Lesson 4 - Student Activity #1 Guide

Name _____

Dice and Data: Chances Are and Wiggle Walk

Introduction

Probability plays a large role in models of complex adaptive systems. We'll be programming our agents to mimic the movement of creatures in the real world. There are also chance events that occur when agents interact, such as the passing of a contagion from one person to the other.

PART 1: "Chances Are"

Directions

- In your group, roll 1 die 50 times in a cup, while the partner marks down the results for all 50 rolls using the chart provided with the possible rolls (1 through 6).

For each roll of the die, record the outcome with a tic mark below next to the number rolled. After 50 rolls, sum up each row and record the sum in the column on the right.

1		Sum:
2		Sum:
3		Sum:
4		Sum:
5		Sum:
6		Sum:

Discussion:

What was the distribution of the results?
Was one number more common?
Why might that be?

Extension:

If time allows, pool all of the data from the class and see what the sums are across groups.
If you graphed this data as a bar chart, what would the graph look like? (Draw it below.)

PART 2: Wiggle Walk

Next imagine that you were going to roll two dice instead of one die and you will subtract the second number from the first number. Do you think we will still get a flat distribution (in which the probability of rolling each outcome would be the same)?

Directions

- Each group should designate a Student 1 and a Student 2, each with their own die.
- This time, roll 2 dice simultaneously and collect the data from 50 rolls.
- Students are to SUBTRACT the Student 1 die number from the Student 2 die number.
- Record the outcome on the activity sheet with a mark next to the sum of the dice rolled (some will be negative numbers). After 50 rolls, sum up each row of tic marks and record the sum in the column on the right.
- For instance, if student 1 rolls a three and student 2 rolls a six, 3 - 6 = -3, so you would put a tic mark in the -3 row.

Area for recording tic marks of subtracted numbers

5		Sum:
4		Sum:
3		Sum:
2		Sum:
1		Sum:
0		Sum:
-1		Sum:
-2		Sum:
-3		Sum:
-4		Sum:
-5		Sum:

Discussion:

What number gets created most often from the rolling and subtraction? Why?
Given this chart, what should be the most commonly created number? Why?

Extension:

If time allows, graph this data as a bar chart. What shape does the graph look like? (Draw it below.)

To understand this phenomenon, let's look at the underlying statistics:
We know that with one die we have equal probability of rolling a 1, 2, 3, 4, 5, or 6.

Fill in the chart below that shows the outcome of rolling two dice. The numbers down the first column represent the number rolled by Student 1; the numbers across the top represent the numbers rolled on the other die, by Student 2. Subtract the second number from the first number.

Student 2

Student 1

--	1	2	3	4	5	6
1	0					
2						
3						
4						
5						
6						

Discussion:
How many ways are there to make 2?
How many ways can you create a 0?
What about other numbers?
What is the most often-seen number in the matrix?
How many times is it seen?

Next, fill in the result of a left turn of random 6 followed by a right turn of random 6.

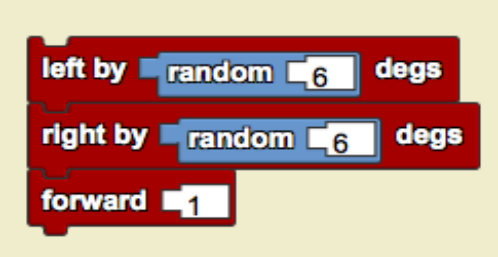
Right turn

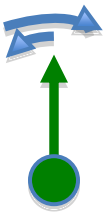
Left turn

--	1	2	3	4	5	6
1	0					
2						
3						
4						
5						
6						

Discussion:
How many ways are there to make 0?
How many ways can you roll a +2?
How many ways can you roll a -2?
What about other numbers?
What is the most often-seen number in the matrix?
How many times is it seen?

Finally, consider rolling two dice where one represents the degrees to turn to the left and the other die represents the degrees to turn to the right. That's similar to using a left turn random 6 followed by a right turn random 6, then taking a step forward.





Turtle seen from above with initial heading.

What is actually going on?

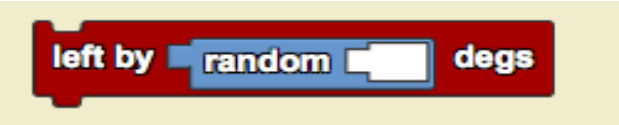
1. Agent has an initial heading.

2. Agent turns left by some random number of degrees between 1 and 6. In this case, it is 2 degrees. (Image not to scale)

3. Agent turns right by some random number of degrees between 0 and 5. In this case, it is 5 degrees, so the final heading is 3 degrees to the right of the original heading. (Image not to scale)

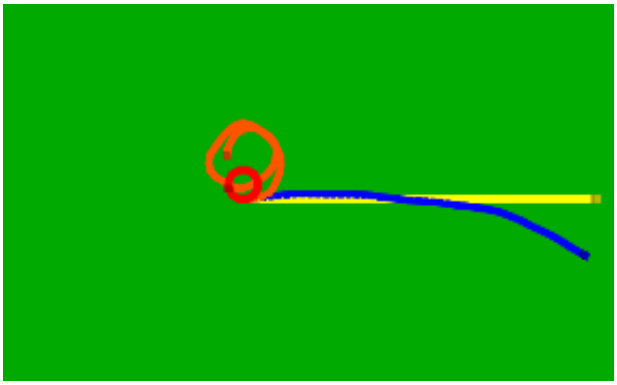
4. Agent takes one step forward at new heading. (Image not to scale)

In StarLogo Nova:



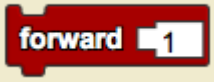
In StarLogo Nova, we use the random command to simulate the roll of a die. Random 6 would give me the result of rolling a 60-sided die with numbers 1 through 6 on the sides. Random functions can also be used within other commands to implement random behavior.

Self-test:



Match the command blocks a, b, c, and d with the path created by an agent following those blocks.

a.

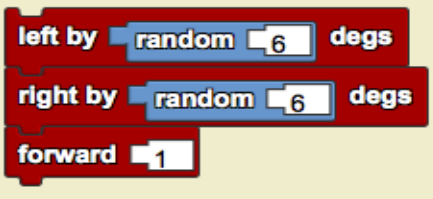


color: _____

c.

color: _____

b.



color: _____

d.

color: _____