

Activity 9

You're Probably Right, It's Wrong

Objectives

- ◆ To use technology to find experimental and theoretical probabilities
- ◆ To use technology to find measures of central tendencies
- ◆ To use technology to explore simulation
- ◆ To use technology to generate random numbers
- ◆ To use technology to plot a histogram

Materials

- ◆ TI-83 Plus

Introduction

Nathan had a choice between studying for a mathematics test and going to the movies with a friend. He knew going to the movies was the wrong choice, but he decided to go anyway. When the math test was handed out the next day, he knew he should have studied. After seeing the test, it was clear that he was not prepared to take it. Nathan was somewhat relieved when he saw that the test had 20 multiple-choice questions. He knew that if he guessed the answers, he would have a 25% chance of getting the correct answer for each question, since each question had four choices. Nathan remembered that his TI-83 Plus had a random number generator. He used this feature to help him guess the answers on the test. Nathan is now nervous about the results of the math test. If he fails this test, he will be grounded for a month. Nathan thinks that he did not pass the test. Is he right?

You will find the *experimental probability* to determine the likelihood that Nathan has passed this test. You will perform a *simulation* to determine the experimental probability. *Probability* is a number between 0 and 1 that measures the likelihood that an event will or will not occur. If the probability is 0, then the probability that the event will occur is impossible. If the probability is 1, then the probability that the event will occur is certain. *Experimental probability* is determined by performing experiments and observing outcomes to determine what might happen in a given situation. A *simulation* is a method for finding experimental probability using a device to model the event.

You will also find the *theoretical probability* of Nathan passing the test. If $P(E)$ represents the probability of the event occurring, m represents successful outcomes, and n represents possible equally likely outcomes (both successful and unsuccessful), then

$P(E) = \frac{m}{n}$ is the *theoretical probability* of the event occurring.

Problem

Was Nathan's idea of generating random numbers to answer the questions on the test a good idea? Should Nathan prepare to clean his room since he might be spending a good deal of time in there?

Collecting the data

Use the TI-83 Plus and the random number generator to perform a simulation to guess answers on the test. The choices of answers are A, B, C, or D. An **A** will be represented by a **1**, a **B** by a **2**, a **C** by a **3**, and a **D** by a **4**. The correct answers for the test are listed below along with the corresponding number for the letter.

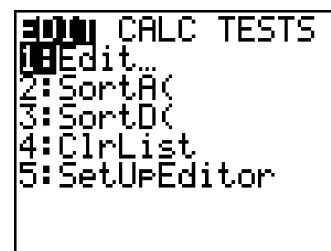
- | | | | |
|----------|-----------|-----------|-----------|
| 1. C – 3 | 6. C – 3 | 11. B – 2 | 16. C – 3 |
| 2. B – 2 | 7. A – 1 | 12. A – 1 | 17. D – 4 |
| 3. C – 3 | 8. B – 2 | 13. A – 1 | 18. D – 4 |
| 4. D – 4 | 9. D – 4 | 14. D – 4 | 19. C – 3 |
| 5. D – 4 | 10. C – 3 | 15. D – 4 | 20. A – 1 |

Setting up the TI-83 Plus

Before starting your data collection, make sure that the TI-83 Plus has the STAT PLOTS turned OFF, Y= functions turned OFF or cleared, the MODE and FORMAT set to their defaults, and the lists cleared. See the Appendix for a detailed description of the general setup steps.

Entering the data in the TI-83 Plus

- Press **STAT** and select **1:Edit** by pressing **ENTER**.



- Enter the data for the answers to the test in **L1**.

The following steps will generate a list of random numbers between 1 and 4 and store them in **L2**.

L1	L2	L3	1
2	-----	-----	
2			
2			
4			
1			
1			
L1(1)=3			

3. Press $\boxed{2\text{nd}} \boxed{[\text{QUIT}]} \boxed{[\text{MATH}]}$.

```
MATH NUM CPX PRB
1: Frac
2: Dec
3: °
4: √(
5: *√
6: fMin(
7: fMax(
```

4. Press $\boxed{\downarrow}$ to move the cursor to the **PRB** menu.

```
MATH NUM CPX PRB
1: rand
2: nPr
3: nCr
4: !
5: randInt(
6: randNorm(
7: randBin(
```

5. Select **5:randInt(** and press $\boxed{\text{ENTER}}$.

```
MATH NUM CPX PRB
1: rand
2: nPr
3: nCr
4: !
5: randInt(
6: randNorm(
7: randBin(
```

```
randInt(
```

6. Press $\boxed{1} \boxed{,} \boxed{4} \boxed{,} \boxed{20} \boxed{)} \boxed{\text{STO}} \boxed{\rightarrow} \boxed{2\text{nd}} \boxed{[\text{L2}]} \boxed{\text{ENTER}}$.

These numbers represent the answers that Nathan used on the test.

```
randInt(1,4,20)→
L2
(4 4 1 3 2 3 1 ...
```

Compare your answers with the correct answers for the test. Using the equal sign, compare the number in **L1** to the corresponding number in **L2**. If the two numbers are *equal*, the TI-83 Plus returns a *1*, which indicates that the statement is *true*. If the numbers are *not equal*, the TI-83 Plus returns a *0*, which indicates that the statement is *false*. Follow the steps to perform this operation.

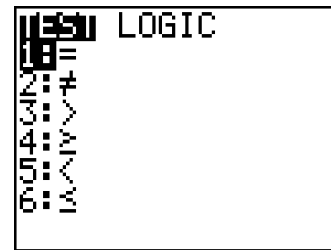
7. Press $\boxed{\text{STAT}} \boxed{\text{ENTER}}$ and move the cursor to **L3**.

8. Press $\boxed{\uparrow}$ to highlight **L3**.

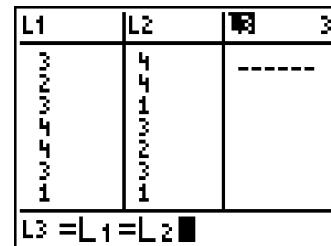
L1	L2	$\frac{\text{L1}}{\text{L2}}$	3
3	4	-----	
3	4		
1	1		
3	2		
2	3		
1	1		

L3 = L1

9. Press $\boxed{2nd}$ $\boxed{[L1]}$ $\boxed{2nd}$ $\boxed{[TEST]}$ to display the **TEST** menu.

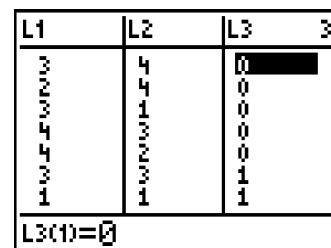


10. Press \boxed{ENTER} to select and paste the equal sign in the function.



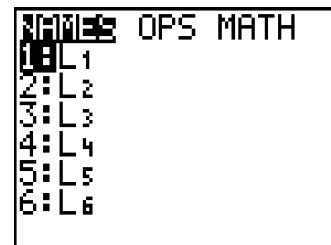
11. Press $\boxed{2nd}$ $\boxed{[L2]}$ \boxed{ENTER} .

12. Press \boxed{ENTER} to see the comparison with the correct answers.



To find the number of correct answers in the simulation, find the sum of the numbers in **L3**.

13. Press $\boxed{2nd}$ $\boxed{[QUIT]}$ $\boxed{2nd}$ $\boxed{[LIST]}$ to display the **NAMES** menu.



14. Move the cursor to the **MATH** menu.



15. Select **5:sum()** and press \boxed{ENTER} .



16. Press $\boxed{2\text{nd}} \boxed{[L3]} \boxed{)}$.

```
randInt(1,4,20)→
L2
(4 4 1 3 2 3 1 ...
sum(L3)
```

17. Press $\boxed{\text{ENTER}}$ to see the calculation.

18. Record the data for this simulation in the table on the **Data Collection and Analysis** page.

```
randInt(1,4,20)→
L2
(4 4 1 3 2 3 1 ...
sum(L3) 6
```

19. Run the simulation again. Press $\boxed{2\text{nd}} \boxed{\text{ENTER}}$ twice until the **randInt**(statement is displayed on the Home screen.

```
randInt(1,4,20)→
L2
(4 4 1 3 2 3 1 ...
sum(L3) 6
randInt(1,4,20)→
L2■
```

20. Press $\boxed{\text{ENTER}}$. A new set of answers has been stored in **L2**.

```
L2
(4 4 1 3 2 3 1 ...
sum(L3) 6
randInt(1,4,20)→
L2
(4 2 2 1 1 3 1 ...
```

21. Compare your answers with the correct answers for the test by pressing $\boxed{\text{STAT}} \boxed{\text{ENTER}} \boxed{\blacktriangle} \boxed{2\text{nd}} \boxed{[L1]} \boxed{2\text{nd}} \boxed{[\text{TEST}]} \boxed{\text{ENTER}} \boxed{2\text{nd}} \boxed{[L2]}$.

L2	$\frac{L2}{L1}$	L4	3
3	0	-----	
4	0		
2	0		
1	0		
2	0		
4	1		
3	1		

L3=L1=L2■

22. Press $\boxed{\text{ENTER}}$ to see the comparison with the correct answers.

L2	L3	L4	3
3	0	-----	
4	0		
2	0		
1	0		
2	0		
4	0		
3	0		

L3(1)=1

To find the number of correct answers in the simulation, find the sum of the numbers in **L3**.

23. Press $\boxed{2nd}$ \boxed{QUIT} .
24. Press $\boxed{2nd}$ \boxed{ENTER} repeatedly until you get the **sum(L3)** statement on the Home screen. Press \boxed{ENTER} .

```
sum(L3)
6
randInt(1,4,20)→
L2
(3 4 2 1 2 4 3 ...
sum(L3)
3
```

25. Record the data for this simulation in the table on the **Data Collection and Analysis** page. Repeat steps 19, 20, and 21 and run the simulation 40 to 50 more times. Record each of the trials in the table.

```
sum(L3)
6
randInt(1,4,20)→
L2
(3 4 2 1 2 4 3 ...
sum(L3)
3
```

Setting up the window

1. Press \boxed{WINDOW} to set up the proper scale for the axes.
2. Set the **Xmin** value by identifying the minimum value in **L1**. Choose a number that is less than the minimum.

```
WINDOW
Xmin=-2
Xmax=13
Xscl=1
Ymin=-2
Ymax=15
Yscl=1
Xres=1
```

3. Set the **Xmax** value by identifying the maximum value in each list. Choose a number that is greater than the maximum. Set the **Xscl** to 1.
4. Set the **Ymin** value by identifying the minimum value in **L2**. Choose a number that is less than the minimum.
5. Set the **Ymax** value by identifying the maximum value in **L2**. Choose a number that is greater than the maximum. Set the **Yscl** to 1.

Graphing the data: Setting up a histogram

Use the data in the table on the **Data Collection and Analysis** page to plot a histogram.

1. Press \boxed{STAT} and select **1:Edit** by pressing \boxed{ENTER} .

```
EDIT: CALC TESTS
1:Edit...
2:SortA(
3:SortD(
4:ClrList
5:SetUpEditor
```

2. Enter the number of correct answers in **L4**.
3. Enter the frequencies in **L5**.

L2	L3	L4	4
4	0		
2	1		
2	0		
1	0		
1	0		
3	1		
1	1		

L4(1)=

4. Press 2nd [STAT PLOT] and select **1:Plot1** by pressing ENTER .

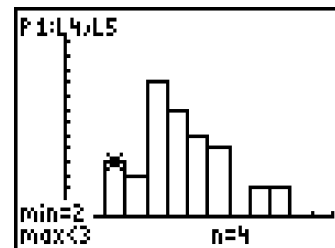
STAT PLOTS	
1:Plot1...Off	
↖ L1 L2	□
2:Plot2...Off	
↖ L1 L3	□
3:Plot3...Off	
↖ L1 L4	□
4↓PlotsOff	

5. Set up the plot as shown by pressing ENTER
 ▼ ▶ ▶ ENTER ▼ 2nd [L4] ENTER 2nd [L5]
 ENTER .

Note: Press ▼ ▼ if **L4** and **L5** are already displayed.

Plot2	Plot3
Off	
Type: ↖ ↗	□
↖ ↗	□
Xlist:L4	
Freq:L5	

6. Press GRAPH to see the plot.
7. Press TRACE ▶ ▶ ▶ ▶ to see the frequencies.



Answer the questions on the **Data Collection and Analysis** page.

Data Collection and Analysis

Name _____

Date _____

Activity 9: You're Probably Right, It's Wrong

Collecting the data

Record your data in the table below.

Number of correct answers	Tally marks	Frequency
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Analyzing the data

1. Find the *mean* for the number of correct answers. _____

(Press **2nd** **[QUIT]** **[CLEAR]** **2nd** **[LIST]** **▶▶** **[L3]** **2nd** **[L4]** **,** **2nd** **[L5]** **)** **[ENTER]**)

2. Find the *median* for the number of correct answers. _____

(Press **[CLEAR]** **2nd** **[LIST]** **▶▶** **[L4]** **2nd** **[L4]** **,** **2nd** **[L5]** **)** **[ENTER]**)

3. Find the *mode* for the number of correct answers. _____

(Use the histogram to find the mode.)

-
4. Which measure of central tendency do you think gives a better indication of what might happen if you use this method to answer the questions on a multiple-choice test? Explain your answer.

5. Using your answer from number 4, find the *experimental probability*.

6. Find the *theoretical probability*. _____

7. How do your answers in number 5 and number 6 compare?

8. Do you think it is a good idea to use a random number generator to answer the multiple-choice questions on a test? Explain.

9. Write a random number statement to answer 20 True / False questions.

randInt(_____)

Teacher Notes



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Objectives

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- ◆ To use technology to find measures of central tendencies
- ◆ To use technology to explore simulation
- ◆ To use technology to generate random numbers
- ◆ To use technology to plot a histogram

Materials

- ◆ TI-83 Plus

Preparation

- ◆ Make sure students run enough trials to produce at least 40 to 50 data items.
- ◆ Find the *mean* and *median* by using the $\boxed{2\text{nd}}$ [LIST] menu on the TI-83 Plus. Find the *mode* by using the histogram. Check students' results for finding the mean.
- ◆ Discuss the values at the bottom of the screen for the plot (that is, the values on *n*, *min*, and *max*).

Answers to Data Collection and Analysis questions

Collecting the data

- ◆ Sample data.

Number of correct answers	Tally marks	Frequency
0	-	0
1	-	0
2	////	4
3	///	3
4	### ##	10
5	### ///	8
6	### /	6
7	###	5
8	-	0
9	//	2
10	//	2
11		
12		
13		

Analyzing the data

1. Find the *mean* for the number of correct answers. 5.15
2. Find the *median* for the number of correct answers. 5
3. Find the *mode* for the number of correct answers. 4
4. Which measure of central tendency do you think gives a better indication of what might happen if you use this method to answer the questions on a multiple-choice test? Explain your answer.

The median or mean gives a better indication of the results of using this method to answer questions on a multiple-choice test. Answers may vary.

5. Using your answer from number 4, find the *experimental probability*.
5/20 or .25
6. Find the *theoretical probability*. 5/20 or .25
7. How do your answers in number 5 and number 6 compare?
They are the same. Answers may vary.
8. Do you think it is a good idea to use a random number generator to answer multiple-choice questions on a test? Explain.

No. The TI-83 Plus simulates the theoretical probability, which means that the score will most likely be around 25%.

9. Write a random number statement to answer 20 True/ False questions.
randInt(1,2,20)

