Dice lab[*]

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Abstract

Using minitab, students will explore the central limit theorem.

Central Limit Theorem Lab
Name: _

1 Student Learning Outcomes:

The student will examine properties of the Central Limit Theorem.

2 Theoretical Distribution: Tossing a Single Die

1. Is the distribution continuous or discrete? _
    2. In words, state the theoretical distribution for the tossing of a single die?
    X∼ _
    3. Calculate μ = _
dicate the formula)
    4. Calculate σ = _
dicate the formula)

3 Collect the Data

1. Using the random number generator in Minitab, simulate the tossing of a single die 360 times.
    Calc -> Random Data -> Integer.
    2. Construct a histogram using Minitab and include it with this lab. Be sure that you label the graph
and axis.
    3. Calculate the following: (include the session window)
    $\overline{x}$ = _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _   s = _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _   n = 1 (single die)
    4. Draw a smooth curve through the tops of the bars of the histogram. Use $1 - 2$ complete sentences,
describe the general shape of the curve.

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[*]Version 1.1: Jul 14, 2009 9:22 pm -0500
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4 Collecting Averages of Pairs

Repeat step #1 (of the section above titled "Collect the Data") with one exception. Instead of recording the value of a single die, record the average of two dice. Use Minitab and generate 360 rows with two columns. Then use the Calc -> Row Statistics and select mean. This will give you a column with the 'average' of the two tosses.

1. Construct a histogram. Scale the axes using the same scaling and labeling for the axis as you did for the first graph and include it with this lab. (This is done by selecting both the original data column and the mean2 column to graph. Then select multiple graphs → separate graphs → same x-scale. This will redraw your first graph, however the computer needs that graph as a reference to draw the second.)

2. Calculate the following:

$\overline{x}$ = _ _ _ _ _ _ _ _ _ _ _ _ _ _ s = _ _ _ _ _ _ _ _ _ _ _ _ _ _ n = 2 (a pair of dice)

3. Draw a smooth curve through tops of the bars of the histogram. Use $1 - 2$ complete sentences, describe the general shape of the curve.

5 Collecting Averages of Groups of Five

Repeat step #1 (of the section above titled "Collect the Data") with one exception. Instead of recording the value of a single die, record the average of five dice. Use Minitab and generate 360 rows with five columns. Then use the Calc -> Row Statistics and select mean. This will give you a column with the 'average' of the five tosses.

1. Construct a histogram. Scale the axes using the same scaling and labeling for the axis as you did for the first graph and include it with this lab. (Again you need to graph both the first data set with this as multiple graphs.)

2. Calculate the following:

$\overline{x}$ = _ _ _ _ _ _ _ _ _ _ _ _ _ _ s = _ _ _ _ _ _ _ _ _ _ _ _ _ _ n = 5 (5 dice)

3. Draw a smooth curve through tops of the bars of the histogram. Use $1 - 2$ complete sentences, describe the general shape of the curve.

6 Collecting Averages of Groups of 20

Repeat step #1 (of the section above titled "Collect the Data") with one exception. Instead of recording the value of a single die, record the average of two dice. Use Minitab and generate 360 rows with twenty columns. Then use the Calc -> Row Statistics and select mean. This will give you a column with the 'average' of the twenty tosses.

1. Construct a histogram. Scale the axes using the same scaling and labeling for the axis as you did for the first graph and include it with this lab. (Again you need to graph both the first data set with this as multiple graphs.)

2. Calculate the following:

$\overline{x}$ = _ _ _ _ _ _ _ _ _ _ _ _ _ _ s = _ _ _ _ _ _ _ _ _ _ _ _ _ _ n = 20 (20 dice)

3. Draw a smooth curve through tops of the bars of the histogram. Use $1 - 2$ complete sentences, describe the general shape of the curve.

7 Discussion Questions:

1. As **n** (the number of dice being averaged) changed, how did the shape of the graph change? (Be sure you have the same x axis for all graphs or you will not be able to correctly answer this question.) Use $1 - 2$ complete sentences to explain what happened.

2. Looking at the values for the sample mean and standard deviation, explain what happens as n increases. Use $1 - 2$ complete sentences to explain what happened.

3. State the Central Limit Theorem. How do your simulations demonstrate this theorem? Use $3 - 4$ complete sentences