Bug Jump – Random Walk Simulation 5.7

Name: . . . . . .

A. Problem

A bug starts in the middle of a 9-meter bridge. Each time it jumps either 1 m to the left or 1 m to the right. What is the expected number of jumps until the bug is off the bridge?

B. Plan

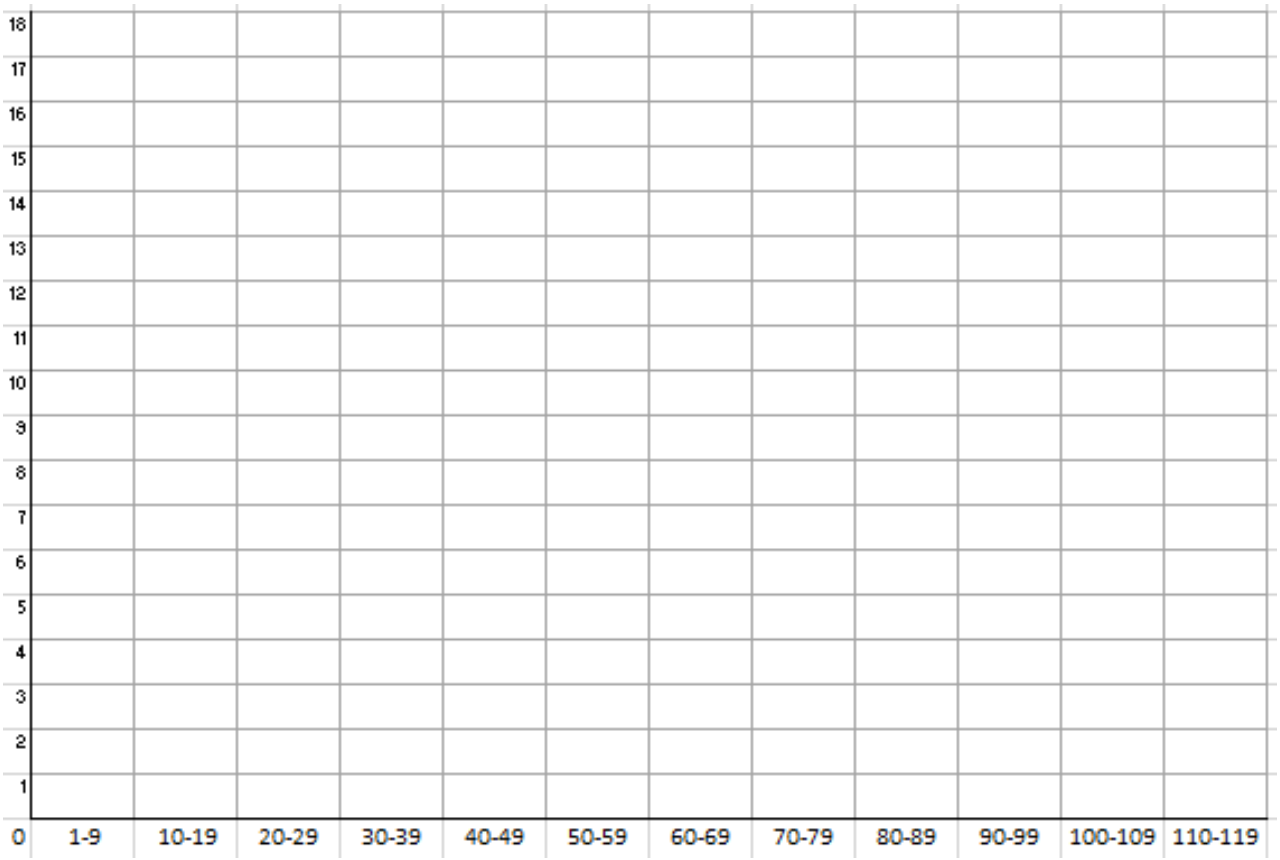
First, we will simulate this by rolling a dice. Write 0 in the start box.
Roll the dice. If it is odd, move right. If it is even, move left. Write 1 in the new box. Repeat this, increasing the count until you are off the bridge.

Off the bridge					Start					Off the bridge

How many hops to get off the bridge? . . . . . .

C. Data.

We will simulate the above process with a problem on code.org (link on the MDM4U website).
Run the program 40 times. Record the number of jumps by colouring in a box each time.



Circle the distribution type: (a) Mound (b) Right Skew (c) Left Shew (d) Bi-modal (e) Uniform

Circle the probability distribution: (a) Binomial (b) Geometric (c) Hypergeometric (d) Normal (e) Uniform

D. Analysis

Based on your histogram, estimate the expected number of hops to get off the bridge? . . . . . .

The actual theoretical probability is found by:

E(x) = (# places to right of start) * (# places to left of start).

What is the theoretical expected value of hops to get off the bridge? . . . . . .

There is another pattern that appears in the hops. What possible routes can the bug take to get off the bridge?

- To start, put a 1 in position 0 to signal the bug's position. A * is in this location.
- In the next row, what are the two places that the bug can go? How many ways can the bug get there?
- In the row for jump 2, what are the three places that the bug can go? How many ways can the bug get there.

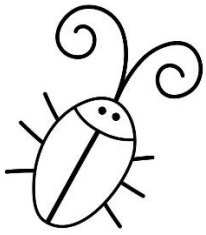
Fill in this table with the possible routes of the bug.

	Off	-4	-3	-2	-1	0	1	2	3	4	Off
Start						*					
Jump 1											
Jump 2											
Jump 3											
Jump 4											
Jump 5											

What pattern appears? . . . . . .

E. Conclusions

Google "random bug walk". Look through the search results and find 6 SPECIFIC real world applications of random walks.



Did your expected value match the theoretical value? Explain why to why not, using the Law of Large Numbers.