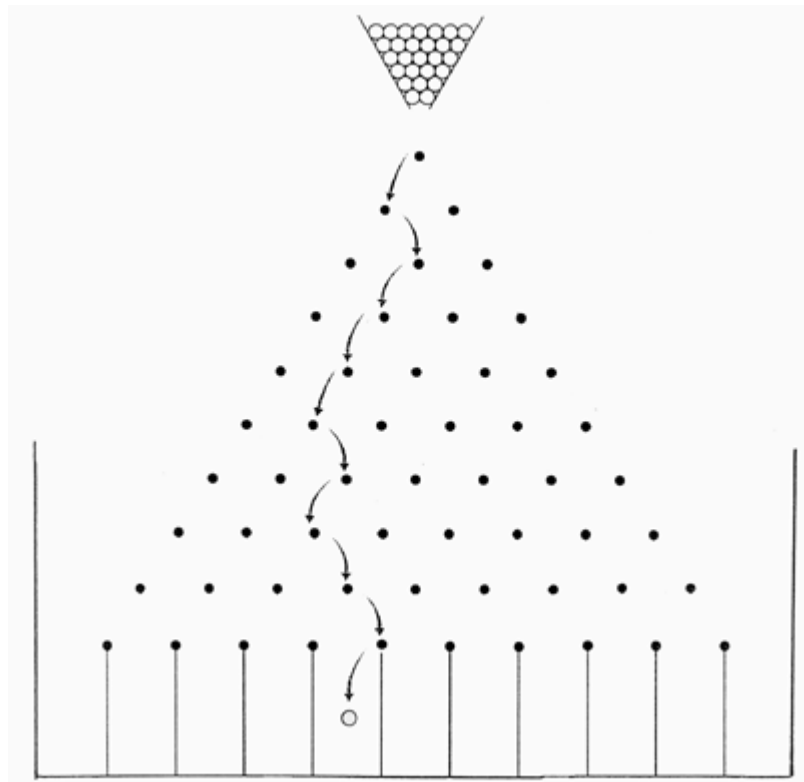




Laboratory Investigation 8.2 Probability Machines

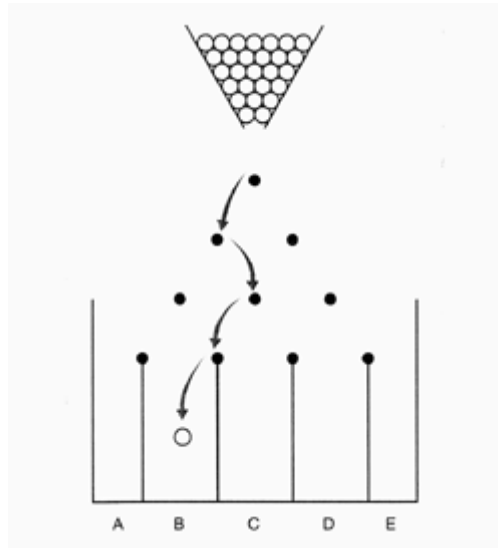
The device shown in the figure below is called a probability machine and was described by Sir Francis Galton in 1889. There are 10 horizontal rows of pegs in the top part of this device. As a ball falls through the opening at the top center, it strikes the center peg in the top row and has an equal chance of going right or left. At each lower row of pegs, the ball hits a peg and in each case it has a 50:50 chance of falling right or left. The balls collect in 11 compartments in the lower half of this device. When many balls are dropped, the distribution of the balls will be approximately normal, with the greatest number in the center compartment and the numbers of balls decreasing as the compartments become farther from the center.



Starting Points for Investigations

1. The probability of a ball falling into a given compartment can be computed by determining the number of ways a ball can fall into each of the compartments. Consider the simplified probability machine in the figure below. The path of one ball that has fallen into compartment B is marked with arrows. Determine the number of ways a ball can fall into each of compartments A, B, C, D, and E; and then determine

the probability of a ball falling into a given compartment. (Hint: The total number of ways a ball can enter these five compartments is 16.)



2. Determine the probability of a ball falling into each compartment of some other simplified probability machine.
3. Look for a pattern. (Hint: The number of ways a ball can fall into a compartment is related to the numbers in Pascal's triangle. See Section 1.2 of Mathematics For Elementary Teachers: A Conceptual Approach.)
4. Use your pattern to predict the probability of a ball falling into the center compartment of a machine with 11 compartments.