COMPUTATIONAL PHYSICS FINAL PROJECT

Galton Board

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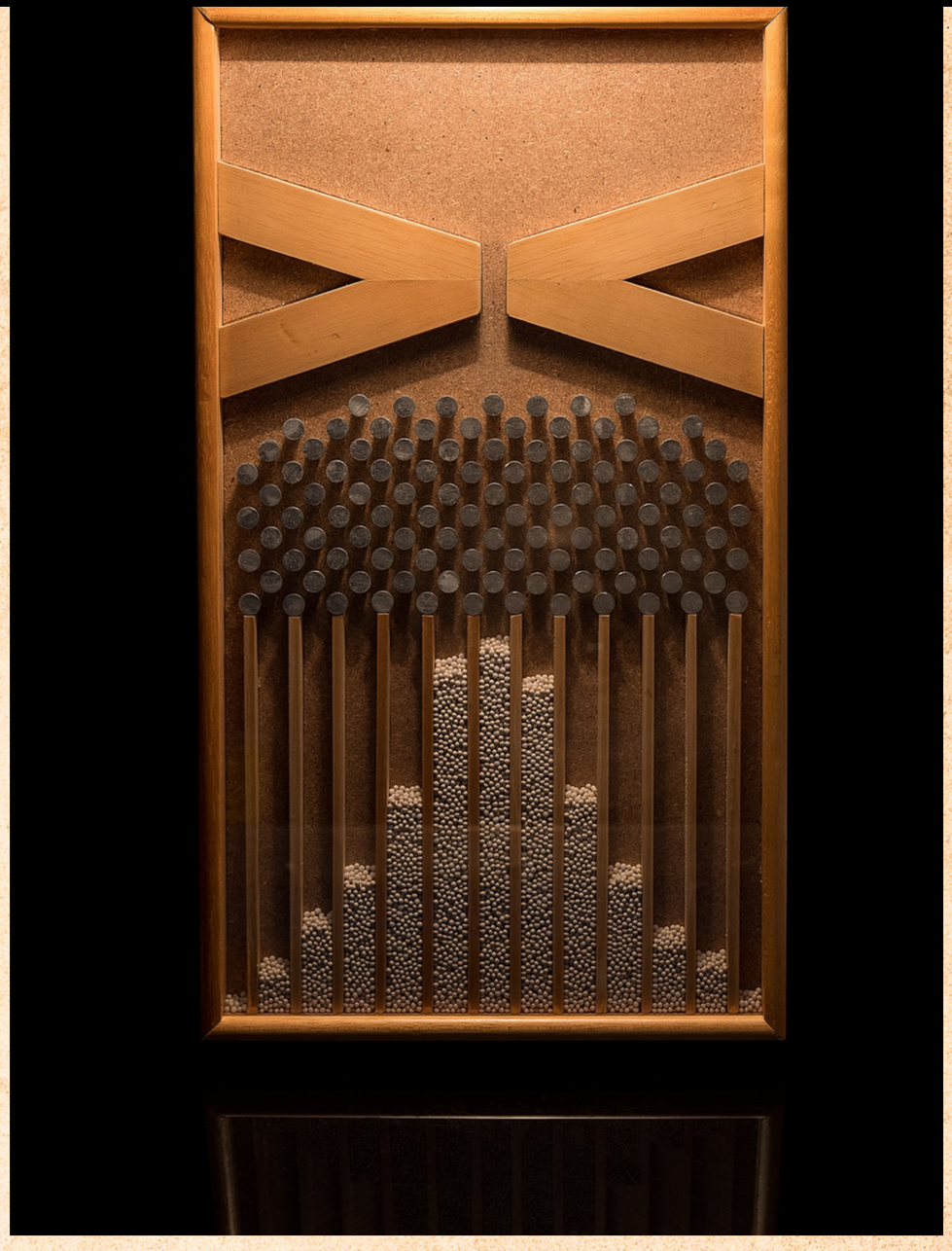


Galton Board

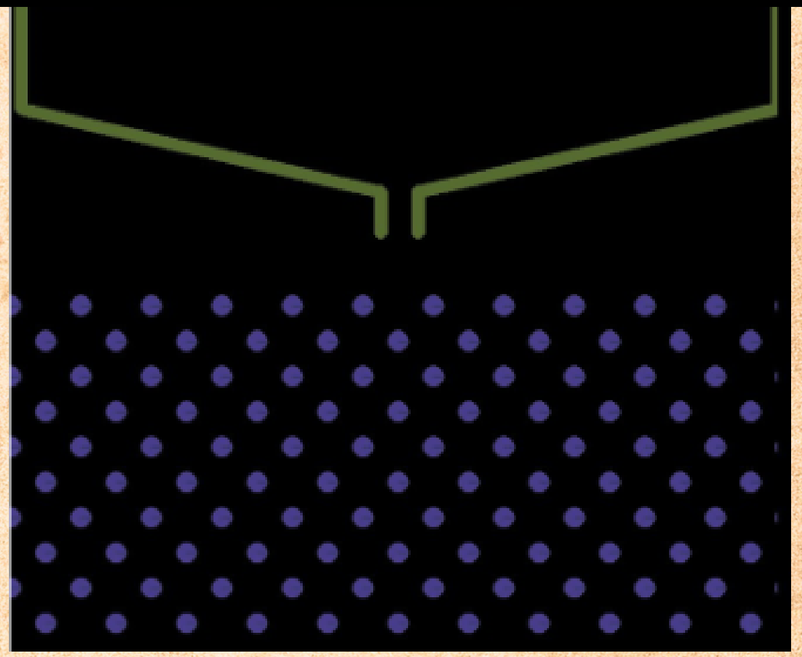
STRUCTURE

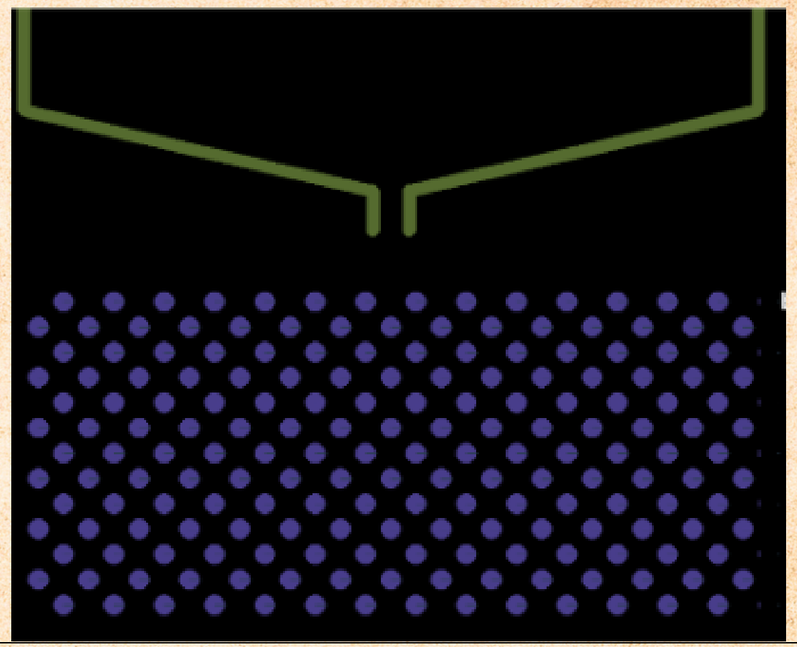
Upper-Half: Evenly spaced pegs arranged in staggered order.

Lower-Half: Divided into a number of evenly-spaced rectangular slots.

PURPOSE

Illustrating the principles of probability and outcome distribution

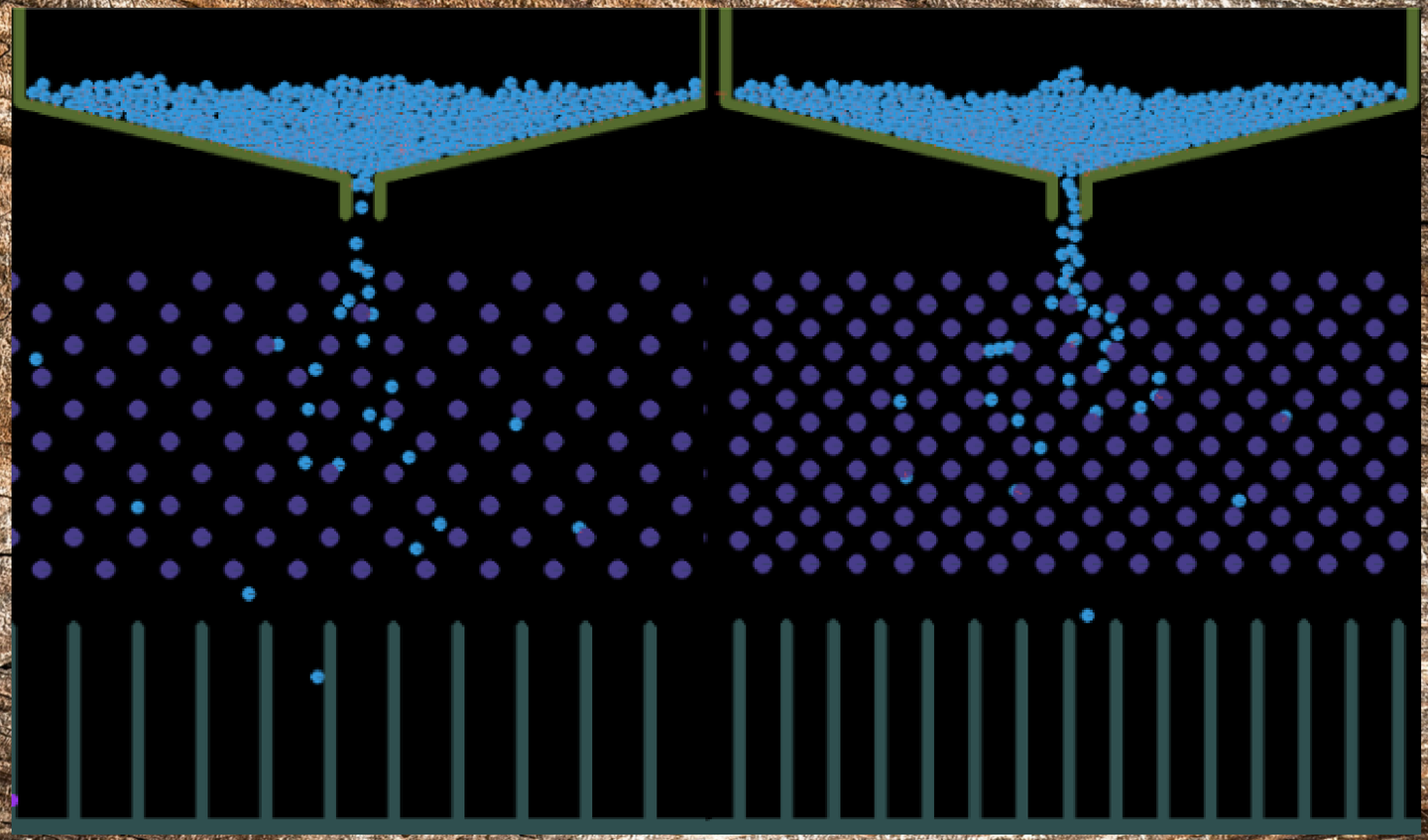




Goal

Observe the differences in the distribution created if we were to change the ball sizes and widths of the pegs and heights

User Interface



Restart

Reset

ball quantities

+ -

ball mass

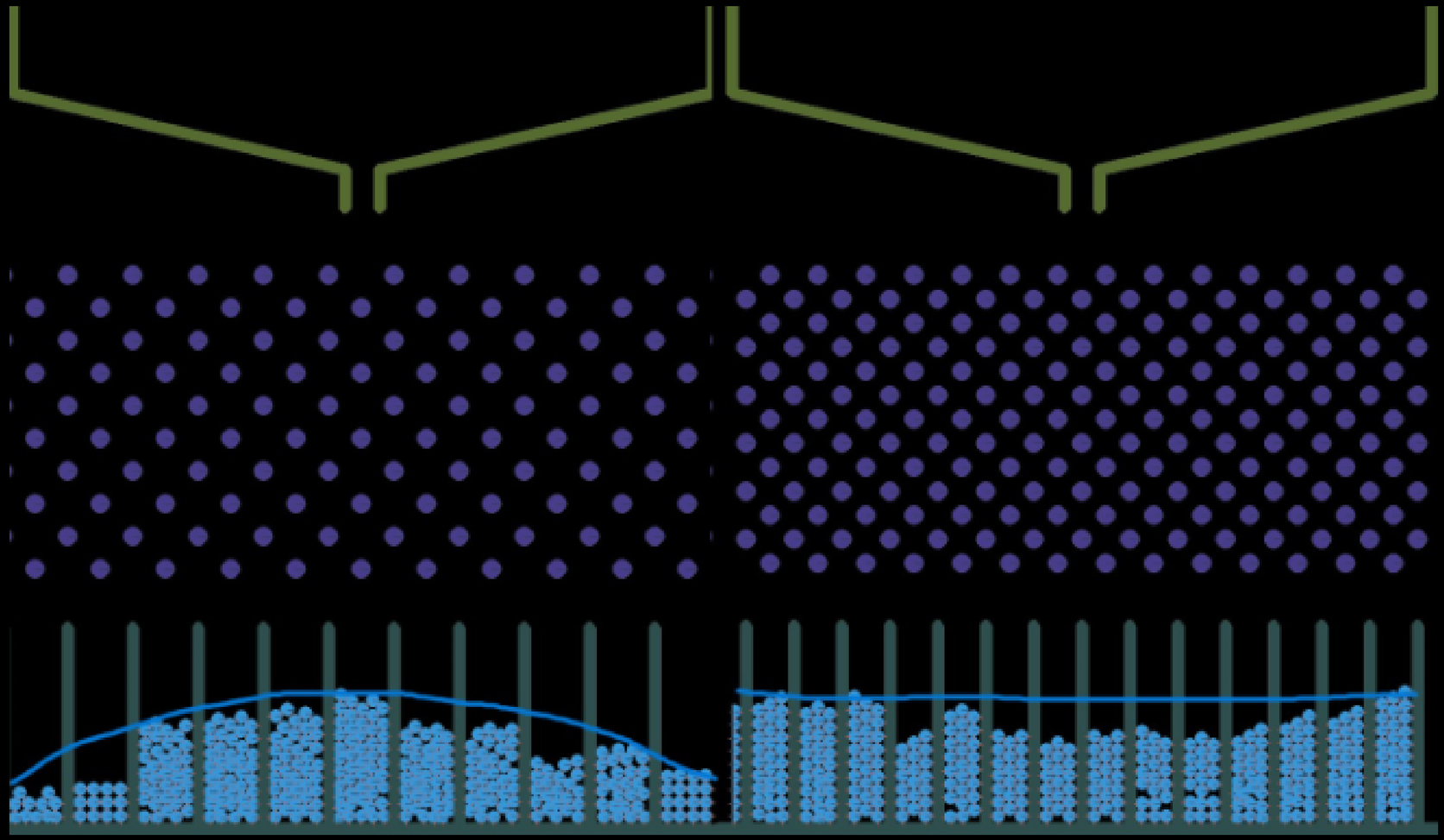
+ -

ball radius

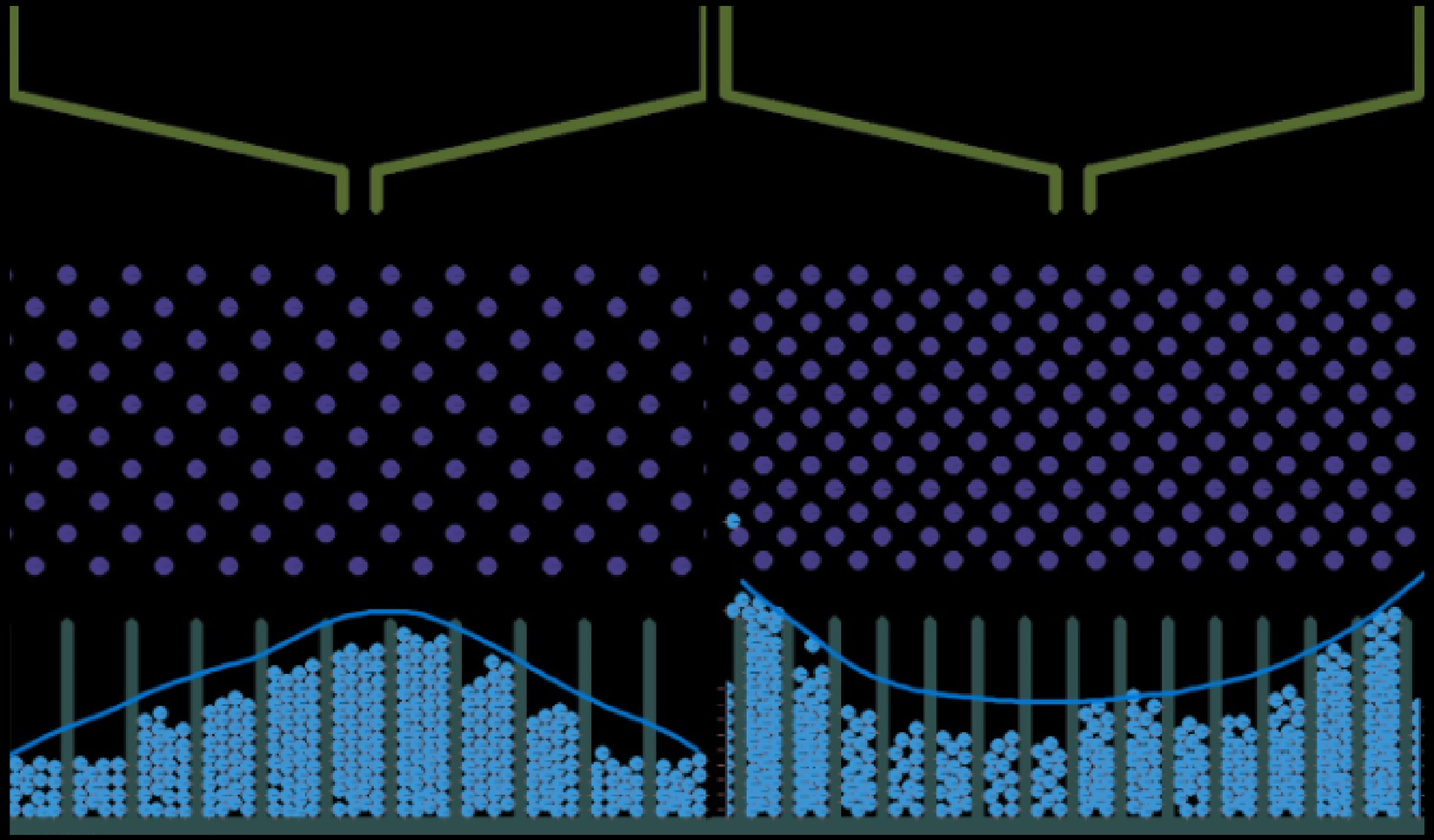
+ -

Project Demo

Results #1

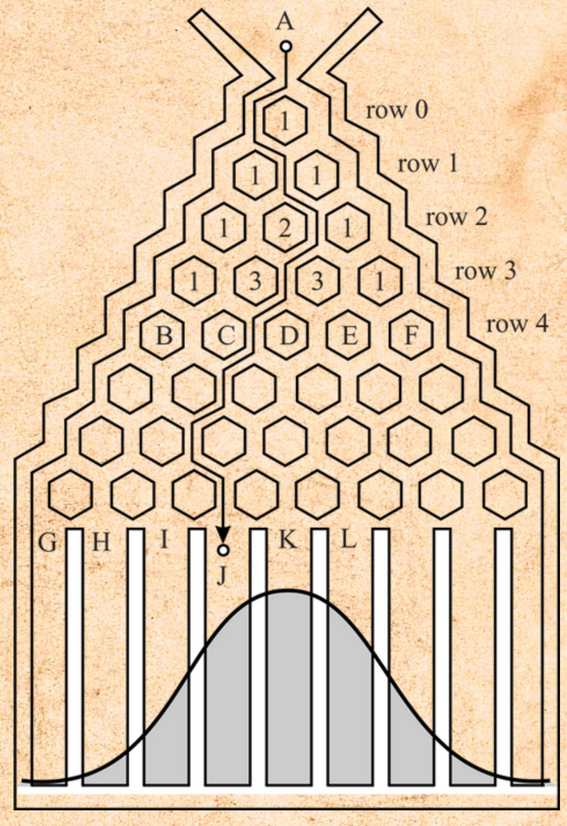


Results #2 (Increased radius)



$$P_p(n \mid N) = \binom{N}{n} p^n q^{N-n}$$

- The weak law of large numbers:
  - If the number of balls is large & p = q = 1/2,
  - The heights of the ball heaps will approximate a normal distribution.
- Each ball hitting a nail can bounce right/left with probability p (q = 1-p).
- In a symmetrically placed nails, balls can bounce right/left with equal probability (p = q = 1/2).
- If the rows are numbered from 0 to N-1, the path of each falling ball is a Bernoulli trial consisting of N steps.
- The probability of a ball hitting the nth peg from the left on the bottom row depends on the number of right turns it has taken (where 0 <= n <= N-1).



Thank You