# PR1

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### ISCAM Investigation B: Random Babies

(i) After at least 1000 trials, complete the table below.

```
> babies <- c("Marvin", "Willie", "Billy", "Sam")
> nights <- 1000
> NumberCorrect <- numeric(nights)
> for(i in 1:nights){
+   shuffle <- sample(babies, size = 4, replace = FALSE)
+   NumberCorrect[i] <- sum(babies == shuffle)
+ }
> xtabs(~NumberCorrect)
```

```
NumberCorrect
  0   1   2   4 
367 328 260  45 
```

```
> TAsi <- xtabs(~NumberCorrect)/nights
> TAsi
```

```
NumberCorrect
    0     1     2     4 
0.367 0.328 0.260 0.045 
```

*The R simulation with 1,000 trials/nights returns and estimated probability that zero mothers receive their own baby of 0.367.*

(o) How many different outcomes are there for returning four babies to their mothers? What is each outcome's probability of occurring for any trial?

```
> library(combinat)
> library(MASS)
> Omega <- permn(babies)
> n <- length(Omega)
> NumberCorrect <- numeric(n)
> for(i in 1:n){
+ NumberCorrect[i] <- sum(Omega[[i]] == babies)
+ }
> FA <- xtabs(~NumberCorrect)/n
> FA
```

```
NumberCorrect
         0          1          2          4 
0.37500000 0.33333333 0.25000000 0.04166667 
```

```
> TA <- fractions(xtabs(~NumberCorrect)/n)
> TA
```

```
NumberCorrect
   0    1    2    4 
 3/8  1/3  1/4 1/24 
```

*There are 24 possible outcomes for returning the four babies to their mothers. The possible outcomes are stored in the variable **`Omega`**. The probability of each outcome of occurring for any trial is $\frac{1}{24}$.*

```
> Omega
```

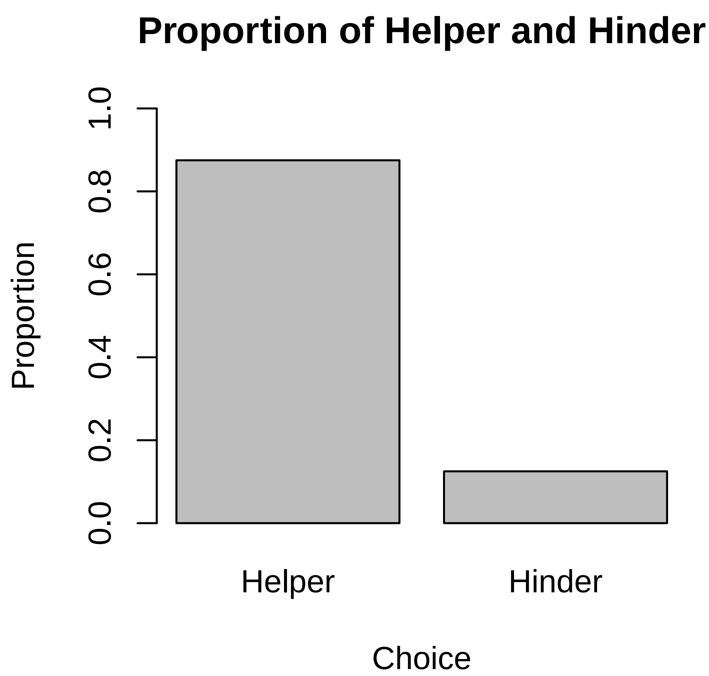
```
[[1]]
[1] "Marvin" "Willie" "Billy"  "Sam"   

[[2]]
[1] "Marvin" "Willie" "Sam"    "Billy" 

[[3]]
[1] "Marvin" "Sam"    "Willie" "Billy" 

[[4]]
[1] "Sam"    "Marvin" "Willie" "Billy" 

[[5]]
[1] "Sam"    "Marvin" "Billy"  "Willie"

[[6]]
[1] "Marvin" "Sam"    "Billy"  "Willie"

[[7]]
[1] "Marvin" "Billy"  "Sam"    "Willie"

[[8]]
[1] "Marvin" "Billy"  "Willie" "Sam"   

[[9]]
[1] "Billy"  "Marvin" "Willie" "Sam"   

[[10]]
[1] "Billy"  "Marvin" "Sam"    "Willie"

[[11]]
[1] "Billy"  "Sam"    "Marvin" "Willie"

[[12]]
[1] "Sam"    "Billy"  "Marvin" "Willie"

[[13]]
[1] "Sam"    "Billy"  "Willie" "Marvin"

[[14]]
[1] "Billy"  "Sam"    "Willie" "Marvin"
```

```
[[15]]
[1] "Billy"  "Willie" "Sam"    "Marvin"

[[16]]
[1] "Billy"  "Willie" "Marvin" "Sam"

[[17]]
[1] "Willie" "Billy"  "Marvin" "Sam"

[[18]]
[1] "Willie" "Billy"  "Sam"    "Marvin"

[[19]]
[1] "Willie" "Sam"    "Billy"  "Marvin"

[[20]]
[1] "Sam"    "Willie" "Billy"  "Marvin"

[[21]]
[1] "Sam"    "Willie" "Marvin" "Billy"

[[22]]
[1] "Willie" "Sam"    "Marvin" "Billy"

[[23]]
[1] "Willie" "Marvin" "Sam"    "Billy"

[[24]]
[1] "Willie" "Marvin" "Billy"  "Sam"
```

### ISCAM Investigation 1.1: Friend or Foe?

(a) What proportion of these infants chose the helper toy? Is this more than half (majority)? Also sketch by hand a simple bar group to display the results for this sample (one bar for each toy, with heights representing the proportion of times that toy was picked, bars are separated).

```
> HH <- c(0.875,0.125)
> barplot(HH, main="Proportion of Helper and Hinder", xlab="Choice", ylab="Proportion", names.arg=c("He
+ border="black",ylim = c(0, 1))
```




*Proportion? These infants chose the helper toy at the proportion of .875.*

*Majority? .875 > .5 so this is definitely a majority.*

(f) Explain why looking at such "could have been" results will beuseful to us.

*The "could have been" results will provide a good demonstration of how a true random simulation would result in. A bell curve with the center around 8 is it's graphical representation. Consequently, the "could have been" results would show how the 14 out of 16 as a result would rarely occur.*

(g) Flip a coin 16 times, representing the 16 infants in the study (one *trial* or *repetition* from this random process). Let a result of heads mean that the infant chooses the helper toy, tails for the hinderer toy. Tally the results below and count how many of the 16 chose the helper toy:

```
> simulation <- sample(c("Head", "Tail"), 16, replace = TRUE)
> heads <- sum(simulation=="Head")
> xtabs(~simulation)
```

```
simulation
Head Tail
   9    7
```

*There were 9 heads for the total number of heads in 16 tosses.*

(h) Repeat this two more times. Keep track of how many infants, out of the 16, choose the helper. Record this number for all three of your repetitions (including the one from the previous question):

```
> a <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
> ahelpers <-sum(a=="Helper")
>
> b <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
```

```
> bhelpers <-sum(b=="Helper")
>
> c <-sample(c("Helper", "Hinder"), 16, replace=TRUE)
> chelpers <-sum(c=="Helper")
```

| Repetition # | 1 | 2 | 3 |
|---|---|---|---|
| **Number of Heads** | *10* | *7* | *10* |

(l) Use the One Proportion Inference applet to simulate these 16 infants making this helper/hinderer choice, still assuming the null model that infants have no real preference and so are equally likely to choose either toy. Report the number of heads (i.e., the number of infants who choose the helper toy) for this "could have been" (nder the null model) outcome.

```
> d <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
> dhelpers <-sum(d=="Helper")
```

*There were 5 heads for the "could have been" outcome.*

(m) **Uncheck** the **Animate** box and press **Draw Samples** four more times, each time recording the number of the 16 infants who choose the helper toy. Did you get the same number of heads all five times?

```
> a1 <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
> a1helpers <-sum(a1=="Helper")
>
> b1 <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
> b1helpers <-sum(b1=="Helper")
>
> c1 <-sample(c("Helper", "Hinder"), 16, replace=TRUE)
> c1helpers <-sum(c1=="Helper")
>
> d1 <-sample(c("Helper", "Hinderer"), 16, replace=TRUE)
> d1helpers <-sum(d1=="Helper")
```

| Repetition # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Number of Heads** | *5* | *10* | *8* | *9* | *8* |

*No, The number of heads occurred differently for all five flips.*

**RR Chapter 1 & 2**