

Physical Principles in Biology
Biology 3550
Fall 2017

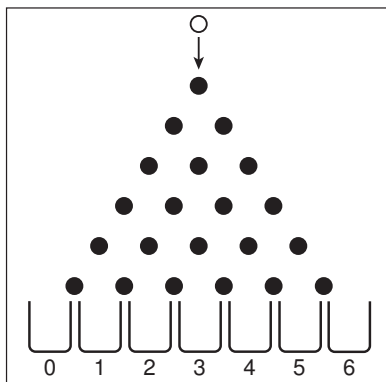
Lecture 6:

Plinko Probabilities, Part 1

Friday, 1 September 2017

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A Six-row Plinko

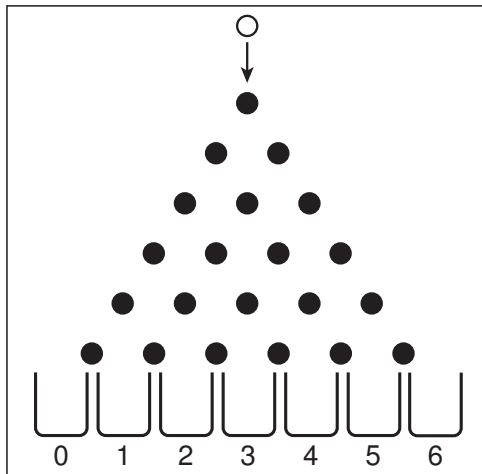


- For N plinko rows, there will be $N + 1$ buckets for balls to land in.
- For convenience, buckets are numbered from 0 to N .
- How shall we define the sample set?

Count The Paths to Reach a Given Bucket

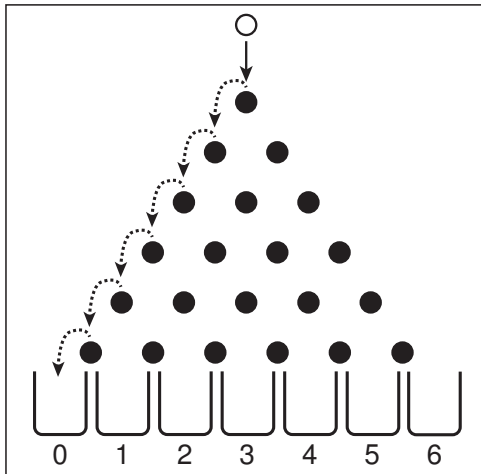
- Define outcomes as all of the possible paths.
- Define events as final positions of ball, *i.e.*, bucket numbers.
- How many possible paths are there?
 - For a 6-row plinko, each path involves 6 places to change direction.
 - The number of different paths is: $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6 = 64$
 - Each path has an equal probability, equal to $1/64$
 - For an n -row plinko, the number of different paths is 2^n , and the probability of each is $1/2^n = 2^{-n}$.

Need to Count the Number of Paths to Each Final Position



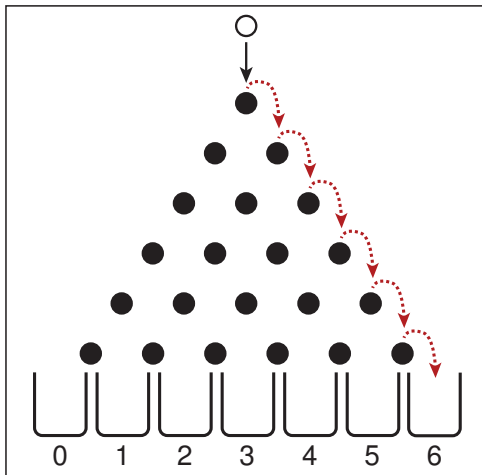
Bucket No.	Paths
0	
1	
2	
3	
4	
5	
6	

How Many Paths to Bucket 0?



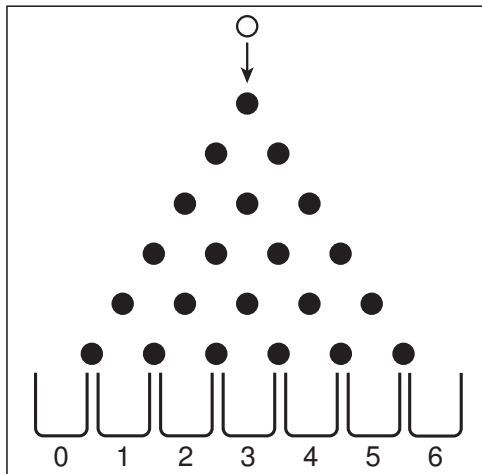
Bucket No.	Paths
0	1
1	
2	
3	
4	
5	
6	

How Many Paths to Bucket 6?



Bucket No.	Paths
0	1
1	
2	
3	
4	
5	
6	1

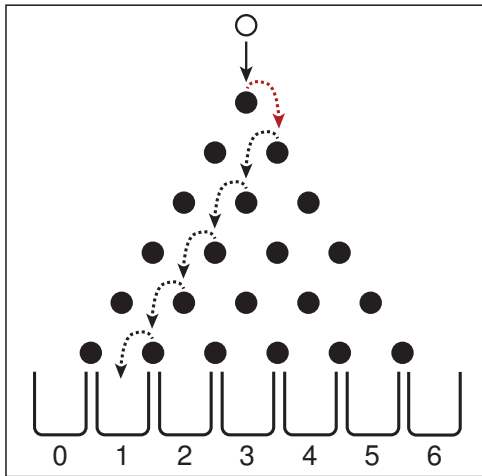
How Many Paths to Bucket 1?



Bucket No.	Paths
0	1
1	
2	
3	
4	
5	
6	1

- Each path to bucket 1 includes 1 turn to the right and 5 to the left.

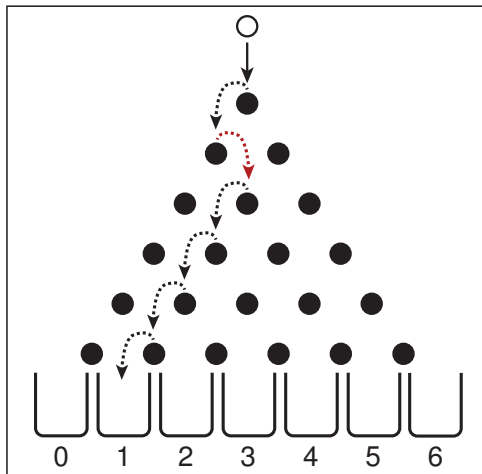
How Many Paths to Bucket 1?



Bucket No.	Paths
0	1
1	
2	
3	
4	
5	
6	1

- Each path to bucket 1 includes 1 turn to the right and 5 to the left.

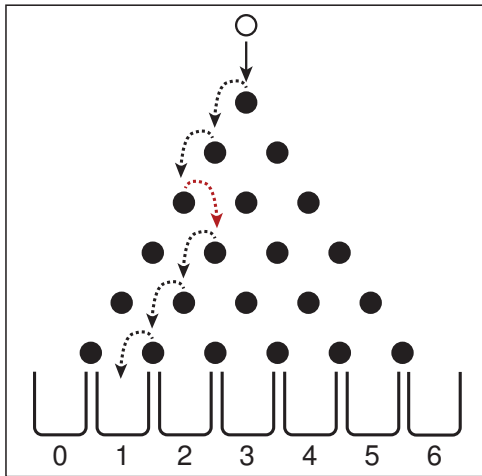
How Many Paths to Bucket 1?



Bucket No.	Paths
0	1
1	
2	
3	
4	
5	
6	1

- Each path to bucket 1 includes 1 turn to the right and 5 to the left.

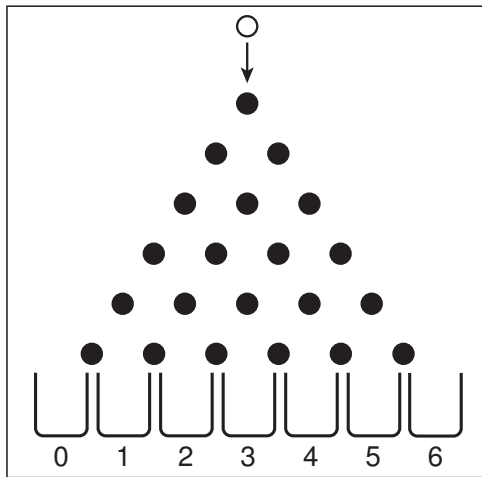
How Many Paths to Bucket 1?



Bucket No.	Paths
0	1
1	6
2	
3	
4	
5	
6	1

- Each path to bucket 1 includes 1 turn to the right and 5 to the left.

How Many Paths to Bucket 5?



Bucket No.	Paths
0	1
1	6
2	
3	
4	
5	6
6	1

- Each path to bucket 5 includes 5 turns to the right and 1 to the left.