Explaining the Bithday Problem

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12/5/2017

# 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 = 4 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 4 unique birthdays, across 10,000 simulations, and report the complement.

birthday.prob = function(n.pers, n.sims) {  
 # simulate birthdays  
 birthdays = matrix(round(runif(n.pers \* n.sims, 1,   
 365)), nrow = n.sims,   
 ncol = n.pers)  
 # for each room (row) get unique birthdays  
 unique.birthdays = apply(birthdays, 1, unique)  
 # Indicator with 1 if all are unique birthdays   
 all.different = (lapply(unique.birthdays, length) == n.pers) # Compute average time all have different birthdays   
 result = 1 - mean(all.different)  
return(result)  
}  
n.pers.param = n.pers  
n.sims.param = 1e4   
birthday.prob(n.pers.param,n.sims.param)

## [1] 0.0172

Ok, I am convinced that the probability of atl least two people in this room share the same birthday is 0.0185