EXPLORATIONS™

Activity 5

Objective

- Explain how probability influences situations such as our health

The Spread of Disease

Introduction

What causes a disease to spread? Infectious diseases are often transmitted through the air. If an infected person breathes or sneezes on you, it is possible that you will become infected, as well. How likely is it that you will become infected? Will you definitely become infected and ill or could you possibly remain uninfected? This activity simulates the spread of disease in a population.

Problem

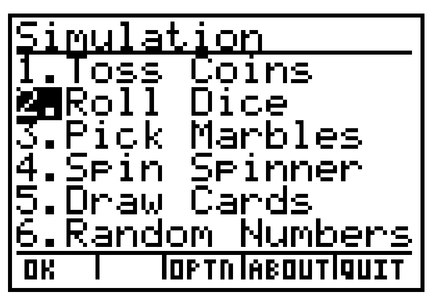
Imagine that there is an outbreak of the flu at your school. How likely is it that you will catch the flu?

Exploration

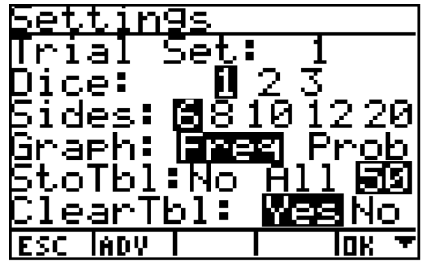
You and your classmates are given a randomly selected ID number. To simulate the outbreak of the flu, all of the students move around the room, coming into contact with other students. As you meet another student, record that person's ID number in Table 1 on the Student Worksheet. Next, each of you roll a die using the Probability Simulation App. Record the sum of the dice after the ID number in the Table 1.

Getting Started

1. Open the Probability Simulation App and select **Roll Dice** from the **Simulation** menu.



2. Select **SET** and change the settings shown.



3. Select **ROLL** to roll the die with each person you meet. Record the sum of your die and the other person's die in Table 1.
4. Continue moving around the room to meet other students, rolling the die, and recording ID numbers and sums.

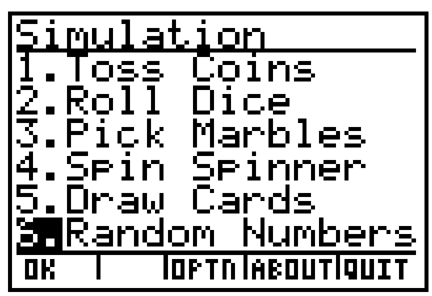
   You will move around the room collecting data for five two-minute stages. (The number of people you meet may be different for each stage.)

Enter the data for the first five stages in Table 1 on the Student Worksheet.

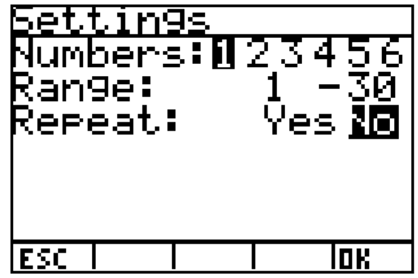
You have now recorded your encounters, but you do not know which of those encounters, if any, led to the flu. One person (your teacher) will use the Random Number Simulation to select a random ID number which indicates the initially infected person and a random sum which indicates whether the people this person came into contact with now have the flu.

Simulating Which Encounters Lead to the Flu

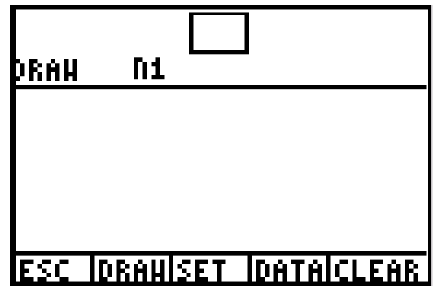
1. Return to the **Simulation** menu and select **Random Numbers.**



2. Select **SET**, and then set the settings as shown. Set the range to fit the range of ID numbers given to the class.



3. Return to the simulation screen, and then select **DRAW** to draw a random number. The number drawn is the ID number of the initially infected person.



4. Return to the Settings screen and change the range to 2 – 12.
5. Select **DRAW** and draw a random number for the contagious sum.

Now that you know the ID number of the initially infected person and the contagious sum, look at Table 1 to see if you had infectious encounters with this person. Not every person who came in contact with the infected person in the first stage became infected; only the people who rolled the contagious sum became infected.

The people who did have an infectious encounter are now contagious. For the second stage, circle any encounter that you had with these newly infected people if you had a contagious sum.

Look at Table 1 on the Student Worksheet. Circle any encounters you had with an infected person who was also contagious in stage 1. Respond to # 2 – 3 on the Student Worksheet.

Return to Table 2 on the Student Worksheet. Finish the summary of the class infection data. Respond to # 4 – 8 on the Student Worksheet.

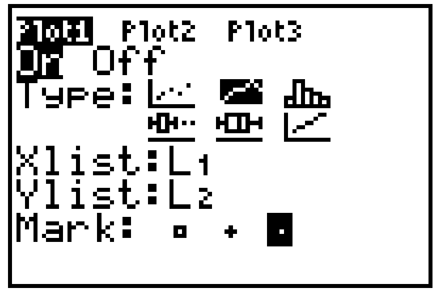
Graph the Data

Graph the data to find out if there is a pattern to it.

1. Press [STAT] and select **1:Edit**.
2. Clear L1 and L2, if necessary.

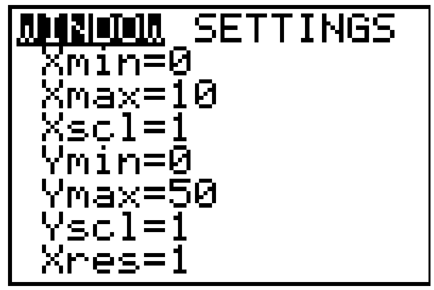
3. Enter the stage numbers from Table 2 on the Student Worksheet into L1. Enter the values from the last column, Total of Infected People, into L2.

4. Press [2nd] [STAT PLOT] **1** to select **1:Plot1** and set up a scatter plot as shown.



5. Set the WINDOW settings as shown.

6. Press s to graph the scatter plot.



Respond to # 9 – 11 on the Student Worksheet.

Student Worksheet

Name ______________________

Date ______________________

The Spread of Disease

Your Personal ID#

1. Use Table 1 below to record each interaction by stages.

Note: *This table will be completed throughout several steps of the Exploration.*

Stage1 ID #Sum	Stage 2 ID #Sum	Stage 3 ID #Sum	Stage 4 ID #Sum	Stage 5 ID #Sum

2. How many encounters were infectious in stage 1 for the entire class? (For example, an infected person rolls a contagious sum with a non-infected person.) Record class data for stage 1 in Table 2 below.

Stage Number	ID #s of NEWLY Infected People	Number of Newly Infected People	TOTAL of Infected People
0	original infected:	0	1
1			
2			
3			
4			
5			

3. How would the infectious encounters have been different if a different sum had been randomly selected?

4. How many of each of the stages 2 – 5 were infectious?

5. In your opinion, is the disease a highly contagious one? Explain your answer.

6. When you came into contact with a contagious person, did you always become infected? Look at your Table 1. How many times did you come into contact with a contagious person and not become infected? What made the difference?

7. Do you think that certain sums are more likely to occur than others? Use the matrix below to list all the possible sums of two dice. Use the matrix to determine the theoretical probability of each sum.

	1	**2**	**3**	**4**	**5**	**6**
1						
2						
3						
4						
5						
6						

8. Which sum occurs most often? Which sum occurs least often? Based on your observations of the matrix, what statements can you make about the probability of an infectious encounter?

9. What pattern, if any, did you notice when you graphed your data in the scatter plot?

10. Each stage represents two minutes, so your X-axis is time. What would the graph look like if the stages continued for 20 minutes?

11. In your classroom, there is a limited number of people. What would the graph look like if the number of people were limitless?

Teacher Notes

Objective

- Explain how probability influences situations such as our health

Materials

- TI-84 Plus/TI-83 Plus

Teaching Time

- 60 minutes

Activity 5

The Spread of Disease

Preparation

This activity uses the Roll Dice Simulation of the Probability Simulation application in a slightly different manner than it was used in Activity 2. Students discover that certain sums occur more often than others because of the combinations of addends of those sums.

You may want to begin the Exploration with a discussion about infectious diseases such as colds, the flu, or chicken pox. Ask students to think about the following: Is a person certain to become ill if he or she is exposed to someone who is sick? Is there a possibility that the person will not catch the disease? You may ask students to speculate on the probability of getting any of the above diseases. What variable might influence one's resistance to the disease? What factors might make a person more vulnerable to the disease?

You can explain that medical professionals look at statistics to determine the likelihood of infection of different diseases. You can point out that the Exploration simulates the spread of disease. Students will use the sum of two dice to think about the rate of contagion of diseases.

You should lead the section entitled *Simulating Which Encounters Lead to the Flu* on page 60. Use the Random Number Simulation to select a random ID number which indicates the initially infected person and a random sum which indicates whether the people this person came into contact with now have the flu.

Answers to Student Worksheet

1. Data will vary.
2. Answers will vary based on classroom data.
3. The number of infections could change.
4. Answers will vary, but increase.
5. Answers will vary.

6. Answers will vary. Not becoming infected should include that the sum was not the contagious one.
7. Yes, certain sums are more likely than others.

	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

8. The sum that occurs most often is 7. The sums that occur least often are 2 and 12. Answers will vary.
9. The graph will always be increasing until everyone is infected, then it will level off.
10. The graph will increase until everyone is infected, then it will level off.
11. The graph would continue to increase.