

1) Find the confidence interval (mean ± 2 standard deviation)

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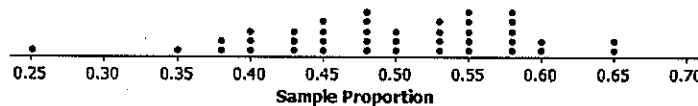
If actual object distribution
Is the theoretical probability
(.5 for a coin) inside the
confidence interval.

If fair object distribution
Is the actual result inside the
confidence interval
Date _____
Algebra II

Confidence Interval (Fair)

1. The following is an example of a sampling distribution of sample proportions of heads in 40 flips of a coin. The mean is .4955 and the sample standard deviation is .0852. Is the coin fair? Explain your answer.

Theoretical Probability
 $\frac{1}{2} = .5$



$$CI = \text{mean} \pm 2(SD)$$

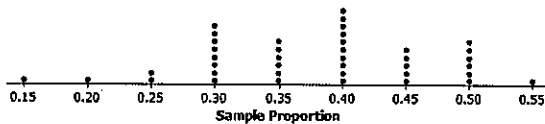
$$CI = .4955 + 2(.0852) = .6659$$

$$.4955 - 2(.0852) = .3251$$

$$[.3251, .6659]$$

Yes, .5 (the theoretical probability)
is inside the confidence interval.

2. A student wanted to decide whether or not a particular coin was fair. She flipped the coin 20 times, calculated the proportion of heads, and repeated this process a total of 40 times. Below is the sampling distribution of sample proportions of heads. The mean and standard deviation of the sampling distribution are 0.379 and 0.091, respectively. Do you think this was a fair coin? Why or why not?



Theoretical Probability
 $\frac{1}{2} = .5$

$$CI = \text{mean} \pm 2(SD)$$

$$CI = .379 + 2(.091) = .561$$

$$.379 - 2(.091) = .197$$

$$[.197, .561]$$

Yes, .5 (the theoretical probability)
is inside the confidence interval.

3. A spinner with 10 sectors labeled 1-10 is spun and it lands on the number one 2 times out of 50. David believes the spinner is unfair so he repeats the process many times and creates a sample distribution. He finds that the mean is .098 and the standard deviation is .04. Is the spinner fair? Explain your answer.

$$\frac{2}{50} = .04$$

$$CI = \text{mean} \pm 2(\text{standard deviation})$$

$$CI = .098 + 2(.04) = .178$$

$$.098 - 2(.04) = .018$$

$$[.018, .178]$$

Theoretical Probability: $\frac{1}{10} = .1$

Yes, .1 (the theoretical probability)
is inside the confidence interval.

4. Juanita rolls a 6 sided die and recorded that it landed on 6 five times out of 50. She questioned whether the die was fair so she ran a computer simulation of 1000 samples of 50 rolls of her die. The mean of the simulation was .094 with a standard deviation of .028. Is her die fair? Explain your answer.

$$CI = \text{mean} \pm 2(SD)$$

$$CI = .094 + 2(.028) = .15$$

$$.094 - 2(.028) = .038$$

$$[.038, .15]$$

$$\frac{\text{Theoretical Probability}}{1/6 = .16}$$

No, ~~.16~~ (the theoretical probability) is not inside the confidence interval.

5. Hasan flipped a coin 100 times and got a proportion of .38 heads. He believed this coin was unfair so he repeated the process 200 times and created a sample distribution. The mean of his data was .41 and the standard deviation was .03. Is Hasan correct that the coin is unfair? Explain your answer.

$$CI = \text{mean} \pm 2(SD)$$

$$CI = .41 + 2(.03) = .47$$

$$.41 - 2(.03) = .35$$

$$[.35, .47]$$

$$\frac{\text{Theoretical Probability}}{1/2 = .5}$$

Yes, ~~.38~~ .5 (the theoretical probability) is not inside the confidence interval.
 the coin is unfair

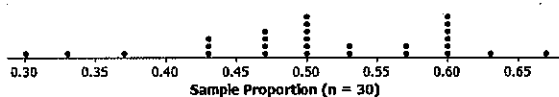
6. A student conducted a simulation of 30 coin flips. Below is a dot plot of the sampling distribution of the proportion of heads. This sampling distribution has a mean of 0.51 and a standard deviation of 0.09. Is the coin fair? Explain your answer.

$$CI = \text{mean} \pm 2(SD)$$

$$CI = .51 + 2(.09) = .69$$

$$.51 - 2(.09) = .33$$

$$[.33, .69]$$



$$\frac{\text{Theoretical Probability}}{1/2 = .5}$$

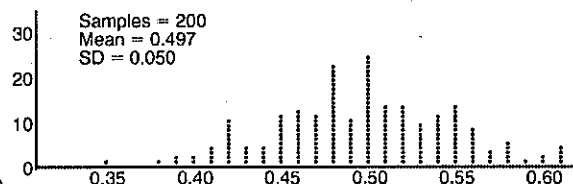
Yes, .5 is inside the confidence.

7. Anne has a coin. She does not know if it is a fair coin. She flipped the coin 100 times and obtained 73 heads and 27 tails. She ran a computer simulation of 200 samples of 100 fair coin flips. The output of the proportion of heads is shown below.

$$\text{actual: } \frac{73}{100} = .73$$

Given the results of her coin flips and of her computer simulation, which statement is most accurate?

- 1) 73 of the computer's next 100 coin flips will be heads.
- 2) 50 of her next 100 coin flips will be heads.
- 3) Her coin is not fair.
- 4) Her coin is fair.



$$CI = \text{mean} \pm 2(SD)$$

$$CI = .497 + 2(.05) = .597$$

$$.497 - 2(.05) = .397$$

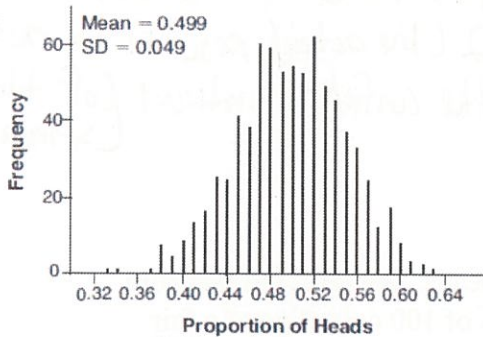
$$[.397, .597]$$

Unfair because .73 (her actual result) is not inside the confidence interval (of a fair coin).

actual result

$$\frac{43}{100} = .43$$

8. Robin flips a coin 100 times. It lands heads up 43 times, and she wonders if the coin is unfair. She runs a computer simulation of 750 samples of 100 fair coin flips. The output of the proportion of heads is shown below. Do the results of the simulation provide strong evidence that Robin's coin is unfair? Explain your answer.



$$CI = \text{mean} \pm 2(SD)$$

$$CI = .499 + 2(.049) = .597$$

$$.499 - 2(.049) = .401$$

$$[.401, .597]$$

No, Robin's coin is fair because

.43 (the actual result) is inside the confidence interval (of the fair coin)

$$\frac{6}{50} = .12$$

9. Juanita rolls a 6 sided die and recorded that it landed on 6 five times out of 50. She questioned whether the die was fair so she ran a computer simulation of 1000 samples of 50 rolls of a fair die. The mean of the simulation was .159 with a standard deviation of .102. Is her die fair? Explain your answer.

$$CI = \text{mean} \pm 2(SD)$$

$$CI = .159 + 2(.102) = .363$$

$$.159 - 2(.102) = -.045$$

Yes, .12 (the actual result) is inside the confidence interval (of the fair die)

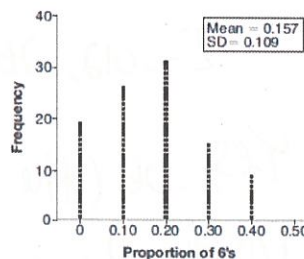
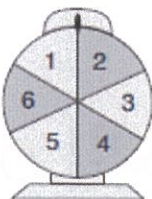
$$\frac{0}{10} = 0$$

10. A game spinner is divided into 6 equally sized regions, as shown in the diagram below. For Miles to win, the spinner must land on the number 6. After spinning the spinner 10 times, and losing all 10 times, Miles complained that the spinner is unfair. At home, his dad ran 100

simulations of spinning the spinner 10 times, assuming the probability of winning each spin is $\frac{1}{6}$.

The output of the simulation is shown in the diagram below.

fair spinner



$$CI = \text{mean} \pm 2(SD)$$

$$.157 + 2(.109) = .375$$

$$.157 - 2(.109) = -.061$$

Is there strong evidence to suggest that the spinner is unfair? Explain your answer.

$$[-.061, .375]$$

No, the spinner is fair because 0 (the actual result) is inside the confidence interval (of the fair spinner).

$$\frac{20}{100} = .2$$

11. A spinner with 8 sectors labeled A, B, C, D, E, F, G, H was spun 100 times. The spinner landed on sector B 20 times out of 100. A computer simulation of 500 samples of 100 spins of a fair 8 sector spinner was run and it was found that the mean proportion of landing on sector B was .126 with a standard deviation of .027. Is the spinner fair? Explain your answer.

$$\begin{aligned} CI &= \text{mean} \pm 2(SD) \\ &= .126 + 2(.027) = .18 \\ &\quad .126 - 2(.027) = .072 \\ &= [.072, .18] \end{aligned}$$

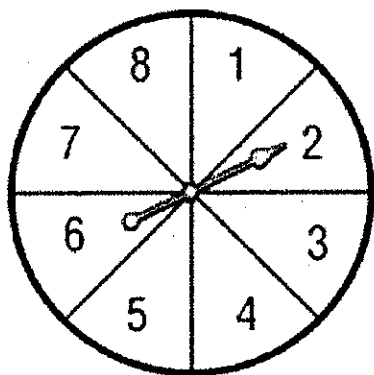
No, the spinner is unfair because .2 (the actual result) is not inside the confidence interval (of the fair spinner)

12. Ally flipped a coin 100 times and got a proportion of .41 heads. She believed this coin was unfair so she ran a computer simulation of 200 samples of 100 coin flips of a fair coin. The mean of the simulation was .502 and the standard deviation was .024. Is Ally's coin fair? Explain your answer.

$$\begin{aligned} CI &= \text{mean} \pm 2(SD) \\ &= .502 + 2(.024) = .55 \\ &\quad .502 - 2(.024) = .454 \\ &= [.454, .55] \end{aligned}$$

No, the coin is unfair because .41 (the actual result) is not inside the confidence interval (of the fair coin).

13. A spinner below is spun and it landed on the number "2" 3 times out of 50. A computer simulation of 500 samples of 50 spins of a fair spinner was spun. The mean of the simulation was .128 and the standard deviation was .07. Is the spinner fair? Explain your answer.



$$\begin{aligned} CI &= \text{mean} \pm 2(SD) \\ &= .128 + 2(.07) = .268 \\ &\quad .128 - 2(.07) = -.012 \\ &= [-.012, .268] \end{aligned}$$

Yes, .06 (the actual result) is inside the confidence interval (of the fair spinner).

$$\frac{3}{50} = .06$$