

Worksheet 13 - probability simulation

Wednesday, March 12, 2025

DS 002R - Jo Hardin

Name: _____

Names of people you worked with: _____

Do you get enough exercise? What do you do?

Task: 10 people are at a party, and all of them are wearing hats. They each place their hat in a pile; when they leave, they choose a hat at random. What is the probability at least one person selected the correct hat?

Write R code to do the following steps:

- Step 1: create the hats
- Step 2: randomly assign hats
- Step 3: measure who got their original hat
- Step 4: repeat many times

Solution:

Step 1: representing the hats

```
hats <- 1:10  
hats
```

```
[1] 1 2 3 4 5 6 7 8 9 10
```

Step 2: everyone draws a hat

```
random_hats <- sample(hats, size = 10, replace = FALSE)  
hats
```

```
[1] 1 2 3 4 5 6 7 8 9 10
```

```
random_hats
```

```
[1] 9 2 7 4 1 10 6 3 5 8
```

Step 3: who got their original hat?

```
hats == random_hats
```

```
[1] FALSE TRUE FALSE TRUE FALSE FALSE FALSE FALSE FALSE
```

```
# TRUE is 1, FALSE is 0  
sum(hats == random_hats)
```

```
[1] 2
```

```
# did at least one person get their hat?  
sum(hats == random_hats) > 0
```

```
[1] TRUE
```

Step 4: repeat many times

Function

- remove the magic number 10

```
hat_match <- function(n){  
  hats <- 1:n  
  random_hats <- sample(hats, size = n, replace = TRUE)  
  sum(hats == random_hats) > 0  
}
```

```
hat_match(10)
```

```
[1] TRUE
```

Iterate

```
map_lgl(1:10, ~hat_match(n = 10))
```

```
[1] TRUE TRUE FALSE TRUE TRUE FALSE FALSE TRUE FALSE TRUE
```

```
map_lgl(1:10, ~hat_match(n = 10)) |>  
  mean()
```

```
[1] 0.7
```

Reproducible

```
set.seed(4747)  
num_iter <- 1000  
  
map_lgl(1:num_iter, ~hat_match(n = 10)) |>  
  mean()
```

```
[1] 0.661
```