_1, L_2

8. Using technology, find the mean and standard deviation of the sample proportions used to construct the sampling distribution created by class.

$\bar{x} = .414$ $S_x = .113$

9. How does the mean of the sampling distribution compare with the population proportion of 0.40? ← what is in each bag

pretty close

NORMAL FLOAT AUTO REAL RADIAN MP

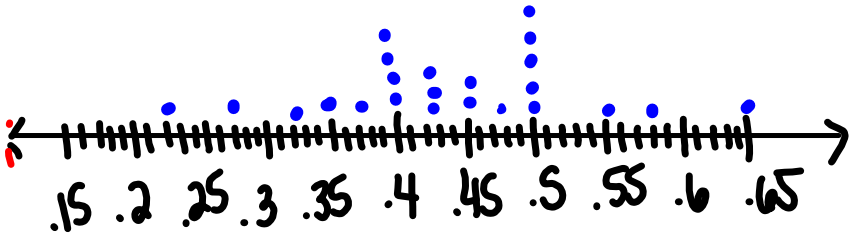
L1	L2	L3	L4	L5
0.15	1	------	------	--
0.2	1			
0.25	1			
0.3	2			
0.35	3			
0.4	3			
0.45	3			
0.5	7			
0.55	3			
------	------			

L2(1)=1

10. Take a random sample with replacement of 40 beans from the container. Count the number of black beans in your sample of 40 beans.

11. What is the proportion of black beans in your sample of 40? (Round your answer to two decimal places.) $\hat{p} = \frac{\#\text{"black"}}{40} =$

12. Write your sample proportion down. Tell your teacher your sample proportion.



Sample Proportion (n = 40)

13. Describe the shape of the distribution.

~ mound

14. What was the smallest sample proportion observed?

.225

15. What was the largest sample proportion observed?

.65

16. What sample proportion occurred most often?

.5 (should be .4)

17. Using technology, find the mean and standard deviation of the sample proportions used to construct the sampling distribution by the class.

$\bar{x} = .438$

$S_x = .095$

18. How does the mean of the sampling distribution compare with the population proportion of 0.40?

relatively close (should be closer)

19. How does the mean of the sampling distribution based on random samples of size 20 compare to the mean of the sampling distribution based on random samples of size 40?

$\bar{x}_{20} = .414$

$\bar{x}_{40} = .438$

relatively close (both should be ~.4)

20. As the sample size increased from 20 to 40 describe what happened to the sampling variability (standard deviation of the distribution of sample proportions)?

s

SD of distribution of sample proportions based on sample size of 40 is less than SD of distribution of sample prop. based on sample size of 20

21. What do you think would happen to the variability (standard deviation) of the distribution of sample proportions if the sample size for each sample were 80 instead of 40? Explain.

Because SD decreased as sample increased form 20 to 40, SD decreases further when sample is 80.

The mean of the sampling distribution of the sample proportions will be approximately = to the value of the population proportion.

As the sample size ↑, the sampling variability in the sample proportion ↓ - the standard deviation of the sampling distribution of the sample proportions also ↓.