

# SDM4 in R: Stats Starts Here (Chapter 1)

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## Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fourth Edition of *Stats: Data and Models* (2014) by De Veaux, Velleman, and Bock. More information about the book can be found at [http://wps.aw.com/aw\\_deveaux\\_stats\\_series](http://wps.aw.com/aw_deveaux_stats_series). This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at <http://nhorton.people.amherst.edu/sdm4>.

This work leverages initiatives undertaken by Project MOSAIC (<http://www.mosaic-web.org>), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the `mosaic` package vignettes (<http://cran.r-project.org/web/packages/mosaic>). A paper describing the `mosaic` approach was published in the *R Journal*: <https://journal.r-project.org/archive/2017/RJ-2017-024>.

## Chapter 1: Stats Starts Here

### Section 1.1: What is Statistics?

### Section 1.2: Data

### Section 1.3: Variables

See table on page 7.

```
library(mosaic)
library(readr)
options(digits = 3)
Tour <- read.delim("http://nhorton.people.amherst.edu/sdm4/data/Tour_de_France_2014.txt",
  sep = "\t", stringsAsFactors = FALSE)
names(Tour)
```

```
## [1] "Year"           "Winner"         "Country"
## [4] "Age"           "Team"          "TotalTime.h.min.sec."
## [7] "TotalTime.h." "Average.Speed" "Stages"
## [10] "DistanceRidden" "StartingRiders" "FinishingRiders"
```

```
dim(Tour)
```

```
## [1] 101 12
```

```
head(Tour, 3)
```

```
##   Year      Winner Country Age      Team TotalTime.h.min.sec.
## 1 1903  Maurice Garin  France 32 La Fran\x8daise      94.33.00
```

```
## 2 1904 Henri Cornet France 20 Cycles JC 96.05.56
## 3 1905 Louis Trousselier France 24 Peugeot 110.26.58
## TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1 94.5 25.7 6 2428 60
## 2 96.1 25.3 6 2428 88
## 3 110.4 27.1 11 2994 60
## FinishingRiders
## 1 21
## 2 27
## 3 24
```

```
tail(Tour, 8)
```

```
## Year Winner Country Age Team
## 94 2007 Contador Alberto Spain 24 Discovery
## 95 2008 Sastre Carlos Spain 33 CSC-Saxo Bank
## 96 2009 Contador Alberto Spain 26 Astana
## 97 2010 Andy Schleck Luxembourg 25 Saxo Bank
## 98 2011 Cadel Evans Australia 34 BMC
## 99 2012 Bradley Wiggins Great Britain 32 Sky
## 100 2013 Christopher Froome Great Britain 28 Sky
## 101 2014 Vincezo Nibali Italy 29 Astana
## TotalTime.h.min.sec. TotalTime.h. Average.Speed Stages DistanceRidden
## 94 91.00.26 91.0 39.2 21 3570
## 95 87.52.52 87.9 40.5 21 3559
## 96 85.48.35 85.8 40.3 21 3460
## 97 91.58.48 92.0 39.6 20 3642
## 98 86.12.22 86.2 39.8 21 3630
## 99 87.34.47 87.6 39.9 20 3497
## 100 94.33.00 94.5 40.5 21 3404
## 101 89.56.06 89.9 40.7 21 3664
## StartingRiders FinishingRiders
## 94 189 141
## 95 180 145
## 96 180 156
## 97 198 170
## 98 198 167
## 99 198 153
## 100 198 169
## 101 198 164
```

Let's find who was the winner in 1998

```
filter(Tour, Year == 1998)
```

```
## Year Winner Country Age Team TotalTime.h.min.sec.
## 1 1998 Marco Pantani Italy 28 Mercatone Uno 92.49.46
## TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1 92.8 40 21 3875 189
## FinishingRiders
## 1 96
```

How many stages were there in the Tour in the years that Alberto Contador won?

```
filter(Tour, Winner == "Contador Alberto")
```

```
##   Year      Winner Country Age      Team TotalTime.h.min.sec.
## 1 2007 Contador Alberto  Spain 24 Discovery          91.00.26
## 2 2009 Contador Alberto  Spain 26  Astana           85.48.35
##   TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1           91.0           39.2    21           3570           189
## 2           85.8           40.3    21           3460           180
##   FinishingRiders
## 1                141
## 2                156
```

Note that the following commands generate the same output.

```
Tour %>%
  filter(Winner == "Contador Alberto")
```

```
##   Year      Winner Country Age      Team TotalTime.h.min.sec.
## 1 2007 Contador Alberto  Spain 24 Discovery          91.00.26
## 2 2009 Contador Alberto  Spain 26  Astana           85.48.35
##   TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1           91.0           39.2    21           3570           189
## 2           85.8           40.3    21           3460           180
##   FinishingRiders
## 1                141
## 2                156
```

The pipe operator (%>%) can be used to connect one dataframe or command to another.

What was the slowest average speed of any tour? Fastest?

```
filter(Tour, Average.Speed == min(Average.Speed))
```

```
##   Year      Winner Country Age      Team TotalTime.h.min.sec.
## 1 1919 Fir Lambot Belgium 33 La Sportive          231.07.15
##   TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1           231           24.1    15           5560           69
##   FinishingRiders
## 1                11
```

```
filter(Tour, Average.Speed == max(Average.Speed))
```

```
##   Year      Winner Country Age      Team TotalTime.h.min.sec.
## 1 2005 Lance Armstrong  USA 34 Discovery          86.15.02
##   TotalTime.h. Average.Speed Stages DistanceRidden StartingRiders
## 1           86.3           41.7    21           3593           189
##   FinishingRiders
## 1                155
```

## What can we say about the Average Speeds?

```
favstats(~ Average.Speed, data = Tour)
```

```
##   min   Q1 median   Q3  max mean   sd   n missing  
## 24.1 29.1  35.4 38.6 41.7   34 5.19 101      0
```