

# Simulation basics

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# Important simulation functions

## Distributions

- `rbeta`, `rbinom`, `rcauchy`, `rchisq`, `rexp`, `rf`, `rgamma`, `rgeom`, `rhyper`, `rlogis`, `rlnorm`, `rnbinom`, `rnorm`, `rpois`, `rt`, `runif`, `rweibull`

## Densities

- `dbeta`, `dbinom`, `dcauchy`, `dchisq`, `dexp`, `df`, `dgamma`, `dgeom`, `dhyper`, `dlogis`, `dlnorm`, `dnbinom`, `dnorm`, `dpois`, `dt`, `dunif`, `dweibull`

## Sampling

- `sample(,replace=TRUE)`, `sample(replace=FALSE)`

# *rfoo* functions generate data

## Normal

```
args(rnorm)
```

```
function (n, mean = 0, sd = 1)
```

```
NULL
```

```
heights = rnorm(10,mean=188,sd=3)
```

```
heights
```

```
[1] 186.0 191.2 187.6 187.9 186.6 187.2 187.2 189.5 190.8 186.4
```

# *rfoo* functions generate data

## Binomial

```
args(rbinom)
```

```
function (n, size, prob)  
NULL
```

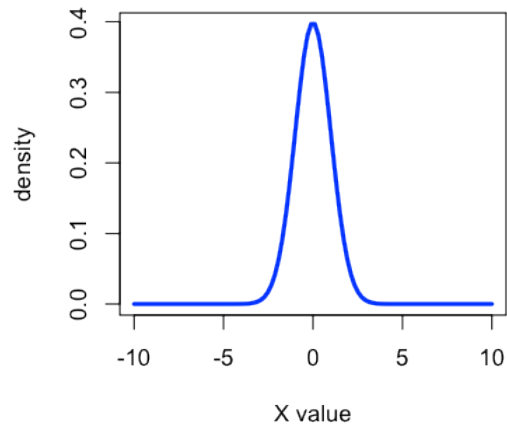
```
coinFlips = rbinom(10,size=10,prob=0.5)  
coinFlips
```

```
[1] 3 4 6 5 7 6 5 8 5 6
```

# Example distribution: Normal

Normal Distribution:  $N(\mu, \sigma)$

- $X \sim N(0, 1)$



# *dfoo* functions calculate the density

## Normal

```
args(dnorm)
```

```
function (x, mean = 0, sd = 1, log = FALSE)  
NULL
```

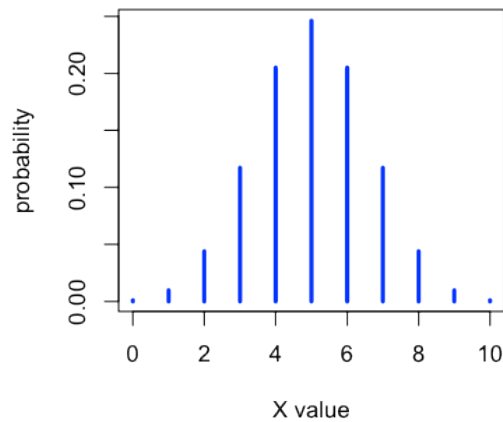
```
x = seq(from=-5,to=5,length=10)  
normalDensity = dnorm(x,mean=0,sd=1)  
round(normalDensity,2)
```

```
[1] 0.00 0.00 0.01 0.10 0.34 0.34 0.10 0.01 0.00 0.00
```

# Example distribution: Binomial

**Binomial distribution:**  $Bin(n, p)$

- $X \sim Bin(10, 0.5)$



# *dfoo* functions calculate the density

## Binomial

```
args(dbinom)
```

```
function (x, size, prob, log = FALSE)  
NULL
```

```
x = seq(0,10,by=1)  
binomialDensity = dbinom(x,size=10,prob=0.5)  
round(binomialDensity,2)
```

```
[1] 0.00 0.01 0.04 0.12 0.21 0.25 0.21 0.12 0.04 0.01 0.00
```



# Sample draws a random sample

```
args(sample)
```

```
function (x, size, replace = FALSE, prob = NULL)
NULL
```

```
heights = rnorm(10,mean=188,sd=3)
heights
```

```
[1] 187.2 185.4 187.9 187.3 184.8 190.3 185.0 188.2 190.0 188.1
```

```
sample(heights,size=10,replace=TRUE)
```

```
[1] 188.2 188.2 184.8 185.0 187.2 188.2 187.9 185.4 184.8 185.4
```

# Sample draws a random sample

```
heights
```

```
[1] 187.2 185.4 187.9 187.3 184.8 190.3 185.0 188.2 190.0 188.1
```

```
sample(heights,size=10,replace=FALSE)
```

```
[1] 185.0 188.2 188.1 184.8 190.3 187.9 187.2 185.4 190.0 187.3
```

# Sample can draw according to a set of probabilities

```
heights
```

```
[1] 187.2 185.4 187.9 187.3 184.8 190.3 185.0 188.2 190.0 188.1
```

```
probs = c(0.4,0.3,0.2,0.1,0,0,0,0,0,0)  
sum(probs)
```

```
[1] 1
```

```
sample(heights,size=10,replace=TRUE,prob=probs)
```

```
[1] 187.2 185.4 187.9 187.3 185.4 187.2 185.4 187.2 187.2 185.4
```

# Setting a seed

Setting a seed ensures reproducible results from random processes in R

```
set.seed(12345)  
rnorm(5,mean=0,sd=1)
```

```
[1]  0.5855  0.7095 -0.1093 -0.4535  0.6059
```

```
set.seed(12345)  
rnorm(5,mean=0,sd=1)
```

```
[1]  0.5855  0.7095 -0.1093 -0.4535  0.6059
```

# For more information

**More on distributions in R**

<http://cran.r-project.org/web/views/Distributions.html>

**Computing for Data Analysis**

[Simulation in R](#)