Statistical Distributions

Gabriel Odom

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Random variables in R are shown on <https://stat.ethz.ch/R-manual/R-devel/library/stats/html/Distributions.html>

# Discrete Random Variables

## Distributions

We have a few common examples of discrete random variables. Each distribution also has a corresponding implementation in R. 1. The Bernoulli Distribution: <https://en.wikipedia.org/wiki/Bernoulli_distribution>

# Random Bernoulli with a fair coin  
rbinom(n = 1, size = 1, prob = 0.5)

## [1] 0

# Weighted coin  
rbinom(n = 1, size = 1, prob = 0.75)

## [1] 1

1. Binomial Distribution: <https://en.wikipedia.org/wiki/Binomial_distribution>

# Flip 10 fair coins and record the results  
rbinom(n = 10, size = 1, prob = 0.5)

## [1] 1 0 0 1 1 0 1 0 1 1

# Flip 10 fair coins and record the number of successes  
rbinom(n = 1, size = 10, prob = 0.5)

## [1] 4

1. Poisson Distribution: <https://en.wikipedia.org/wiki/Poisson_distribution>

# How many horse kicks in each group of 10 soldiers? We expect 2 kicks  
rpois(n = 10, lambda = 2)

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

# Now the horses are angry...  
rpois(n = 10, lambda = 4)

## [1] 1 2 1 6 4 3 5 5 9 2

## Moments of these Distributions

The common moments we would care about are the *first* and *second* moments, from which we calculate the mean and variance, respectively.

### Binomial

# Random draw of five fair coins  
xBinom <- rbinom(n = 5, size = 1, prob = 0.5)  
xBinom

## [1] 0 1 1 0 0

# mean  
mean(xBinom)

## [1] 0.4

# variance  
var(xBinom)

## [1] 0.3

# Random draw of 100 fair coins  
xBinom2 <- rbinom(n = 100, size = 1, prob = 0.5)  
  
# mean  
mean(xBinom2)

## [1] 0.46

# variance  
var(xBinom2)

## [1] 0.2509091

# Continuous Random Variables