Birthday Problem

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## Build a Functions

Create a function birthday.matrix

birthday.matrix <- function(maxn=30)   
 {  
 ### Define a local function to compute the probability for a single n ###  
 birthday.prob = function(n = 23){  
 1 - prod((365-(0:(n-1)))/365)  
 }  
 ### Create an n x 1 matrix, or a vector, from 1 to n ###  
 n = matrix(1:maxn, ncol=1)  
 ### Compute the probabilities, p, for each of the values in n. ###  
 ### The "1" which is the second argument indicates that the application ###  
 ### of the function birthday.prob is over the rows. ###  
 p = apply(n, 1, birthday.prob)  
 ### Now return a data.frame that contains the (n,p) pairs. This can ###  
 ### also be treated as a matrix. ###  
 return(data.frame(n,p))  
 }

## Run the Function

Run the function birthday.matrix using the default n=30.

birthday.matrix()

## n p  
## 1 1 0.000000000  
## 2 2 0.002739726  
## 3 3 0.008204166  
## 4 4 0.016355912  
## 5 5 0.027135574  
## 6 6 0.040462484  
## 7 7 0.056235703  
## 8 8 0.074335292  
## 9 9 0.094623834  
## 10 10 0.116948178  
## 11 11 0.141141378  
## 12 12 0.167024789  
## 13 13 0.194410275  
## 14 14 0.223102512  
## 15 15 0.252901320  
## 16 16 0.283604005  
## 17 17 0.315007665  
## 18 18 0.346911418  
## 19 19 0.379118526  
## 20 20 0.411438384  
## 21 21 0.443688335  
## 22 22 0.475695308  
## 23 23 0.507297234  
## 24 24 0.538344258  
## 25 25 0.568699704  
## 26 26 0.598240820  
## 27 27 0.626859282  
## 28 28 0.654461472  
## 29 29 0.680968537  
## 30 30 0.706316243

## Plot the Probabilities

Now create a plot of the probabilities. Using type=âlâ gives a line without points.

plot(birthday.matrix(75),type="l")  
 ### Add a horizontal line at p=0.5 using a dashed line type.  
 abline(h=0.5,lty=2)  
 ### Add a vertical line at n=23 using a dashed line type.  
 abline(v=23, lty=2)  
 ### Add a title.  
 title("Probability of a Shared Birthday")

