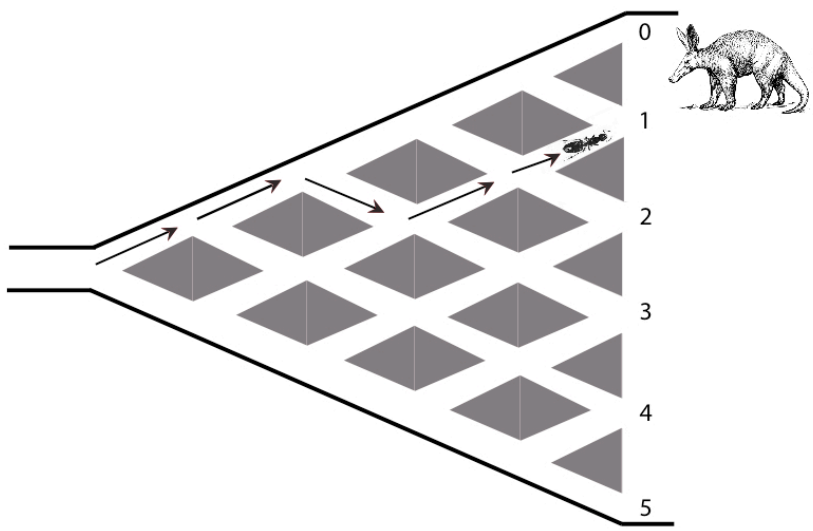
The Ants and the Aardvark

Name(s): ______________________

Every morning, a horde of ants leaves their nest to gather food outside. To get outside, the ants walk through a maze and come out of one of six holes. At each tunnel intersection in the maze, an ant decides randomly to go either up or down.

In the diagram, you see an ant about to come out of hole 1. You can follow the arrows to see the path it took. It went up at the first intersection, up at the second, down at the third, up at the fourth, and up at the fifth. We can summarize this by saying the ant went "u, u, d, u, u" and came out of hole 1.

A hungry aardvark has discovered the holes. They are close enough together so that the aardvark can stand between two holes and eat all the ants that come out of either one. In the diagram, we see the aardvark standing between holes 0 and 1, ready to eat the unlucky ant as it comes out of hole 1. When the ant saw the aardvark, it said to itself, "If only I had gone 'd, d, u, u, d.'"



1. If the ant had gone "d, d, u, u, d," which hole would it had come out of? (It might help to draw the path on the previous diagram .)

Hundreds of ants are going to be coming through this maze, deciding which path to take by "flipping a coin" at each tunnel intersection.

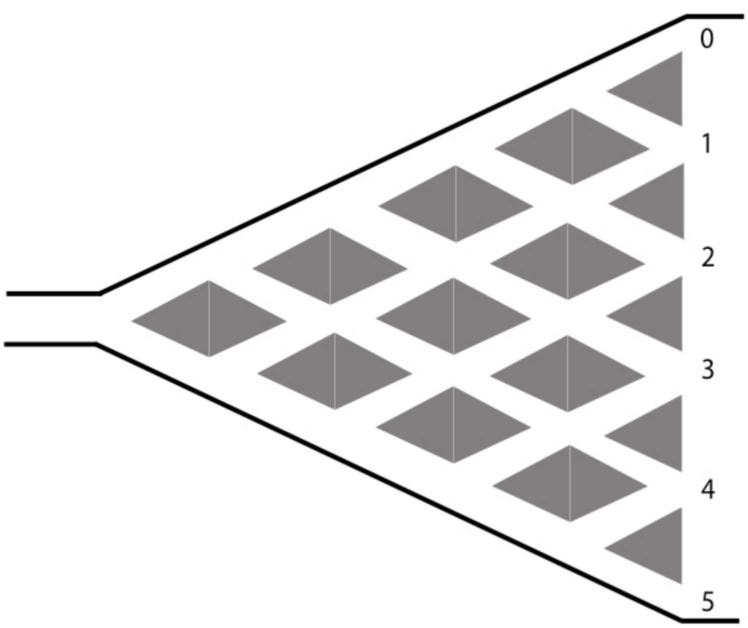
2. Where do you think the aardvark should stand to get the most ants? Explain your answer.

3. Working with a partner, send ten ants through the maze to see where they come out. Flip a coin to determine the path for each ant. If it lands heads up, the ant goes up ("u"), and if it lands tails up, the ant goes down ("d").

4. In the table, record the path each ant takes and the hole it comes out of. For example, the path "u, d, u, d, d" leads to hole 3. Trace the path of each ant as you flip the coin in the empty maze. After you've sent ten ants through, write the total number of ants that came out of each hole in the column to the right of the maze.

Ant	Path	Hole
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Total # of Ants



______
______
______
______
______
______

5. Where do you now think the aardvark should stand to get the most ants?

6. If you changed your answer, explain why you changed it.

7. Open the TinkerPlots document **Ants.tp**.
8. The sampler is currently set to send ten ants through the maze. Click the **RUN** button and watch how the sampler does what you did with the coin.
9. Change Repeat to 100 and run the sampler again. This will model sending 100 ants through the maze. Record the number of ants coming out of each hole in the column labeled Run 1.

Hole #	Run 1	Run 2	Run 3
0			
1			
2			
3			
4			
5			

10. Draw two more samples of 100, and record the results in columns Run 2 and Run 3.
11. Clearly, more ants are coming out of holes 2 and 3. Explain why you think this is happening.

Here are eight different paths an ant can take. You can quickly figure out which hole each path leads to without tracing the paths in the grid. For example, the first path ("u, d, u, d, u") leads to hole 2. The second path ("d, d, d, d, d") leads to hole 5.

Path	Hole
u, d, u, d, u	2
d, d, d, d, d	5
u, u, u, u, u	
d, d, u, d, d	
d, u, d, u, u	
u, d, d, d, d	
u, d, u, u, u	
d, u, u, d, d	

12. Can you see how to quickly figure out the hole number from the path? Figure out which holes the other paths lead to and write the hole number next to each path in the table.

There is only one path that leads to hole 0. An ant has to go up every time ("u, u, u, u, u") to come out of hole 0. The same is true of hole 5. There's only one way to get there and that's by going down at every intersection ("d, d, d, d, d").

13. There are a total of five ways to get to hole 1. One way is to go "d, u, u, u, u." List the other four paths to hole 1.

14. List all five paths that lead to hole 4.

15. One way to get to hole 2 is to go "d, d, u, u, u." You know this path goes to hole 2 because it has two "d's" in it. List all ten ways to get to hole 2. (*Hint:* It will help if you use a system for making the different paths.)

16. List all the ways to get to hole 3.

17. Now that you've figured out all the paths the ants can take and where they lead, explain why the aardvark should stand between holes 2 and 3 to get the most ants.

18. Sean is about to flip a coin five times. Explain why he is more likely to get three heads and two tails than he is to get five heads.