Probability

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setwd("~/Desktop/PK_Portfolio/Khan_Academy/Probability")

Introduction to Probability

Khan Academy Videos - French, English, Spanish and Portuguese

Probabilités "Notions de Base"

Intro to Probability "Probability Explained"

Probabilidad "Introduccíon Básica"

Probabilidade "Introdução Básico"

Here are versions in three African lanuages: Kiswahili, Xhosa and Zulu

Uwezekano wa Kimsingi "Kiswahili"

Probability "Xhosa"

Probability "Zulu"

Introduction to Probability - Using R

Question: If I flip a fair coin, what is the probability that it lands on Heads? For this random event, there are two equally likely, mutually exclusive, independent possibilies: Heads or Tails.

p(H) = (Possibility of Heads) / (Possibility of Heads or Tails) = 1/2 = 0.5 = 50%

If I were to run this experiment many times, what is the likely proportion of the results that would equal Heads?

The larger the number of flips, the higher the probability that p(H) will trend towards 50%.

p(H) = (Probability of Heads) / (Probability of Heads or Tails) = 1/2 = 0.5 = 50%

Remember that p(H) + p(T) = 1.0 (In other words, 100 %)

p(T) = 1-p(H) = 0.5 = 50 %

That's the theory, now let's do some calculations.

```
# Create a coin with 2 sides
fair_coin <- c(Heads=1, Tails=0)
fair_coin
```

```
## Heads Tails
##     1     0
```

```
#Do lots of trials
number_of_tosses <- 1000
# The sample function generates a different random result every time is is executed
# If we want a result that is repeatable, we can use the command: set.seed(any number)
# set.seed(11235) # for example
trial <- sample(fair_coin,number_of_tosses,replace = TRUE) # Toss the coin 1000 times
n <- length(trial)
n
```

```
## [1] 1000
```

```
Heads <- sum(trial) / n
Heads
```

```
## [1] 0.5
```

```
Heads <- Heads * 100
paste("Proportion Heads =",Heads,"%")
```

```
## [1] "Proportion Heads = 50 %"
```

```
Tails <- 100 - Heads
paste("Proportion Tails =", Tails,"%")
```

```
## [1] "Proportion Tails = 50 %"
```

Rolling the die (Plural of die = dice)

```
# Create a 6-sided die
die <- c(1:6)
die
```

```
## [1] 1 2 3 4 5 6
```

Roll the die 1000 times. What is the probability of getting a one?

P(1) = (Possibility of One) / (Possibility of all of 6 sides) = 1/6 = 0.167 = 16.7 %

```
n <- 1000
trial_1 <- sample(die, n, replace=TRUE)
# "==" is a logical operator that returns TRUE or FALSE (1 or 0)
p_1 <- ifelse(trial_1 == 1, 1,0)
p_1 <- sum(p_1) / n
p_1
```

```
## [1] 0.154
```

```r
p_1 = round(p_1 * 100, digits = 2)
paste("Probability of 1 =", p_1,"%")
```

```
## [1] "Probability of 1 = 15.4 %"
```

What is the probability of rolling a 1 or a 6?

P(1 or 6) = (Poss. of 1 or 6) / (Poss. of all of 6 sides) = 2/6 = 1/3 = 0.333 = 33.3 %

```r
trial_2 <- sample(die, n, replace=TRUE)
p_1or6 <- ifelse(trial_2 == 1 | trial_2 == 6, 1,0)
p_1or6 <- sum(p_1or6) / n
p_1or6
```

```
## [1] 0.34
```

```r
p_1or6 = round(p_1or6 * 100, digits = 2)
paste("Probability of 1 or 6 =", p_1or6,"%")
```

```
## [1] "Probability of 1 or 6 = 34 %"
```

What is the probability of rolling a 1 or a 6?

P(1 or 6) = (Poss. of 1 or 6) / (Poss. of all of 6 sides) = 2/6 = 1/3 = 0.333 = 33.3 %

```r
trial_2 <- sample(die, n, replace=TRUE)
p_1or6 <- ifelse(trial_2 == 1 | trial_2 == 6, 1,0)
p_1or6 <- sum(p_1or6) / n
p_1or6
```

```
## [1] 0.311
```

```r
p_1or6 = round(p_1or6 * 100, digits = 2)
paste("Probability of 1 or 6 =", p_1or6,"%")
```

```
## [1] "Probability of 1 or 6 = 31.1 %"
```

p(2 and 3) = Impossible = 0/6 = 0

What is the probabbility of getting an even number (2 or 4 or 6) ?

P(2 or 4 o6 6) = (Poss. of 2 or 4 or 6) / (Poss. of all of 6 sides) = 3/6 = 3/6 = 0.5 = 50.0 %

```r
trial_3 <- sample(die, n, replace=TRUE)
# "|" is the operator that means or
p_even <- ifelse(trial_3 == 2 | trial_3 == 4 |trial_3 == 6 , 1,0)
p_even <- sum(p_even) / n
p_even
```

```
## [1] 0.451
```

```r
p_even = round(p_even * 100, digits = 2)
paste("Probability of an even number=", p_even,"%")
```

```
## [1] "Probability of an even number= 45.1 %"
```

```r
# Or one can use the modulus function that gets an identical result
# %% = the modulus function
# example: if the quotient of a number divided by 2 = 0,
# this means that the remainder = 0, and thus the number is even.
p_even_mod <- ifelse(trial_3 %% 2 == 0, 1,0)
p_even_mod <- sum(p_even_mod) / n
p_even_mod
```

```
## [1] 0.451
```

```r
p_even_mod = round(p_even_mod * 100, digits = 2)
paste("Probability of an even number=", p_even_mod,"%")
```

```
## [1] "Probability of an even number= 45.1 %"
```

Khan Academy provides exercises to help you reinforce your understanding of simple probbability.

There is even an on-screen calculator if you need it.

Simple Probability "Practice Makes Perfect"

Happy Learning