Explaining the Bithday Problem

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09/03/2021

# Birthday problem

What is the probability that at least two people share the same birhtday in this room?

Is is

## Analytical solution

But actually when we compute the math. We get an surprising result:

## Simulations

1 - Simulate 10,000 rooms with n = 21 random birthdays, and store the results in matrix where each row represents a room.  
2 - For each room (row) compute the number of unique birthdays.  
3 - Compute the average number of times a room has 21 unique birthdays, across 10,000 simulations, and report the complement.

birthday.prob = function(n.pers\_var, n.sims\_var) {  
 # simulate birthdays  
 birthdays = matrix(round(runif(n = n.pers\_var \* n.sims\_var, min = 1, max = 365) ),  
 nrow = n.sims\_var, ncol = n.pers\_var)  
 # for each room (row) get unique birthdays  
 unique.birthdays = apply(birthdays, 1,  
 function(x) length( unique(x) ) )  
 # Indicator with 1 if all are unique birthdays  
 all.different = 1 \* (unique.birthdays==n.pers\_var)  
 # Compute average time all have different birthdays   
 result = 1 - mean(all.different)  
return(result)  
}  
  
bp\_sim = birthday.prob(n.pers\_var = 21, n.sims\_var = 10000)  
print(bp\_sim)

## [1] 0.4531

Ok, I am convinced that the probability that least two people in this room share the same birthday is 45.31%.