importing_data_e1

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Contents

Tutorium in R

Importing data with R

Exercise Introduction to Importing Data in R - Number 1

By: Teodor Chakarov 12141198 import csv

```
pools <- read.csv("swimming_pools.csv")
str(pools)
```

```
## 'data.frame':    20 obs. of  4 variables:
##  $ Name     : chr  "Acacia Ridge Leisure Centre" "Bellbowrie Pool" "Carole Park" "Centenary Pool (in
##  $ Address  : chr  "1391 Beaudesert Road, Acacia Ridge" "Sugarwood Street, Bellbowrie" "Cnr Boundary
##  $ Latitude : num  -27.6 -27.6 -27.6 -27.5 -27.4 ...
##  $ Longitude: num  153 153 153 153 153 ...
```

stringsAsFactors convert strings columns in readable values

```
pools = read.csv("swimming_pools.csv", stringsAsFactors=FALSE)
```

Import txt file, setting separator by TABS, removing the header and give us an overveiw of the data

```
hotdogs = read.delim("hotdogs.txt", sep="\t", header = FALSE)
summary(hotdogs)
```

```
##       V1                  V2              V3
##  Length:54          Min.   : 86.0   Min.   :144.0
##  Class :character   1st Qu.:132.0   1st Qu.:362.5
##  Mode  :character   Median :145.0   Median :405.0
##                     Mean   :145.4   Mean   :424.8
##                     3rd Qu.:172.8   3rd Qu.:503.5
##                     Max.   :195.0   Max.   :645.0
```

Show the path of the file and read the file

```
path <- file.path("hotdogs.txt")
hotdogs <- read.table(path,
                      sep = "",
                      col.names = c("type", "calories", "sodium"))
```

Finish the read.delim() call, setting up the names of the columns

```
hotdogs <- read.delim("hotdogs.txt", header = FALSE, col.names = c("type", "calories", "sodium"))
lily <- hotdogs[which.min(hotdogs$calories), ]
print(lily)
```

```
##       type calories sodium
## 50 Poultry       86    358
```

Select the observation with the most sodium: tom

```
tom <- hotdogs[which.max(hotdogs$sodium), ]
print(tom)
```

```
##    type calories sodium
## 15 Beef      190    645
```

```
library(readr)

hotdogs2 <- read.delim("hotdogs.txt", header = FALSE,
                       col.names = c("type", "calories", "sodium"),
                       colClasses = c("factor", "NULL", "numeric"))

properties <- c("area", "temp", "size", "storage", "method",
                "texture", "flavor", "moistness")

potatoes <- read_tsv("potatoes.txt", col_names=properties)
```

```
## Rows: 160 Columns: 8
## -- Column specification --------------------------------------------------------
## Delimiter: "\t"
## dbl (8): area, temp, size, storage, method, texture, flavor, moistness
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
head(potatoes)
```

```
## # A tibble: 6 x 8
##    area  temp  size storage method texture flavor moistness
##   <dbl> <dbl> <dbl>   <dbl>  <dbl>   <dbl>  <dbl>     <dbl>
## 1     1     1     1       1      1     2.9    3.2       3
## 2     1     1     1       1      2     2.3    2.5       2.6
## 3     1     1     1       1      3     2.5    2.8       2.8
## 4     1     1     1       1      4     2.1    2.9       2.4
## 5     1     1     1       1      5     1.9    2.8       2.2
## 6     1     1     1       2      1     1.8    3         1.7
```

Skipping the first 2 observations

```
potatoes_fragment <- read_tsv("potatoes.txt", skip = 2, n_max = 3, col_names = properties)
```

```
## Rows: 3 Columns: 8
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: "\t"
## dbl (8): area, temp, size, storage, method, texture, flavor, moistness
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
head(potatoes_fragment)
```

```
## # A tibble: 3 x 8
##    area  temp  size storage method texture flavor moistness
##   <dbl> <dbl> <dbl>   <dbl>  <dbl>   <dbl>  <dbl>     <dbl>
## 1     1     1     1       1      3     2.5    2.8       2.8
## 2     1     1     1       1      4     2.1    2.9       2.4
## 3     1     1     1       1      5     1.9    2.8       2.2
```

Set collector to for setting types of the columns

```
fac <- col_factor(levels = c("Beef", "Meat", "Poultry"))
int <- col_integer()
hotdogs_factor <- read_tsv("hotdogs.txt",
                           col_names = c("type", "calories", "sodium"),
                           col_types = list(fac,int,int))

# Before
summary(hotdogs) #  type: Class :character  Mode  :character
```

```
##      type              calories         sodium
##  Length:54          Min.   : 86.0   Min.   :144.0
##  Class :character   1st Qu.:132.0   1st Qu.:362.5
##  Mode  :character   Median :145.0   Median :405.0
##                     Mean   :145.4   Mean   :424.8
##                     3rd Qu.:172.8   3rd Qu.:503.5
##                     Max.   :195.0   Max.   :645.0
```

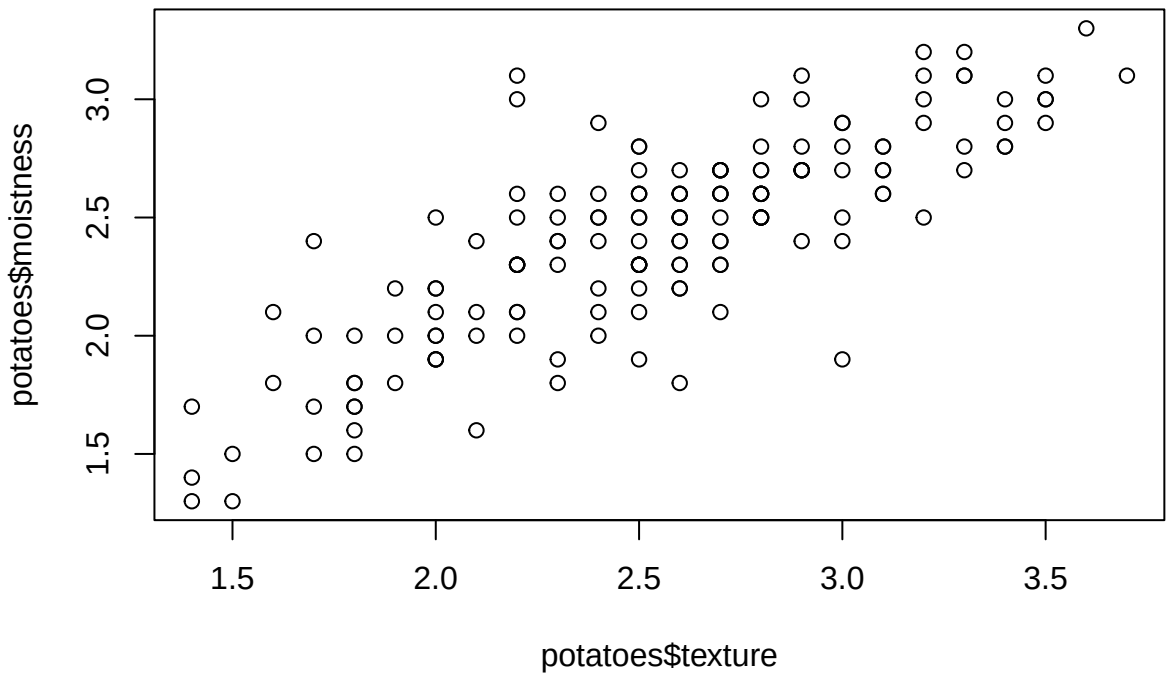
```
# After
summary(hotdogs_factor)# type: Beef: 20, Meat: 17, Poultry: 17
```

```
##       type       calories         sodium
##  Beef   :20   Min.   : 86.0   Min.   :144.0
##  Meat   :17   1st Qu.:132.0   1st Qu.:362.5
##  Poultry:17   Median :145.0   Median :405.0
##               Mean   :145.4   Mean   :424.8
##               3rd Qu.:172.8   3rd Qu.:503.5
##               Max.   :195.0   Max.   :645.0
```

Visulization

```
library(data.table)
potatoes <- fread("potatoes.csv") # easy and fast to use for importing data
potatoes <- fread("potatoes.csv", select=c("texture", "moistness"))

# Plot texture (x) and moistness (y) of potatoes
plot(x=potatoes$texture, y=potatoes$moistness)
```




```
selecting only the columns we need

fread("path/to/file.txt", drop = 2:4)
fread("path/to/file.txt", select = c(1, 5))
fread("path/to/file.txt", drop = c("b", "c", "d"))
fread("path/to/file.txt", select = c("a", "e"))
```

The class of the result of fread() is both data.table and data.frame. read_csv() creates an object with three classes: tbl_df, tbl and data.frame

Working with Excel

This package is on heavy development -> gdata is more reliable

```
library(readxl)
excel_sheets("urbanpop.xlsx") # names of the sheets in the excel file
```

```
## [1] "1960-1966" "1967-1974" "1975-2011"
```

Read the sheets, one by one

```
pop_1 <- read_excel("urbanpop.xlsx", sheet = 1)
pop_2 <- read_excel("urbanpop.xlsx", sheet = 2)
pop_3 <- read_excel("urbanpop.xlsx", sheet = 3)
```

Put pop_1, pop_2 and pop_3 in a list: pop_list

```
pop_list <- list(pop_1, pop_2, pop_3)
str(pop_list)
```

```
## List of 3
##  $ : tibble [209 x 8] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1960   : num [1:209] 769308 494443 3293999 NA NA ...
##   ..$ 1961   : num [1:209] 814923 511803 3515148 13660 8724 ...
##   ..$ 1962   : num [1:209] 858522 529439 3739963 14166 9700 ...
##   ..$ 1963   : num [1:209] 903914 547377 3973289 14759 10748 ...
##   ..$ 1964   : num [1:209] 951226 565572 4220987 15396 11866 ...
##   ..$ 1965   : num [1:209] 1000582 583983 4488176 16045 13053 ...
##   ..$ 1966   : num [1:209] 1058743 602512 4649105 16693 14217 ...
##  $ : tibble [209 x 9] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1967   : num [1:209] 1119067 621180 4826104 17349 15440 ...
##   ..$ 1968   : num [1:209] 1182159 639964 5017299 17996 16727 ...
##   ..$ 1969   : num [1:209] 1248901 658853 5219332 18619 18088 ...
##   ..$ 1970   : num [1:209] 1319849 677839 5429743 19206 19529 ...
##   ..$ 1971   : num [1:209] 1409001 698932 5619042 19752 20929 ...
##   ..$ 1972   : num [1:209] 1502402 720207 5815734 20263 22406 ...
##   ..$ 1973   : num [1:209] 1598835 741681 6020647 20742 23937 ...
##   ..$ 1974   : num [1:209] 1696445 763385 6235114 21194 25482 ...
##  $ : tibble [209 x 38] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1975   : num [1:209] 1793266 785350 6460138 21632 27019 ...
##   ..$ 1976   : num [1:209] 1905033 807990 6774099 22047 28366 ...
##   ..$ 1977   : num [1:209] 2021308 830959 7102902 22452 29677 ...
##   ..$ 1978   : num [1:209] 2142248 854262 7447728 22899 31037 ...
##   ..$ 1979   : num [1:209] 2268015 877898 7810073 23457 32572 ...
##   ..$ 1980   : num [1:209] 2398775 901884 8190772 24177 34366 ...
##   ..$ 1981   : num [1:209] 2493265 927224 8637724 25173 36356 ...
##   ..$ 1982   : num [1:209] 2590846 952447 9105820 26342 38618 ...
##   ..$ 1983   : num [1:209] 2691612 978476 9591900 27655 40983 ...
##   ..$ 1984   : num [1:209] 2795656 1006613 10091289 29062 43207 ...
##   ..$ 1985   : num [1:209] 2903078 1037541 10600112 30524 45119 ...
##   ..$ 1986   : num [1:209] 3006983 1072365 11101757 32014 46254 ...
##   ..$ 1987   : num [1:209] 3113957 1109954 11609104 33548 47019 ...
##   ..$ 1988   : num [1:209] 3224082 1146633 12122941 35095 47669 ...
##   ..$ 1989   : num [1:209] 3337444 1177286 12645263 36618 48577 ...
##   ..$ 1990   : num [1:209] 3454129 1198293 13177079 38088 49982 ...
##   ..$ 1991   : num [1:209] 3617842 1215445 13708813 39600 51972 ...
##   ..$ 1992   : num [1:209] 3788685 1222544 14248297 41049 54469 ...
##   ..$ 1993   : num [1:209] 3966956 1222812 14789176 42443 57079 ...
##   ..$ 1994   : num [1:209] 4152960 1221364 15322651 43798 59243 ...
##   ..$ 1995   : num [1:209] 4347018 1222234 15842442 45129 60598 ...
##   ..$ 1996   : num [1:209] 4531285 1228760 16395553 46343 60927 ...
##   ..$ 1997   : num [1:209] 4722603 1238090 16935451 47527 60462 ...
##   ..$ 1998   : num [1:209] 4921227 1250366 17469200 48705 59685 ...
##   ..$ 1999   : num [1:209] 5127421 1265195 18007937 49906 59281 ...
##   ..$ 2000   : num [1:209] 5341456 1282223 18560597 51151 59719 ...
##   ..$ 2001   : num [1:209] 5564492 1315690 19198872 52341 61062 ...
```

```
##   ..$ 2002   : num [1:209] 5795940 1352278 19854835 53583 63212 ...
##   ..$ 2003   : num [1:209] 6036100 1391143 20529356 54864 65802 ...
##   ..$ 2004   : num [1:209] 6285281 1430918 21222198 56166 68301 ...
##   ..$ 2005   : num [1:209] 6543804 1470488 21932978 57474 70329 ...
##   ..$ 2006   : num [1:209] 6812538 1512255 22625052 58679 71726 ...
##   ..$ 2007   : num [1:209] 7091245 1553491 23335543 59894 72684 ...
##   ..$ 2008   : num [1:209] 7380272 1594351 24061749 61118 73335 ...
##   ..$ 2009   : num [1:209] 7679982 1635262 24799591 62357 73897 ...
##   ..$ 2010   : num [1:209] 7990746 1676545 25545622 63616 74525 ...
##   ..$ 2011   : num [1:209] 8316976 1716842 26216968 64817 75207 ...
```

Read all Excel sheets with lapply()

```
pop_list <- lapply(excel_sheets("urbanpop.xlsx"), read_excel, path = "urbanpop.xlsx")

str(pop_list)
```

```
## List of 3
##  $ : tibble [209 x 8] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1960   : num [1:209] 769308 494443 3293999 NA NA ...
##   ..$ 1961   : num [1:209] 814923 511803 3515148 13660 8724 ...
##   ..$ 1962   : num [1:209] 858522 529439 3739963 14166 9700 ...
##   ..$ 1963   : num [1:209] 903914 547377 3973289 14759 10748 ...
##   ..$ 1964   : num [1:209] 951226 565572 4220987 15396 11866 ...
##   ..$ 1965   : num [1:209] 1000582 583983 4488176 16045 13053 ...
##   ..$ 1966   : num [1:209] 1058743 602512 4649105 16693 14217 ...
##  $ : tibble [209 x 9] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1967   : num [1:209] 1119067 621180 4826104 17349 15440 ...
##   ..$ 1968   : num [1:209] 1182159 639964 5017299 17996 16727 ...
##   ..$ 1969   : num [1:209] 1248901 658853 5219332 18619 18088 ...
##   ..$ 1970   : num [1:209] 1319849 677839 5429743 19206 19529 ...
##   ..$ 1971   : num [1:209] 1409001 698932 5619042 19752 20929 ...
##   ..$ 1972   : num [1:209] 1502402 720207 5815734 20263 22406 ...
##   ..$ 1973   : num [1:209] 1598835 741681 6020647 20742 23937 ...
##   ..$ 1974   : num [1:209] 1696445 763385 6235114 21194 25482 ...
##  $ : tibble [209 x 38] (S3: tbl_df/tbl/data.frame)
##   ..$ country: chr [1:209] "Afghanistan" "Albania" "Algeria" "American Samoa" ...
##   ..$ 1975   : num [1:209] 1793266 785350 6460138 21632 27019 ...
##   ..$ 1976   : num [1:209] 1905033 807990 6774099 22047 28366 ...
##   ..$ 1977   : num [1:209] 2021308 830959 7102902 22452 29677 ...
##   ..$ 1978   : num [1:209] 2142248 854262 7447728 22899 31037 ...
##   ..$ 1979   : num [1:209] 2268015 877898 7810073 23457 32572 ...
##   ..$ 1980   : num [1:209] 2398775 901884 8190772 24177 34366 ...
##   ..$ 1981   : num [1:209] 2493265 927224 8637724 25173 36356 ...
##   ..$ 1982   : num [1:209] 2590846 952447 9105820 26342 38618 ...
##   ..$ 1983   : num [1:209] 2691612 978476 9591900 27655 40983 ...
##   ..$ 1984   : num [1:209] 2795656 1006613 10091289 29062 43207 ...
##   ..$ 1985   : num [1:209] 2903078 1037541 10600112 30524 45119 ...
##   ..$ 1986   : num [1:209] 3006983 1072365 11101757 32014 46254 ...
##   ..$ 1987   : num [1:209] 3113957 1109954 11609104 33548 47019 ...
##   ..$ 1988   : num [1:209] 3224082 1146633 12122941 35095 47669 ...
##   ..$ 1989   : num [1:209] 3337444 1177286 12645263 36618 48577 ...
##   ..$ 1990   : num [1:209] 3454129 1198293 13177079 38088 49982 ...
```

```
##   ..$ 1991   : num [1:209] 3617842 1215445 13708813 39600 51972 ...
##   ..$ 1992   : num [1:209] 3788685 1222544 14248297 41049 54469 ...
##   ..$ 1993   : num [1:209] 3966956 1222812 14789176 42443 57079 ...
##   ..$ 1994   : num [1:209] 4152960 1221364 15322651 43798 59243 ...
##   ..$ 1995   : num [1:209] 4347018 1222234 15842442 45129 60598 ...
##   ..$ 1996   : num [1:209] 4531285 1228760 16395553 46343 60927 ...
##   ..$ 1997   : num [1:209] 4722603 1238090 16935451 47527 60462 ...
##   ..$ 1998   : num [1:209] 4921227 1250366 17469200 48705 59685 ...
##   ..$ 1999   : num [1:209] 5127421 1265195 18007937 49906 59281 ...
##   ..$ 2000   : num [1:209] 5341456 1282223 18560597 51151 59719 ...
##   ..$ 2001   : num [1:209] 5564492 1315690 19198872 52341 61062 ...
##   ..$ 2002   : num [1:209] 5795940 1352278 19854835 53583 63212 ...
##   ..$ 2003   : num [1:209] 6036100 1391143 20529356 54864 65802 ...
##   ..$ 2004   : num [1:209] 6285281 1430918 21222198 56166 68301 ...
##   ..$ 2005   : num [1:209] 6543804 1470488 21932978 57474 70329 ...
##   ..$ 2006   : num [1:209] 6812538 1512255 22625052 58679 71726 ...
##   ..$ 2007   : num [1:209] 7091245 1553491 23335543 59894 72684 ...
##   ..$ 2008   : num [1:209] 7380272 1594351 24061749 61118 73335 ...
##   ..$ 2009   : num [1:209] 7679982 1635262 24799591 62357 73897 ...
##   ..$ 2010   : num [1:209] 7990746 1676545 25545622 63616 74525 ...
##   ..$ 2011   : num [1:209] 8316976 1716842 26216968 64817 75207 ...
```

Setting column names using loop

```
cols <- c("country", paste0("year_", 1960:1966))
pop_b <- read_excel("urbanpop_nonames.xlsx", col_names = cols)
```

Import the second sheet of urbanpop.xlsx, skipping the first 21 rows: urbanpop_sel

```
urbanpop_sel <- read_excel("urbanpop.xlsx", skip=21, col_names=FALSE, sheet = 2)
```

```
## New names:
## * `` -> ...1
## * `` -> ...2
## * `` -> ...3
## * `` -> ...4
## * `` -> ...5
## * ...
```

```
head(urbanpop_sel, n=1)
```

```
## # A tibble: 1 x 9
##   ...1     ...2    ...3    ...4    ...5    ...6    ...7    ...8    ...9
##   <chr>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
## 1 Benin 382022. 411859. 443013. 475611. 515820. 557938. 602093. 648410.
```

```
library(gdata)
```

```
## gdata: Unable to locate valid perl interpreter
## gdata:
## gdata: read.xls() will be unable to read Excel XLS and XLSX files
## gdata: unless the 'perl=' argument is used to specify the location of a
## gdata: valid perl intrpreter.
## gdata:
## gdata: (To avoid display of this message in the future, please ensure
## gdata: perl is installed and available on the executable search path.)
```

```
## gdata: Unable to load perl libaries needed by read.xls()
```

```
## gdata: to support 'XLX' (Excel 97-2004) files.
##
## gdata: Unable to load perl libaries needed by read.xls()
## gdata: to support 'XLSX' (Excel 2007+) files.
##
## gdata: Run the function 'installXLSXsupport()'
## gdata: to automatically download and install the perl
## gdata: libaries needed to support Excel XLS and XLSX formats.
##
## Attaching package: 'gdata'
## The following objects are masked from 'package:data.table':
##
##     first, last
## The following object is masked from 'package:stats':
##
##     nobs
## The following object is masked from 'package:utils':
##
##     object.size
## The following object is masked from 'package:base':
##
##     startsWith
```

```
perl<- "C:\\Users\\tedoc\\OneDrive\\Dokumente\\R\\win-library\\4.1\\rtools42\\usr\\bin\\perl5.32.1.exe"
urban_pop <- read.xls("urbanpop.xls", sheet = "1967-1974", perl = perl)
```

```
## Warning in system(cmd, intern = intern, wait = wait | intern,
## show.output.on.console = wait, : running command 'C:\Windows\system32\cmd.exe /c
## ftype perl' had status 2

## Warning in system(cmd, intern = intern, wait = wait | intern,
## show.output.on.console = wait, : running command 'C:\Windows\system32\cmd.exe /c
## ftype perl' had status 2
```

```
head(urban_pop, n = 11)
```

```
##                country       X1967       X1968       X1969       X1970
## 1          Afghanistan  1119067.20  1182159.06  1248900.79  1319848.78
## 2              Albania   621179.85   639964.46   658853.12   677839.12
## 3              Algeria  4826104.22  5017298.60  5219331.87  5429743.08
## 4       American Samoa    17348.66    17995.51    18618.68    19206.39
## 5              Andorra    15439.62    16726.99    18088.32    19528.96
## 6               Angola   757496.32   798459.26   841261.96   886401.63
## 7  Antigua and Barbuda    22086.25    22149.39    22182.92    22180.87
## 8            Argentina 17753280.98 18124103.64 18510462.30 18918072.79
## 9              Armenia  1337032.09  1392892.13  1449641.49  1507619.77
## 10               Aruba    29414.72    29576.09    29737.87    29901.57
## 11           Australia  9934404.03 10153969.77 10412390.67 10664093.55
##          X1971       X1972       X1973       X1974
## 1   1409001.09  1502401.79  1598835.45  1696444.83
## 2    698932.25   720206.57   741681.04   763385.45
```

```
## 3   5619041.53  5815734.49  6020647.35  6235114.38
## 4     19752.02    20262.67    20741.97    21194.38
## 5     20928.73    22405.84    23937.05    25481.98
## 6    955010.09  1027397.35  1103829.78  1184486.23
## 7     22560.87    22907.76    23221.29    23502.92
## 8  19329718.16 19763078.00 20211424.85 20664728.90
## 9   1564367.60  1622103.53  1680497.75  1739063.02
## 10    30081.36    30279.76    30467.42    30602.87
## 11 11047706.39 11269945.50 11461120.68 11772934.25
```

```
columns <- c("country", paste0("year_", 1967:1974))


urban_pop <- read.xls("urbanpop.xls", sheet = 2,
                      skip = 50, header = FALSE, stringsAsFactors = FALSE,
                      col.names = columns, perl = perl)
```

```
## Warning in system(cmd, intern = intern, wait = wait | intern,
## show.output.on.console = wait, : running command 'C:\Windows\system32\cmd.exe /c
## ftype perl' had status 2

## Warning in system(cmd, intern = intern, wait = wait | intern,
## show.output.on.console = wait, : running command 'C:\Windows\system32\cmd.exe /c
## ftype perl' had status 2
```

```
head(urban_pop, n =10)
```

```
##               country   year_1967   year_1968   year_1969   year_1970
## 1              Cyprus   231929.74   237831.38   243983.34   250164.52
## 2      Czech Republic  6204409.91  6266304.50  6326368.97  6348794.89
## 3             Denmark  3777552.62  3826785.08  3874313.99  3930042.97
## 4            Djibouti    77788.04    84694.35    92045.77    99845.22
## 5            Dominica    27550.36    29527.32    31475.62    33328.25
## 6  Dominican Republic  1535485.43  1625455.76  1718315.40  1814060.00
## 7             Ecuador  2059355.12  2151395.14  2246890.79  2345864.41
## 8               Egypt 13798171.00 14248342.19 14703858.22 15162858.52
## 9         El Salvador  1345528.98  1387218.33  1429378.98  1472181.26
## 10  Equatorial Guinea    75364.50    77295.03    78445.74    78411.07
##      year_1971   year_1972   year_1973   year_1974
## 1    261213.21   272407.99   283774.90   295379.83
## 2   6437055.17  6572632.32  6718465.53  6873458.18
## 3   3981360.12  4028247.92  4076867.28  4120201.43
## 4    107799.69   116098.23   125391.58   136606.25
## 5     34761.52    36049.99    37260.05    38501.47
## 6   1915590.38  2020157.01  2127714.45  2238203.87
## 7   2453817.78  2565644.81  2681525.25  2801692.62
## 8  15603661.36 16047814.69 16498633.27 16960827.93
## 9   1527985.34  1584758.18  1642098.95  1699470.87
## 10    77055.29    74596.06    71438.96    68179.26
```

Import 3 different sheets

```
path <- "urbanpop.xls"
urban_sheet1 <- read.xls(path, sheet = 1, stringsAsFactors = FALSE, perl = perl)
urban_sheet2 <- read.xls(path, sheet = 2, stringsAsFactors = FALSE, perl = perl)
urban_sheet3 <- read.xls(path, sheet = 3, stringsAsFactors = FALSE, perl = perl)
```

- Combining the tables but dropping the first colums of 2 and 3

```
urban <- cbind(urban_sheet1, urban_sheet2[-1], urban_sheet3[-1])
```

- Remove all rows with NANs from urban

```
urban_clean <- na.omit(urban)
```

Build a "bridge" between your Excel file and your R session.

```
library("XLConnect")
```

```
## XLConnect 1.0.5 by Mirai Solutions GmbH [aut],
##   Martin Studer [cre],
##   The Apache Software Foundation [ctb, cph] (Apache POI),
##   Graph Builder [ctb, cph] (Curvesapi Java library),
##   Brett Woolridge [ctb, cph] (SparseBitSet Java library)
```

```
## https://mirai-solutions.ch
## https://github.com/miraisolutions/xlconnect
```

```
my_book <- loadWorkbook("urbanpop.xlsx")
class(my_book)
```

```
## [1] "workbook"
## attr(,"package")
## [1] "XLConnect"
```

```
my_book <- loadWorkbook("urbanpop.xlsx")
```

List the sheets in my_book

```
getSheets(my_book)
```

```
## [1] "1960-1966" "1967-1974" "1975-2011"
```

```
# Import the second sheet in my_book
readWorksheet(my_book, sheet = 2)
```

```
##                          country        X1967        X1968        X1969
## 1                    Afghanistan 1.119067e+06 1.182159e+06 1.248901e+06
## 2                        Albania 6.211798e+05 6.399645e+05 6.588531e+05
## 3                        Algeria 4.826104e+06 5.017299e+06 5.219332e+06
## 4                 American Samoa 1.734866e+04 1.799551e+04 1.861868e+04
## 5                        Andorra 1.543962e+04 1.672699e+04 1.808832e+04
## 6                         Angola 7.574963e+05 7.984593e+05 8.412620e+05
## 7            Antigua and Barbuda 2.208625e+04 2.214939e+04 2.218292e+04
## 8                      Argentina 1.775328e+07 1.812410e+07 1.851046e+07
## 9                        Armenia 1.337032e+06 1.392892e+06 1.449641e+06
## 10                         Aruba 2.941472e+04 2.957609e+04 2.973787e+04
## 11                     Australia 9.934404e+06 1.015397e+07 1.041239e+07
## 12                       Austria 4.803149e+06 4.831817e+06 4.852208e+06
## 13                    Azerbaijan 2.446990e+06 2.495725e+06 2.542062e+06
## 14                       Bahamas 9.868390e+04 1.036697e+05 1.084730e+05
## 15                       Bahrain 1.619616e+05 1.663785e+05 1.714590e+05
## 16                    Bangladesh 4.173453e+06 4.484842e+06 4.790505e+06
## 17                      Barbados 8.819371e+04 8.858041e+04 8.902489e+04
## 18                       Belarus 3.556448e+06 3.696854e+06 3.838003e+06
```

```
## 19                      Belgium 8.950504e+06 8.999366e+06 9.038506e+06
## 20                       Belize 5.879024e+04 5.971173e+04 6.049220e+04
## 21                        Benin 3.820221e+05 4.118595e+05 4.430131e+05
## 22                      Bermuda 5.200000e+04 5.300000e+04 5.400000e+04
## 23                       Bhutan 1.437897e+04 1.561689e+04 1.694642e+04
## 24                      Bolivia 1.527065e+06 1.575177e+06 1.625173e+06
## 25       Bosnia and Herzegovina 8.516924e+05 8.902697e+05 9.294496e+05
## 26                     Botswana 3.431976e+04 4.057616e+04 4.722223e+04
## 27                       Brazil 4.719352e+07 4.931688e+07 5.148910e+07
## 28                       Brunei 6.128905e+04 6.622218e+04 7.150276e+04
## 29                     Bulgaria 4.019906e+06 4.158186e+06 4.300669e+06
## 30                 Burkina Faso 2.968238e+05 3.086611e+05 3.209607e+05
## 31                      Burundi 7.616560e+04 7.881625e+04 8.135573e+04
## 32                     Cambodia 8.357562e+05 9.263155e+05 1.017799e+06
## 33                     Cameroon 1.157892e+06 1.231243e+06 1.308158e+06
## 34                       Canada 1.510423e+07 1.546449e+07 1.579236e+07
## 35                   Cape Verde 4.724476e+04 4.923400e+04 5.135658e+04
## 36                Cayman Islands 8.875000e+03 9.002000e+03 9.216000e+03
## 37       Central African Republic 4.303721e+05 4.529338e+05 4.761054e+05
## 38                         Chad 3.315042e+05 3.605791e+05 3.909776e+05
## 39                Channel Islands 4.329456e+04 4.344349e+04 4.358417e+04
## 40                         Chile 6.606825e+06 6.805959e+06 7.005123e+06
## 41                         China 1.343974e+08 1.368900e+08 1.396005e+08
## 42                      Colombia 1.033119e+07 1.078053e+07 1.123560e+07
## 43                       Comoros 3.978906e+04 4.183902e+04 4.396565e+04
## 44              Congo, Dem. Rep. 5.161472e+06 5.475208e+06 5.802069e+06
## 45                   Congo, Rep. 4.506698e+05 4.733352e+05 4.972107e+05
## 46                    Costa Rica 6.217858e+05 6.499164e+05 6.782539e+05
## 47                 Cote d'Ivoire 1.243350e+06 1.330719e+06 1.424438e+06
## 48                       Croatia 1.608233e+06 1.663051e+06 1.717607e+06
## 49                          Cuba 4.927341e+06 5.032014e+06 5.137260e+06
## 50                        Cyprus 2.319297e+05 2.378314e+05 2.439833e+05
## 51                Czech Republic 6.204410e+06 6.266305e+06 6.326369e+06
## 52                       Denmark 3.777553e+06 3.826785e+06 3.874314e+06
## 53                      Djibouti 7.778804e+04 8.469435e+04 9.204577e+04
## 54                      Dominica 2.755036e+04 2.952732e+04 3.147562e+04
## 55            Dominican Republic 1.535485e+06 1.625456e+06 1.718315e+06
## 56                       Ecuador 2.059355e+06 2.151395e+06 2.246891e+06
## 57                         Egypt 1.379817e+07 1.424834e+07 1.470386e+07
## 58                   El Salvador 1.345529e+06 1.387218e+06 1.429379e+06
## 59               Equatorial Guinea 7.536450e+04 7.729503e+04 7.844574e+04
## 60                       Eritrea 2.025150e+05 2.121646e+05 2.221863e+05
## 61                       Estonia 8.283882e+05 8.472205e+05 8.662579e+05
## 62                      Ethiopia 2.139904e+06 2.249670e+06 2.365149e+06
## 63                  Faeroe Islands 9.878976e+03 1.017780e+04 1.047732e+04
## 64                          Fiji 1.632216e+05 1.690663e+05 1.749364e+05
## 65                       Finland 2.822234e+06 2.872371e+06 2.908120e+06
## 66                        France 3.486791e+07 3.554830e+07 3.622608e+07
## 67                French Polynesia 5.087720e+04 5.421077e+04 5.768190e+04
## 68                         Gabon 1.380242e+05 1.478459e+05 1.582525e+05
## 69                        Gambia 7.036836e+04 7.628527e+04 8.261546e+04
## 70                       Georgia 1.863610e+06 1.900576e+06 1.938616e+06
## 71                       Germany 5.546852e+07 5.576506e+07 5.625874e+07
## 72                         Ghana 2.219604e+06 2.311442e+06 2.408851e+06
```

```
## 73                       Greece 4.300274e+06 4.415310e+06 4.518763e+06
## 74                    Greenland 2.879686e+04 3.040882e+04 3.206093e+04
## 75                      Grenada 3.004680e+04 3.019593e+04 3.031077e+04
## 76                         Guam 4.629560e+04 4.844571e+04 5.065242e+04
## 77                    Guatemala 1.739459e+06 1.802725e+06 1.868309e+06
## 78                       Guinea 5.618868e+05 5.962425e+05 6.304226e+05
## 79                Guinea-Bissau 8.719596e+04 8.804516e+04 8.932212e+04
## 80                       Guyana 1.979563e+05 2.033071e+05 2.081042e+05
## 81                        Haiti 8.205857e+05 8.567168e+05 8.934834e+05
## 82                     Honduras 6.700552e+05 7.041621e+05 7.396318e+05
## 83            Hong Kong, China 3.236781e+06 3.316190e+06 3.379661e+06
## 84                      Hungary 6.013289e+06 6.079237e+06 6.147720e+06
## 85                      Iceland 1.661399e+05 1.693063e+05 1.717736e+05
## 86                        India 9.936339e+07 1.025948e+08 1.059532e+08
## 87                    Indonesia 1.786885e+07 1.862152e+07 1.940053e+07
## 88                         Iran 1.024223e+07 1.074839e+07 1.127204e+07
## 89                         Iraq 4.785700e+06 5.053788e+06 5.335012e+06
## 90                      Ireland 1.448735e+06 1.472843e+06 1.499153e+06
## 91                  Isle of Man 2.974060e+04 3.041582e+04 3.107182e+04
## 92                       Israel 2.257543e+06 2.323491e+06 2.403561e+06
## 93                        Italy 3.322924e+07 3.369844e+07 3.414982e+07
## 94                      Jamaica 7.040407e+05 7.257254e+05 7.482876e+05
## 95                        Japan 6.997406e+07 7.101819e+07 7.332929e+07
## 96                       Jordan 7.024333e+05 7.513107e+05 7.991228e+05
## 97                   Kazakhstan 6.018757e+06 6.209379e+06 6.396692e+06
## 98                        Kenya 9.424282e+05 1.010199e+06 1.082085e+06
## 99                     Kiribati 9.944575e+03 1.054187e+04 1.115324e+04
## 100                 North Korea 6.359134e+06 6.797010e+06 7.252939e+06
## 101                 South Korea 1.067144e+07 1.142358e+07 1.219746e+07
## 102                      Kuwait 4.812897e+05 5.332849e+05 5.878232e+05
## 103              Kyrgyz Republic 9.987404e+05 1.037698e+06 1.075216e+06
## 104                         Lao 2.214381e+05 2.333150e+05 2.458144e+05
## 105                      Latvia 1.343553e+06 1.374667e+06 1.404423e+06
## 106                     Lebanon 1.253621e+06 1.320402e+06 1.390579e+06
## 107                     Lesotho 7.042371e+04 7.636722e+04 8.253367e+04
## 108                     Liberia 3.145211e+05 3.336211e+05 3.536543e+05
## 109                       Libya 7.048490e+05 7.933851e+05 8.884915e+05
## 110               Liechtenstein 3.771201e+03 3.835222e+03 3.893073e+03
## 111                   Lithuania 1.415402e+06 1.462854e+06 1.508107e+06
## 112                  Luxembourg 2.442931e+05 2.465394e+05 2.493815e+05
## 113                Macao, China 2.193452e+05 2.292781e+05 2.376078e+05
## 114              Macedonia, FYR 6.524718e+05 6.802103e+05 7.086757e+05
## 115                  Madagascar 7.919615e+05 8.337642e+05 8.775250e+05
## 116                      Malawi 2.242118e+05 2.398927e+05 2.565303e+05
## 117                    Malaysia 3.168042e+06 3.324289e+06 3.484442e+06
## 118                    Maldives 1.252289e+04 1.289746e+04 1.330701e+04
## 119                        Mali 7.656009e+05 7.972307e+05 8.302079e+05
## 120                       Malta 2.796928e+05 2.763384e+05 2.730307e+05
## 121             Marshall Islands 8.640897e+03 9.323270e+03 1.007123e+04
## 122                  Mauritania 1.236419e+05 1.367608e+05 1.505604e+05
## 123                   Mauritius 3.058232e+05 3.195152e+05 3.332923e+05
## 124                      Mexico 2.691017e+07 2.808642e+07 2.931700e+07
## 125          Micronesia, Fed. Sts. 1.354285e+04 1.419170e+04 1.477304e+04
## 126                     Moldova 8.569232e+05 8.959091e+05 9.356514e+05
```

```
## 127                         Monaco 2.304600e+04 2.323400e+04 2.344800e+04
## 128                       Mongolia 5.089148e+05 5.307544e+05 5.535133e+05
## 129                     Montenegro 1.244879e+05 1.292181e+05 1.340713e+05
## 130                        Morocco 4.639516e+06 4.848380e+06 5.061952e+06
## 131                     Mozambique 4.491451e+05 4.803006e+05 5.127060e+05
## 132                        Myanmar 5.297725e+06 5.512884e+06 5.737830e+06
## 133                        Namibia 1.504638e+05 1.578102e+05 1.656184e+05
## 134                          Nepal 4.268625e+05 4.411255e+05 4.559937e+05
## 135                    Netherlands 7.699643e+06 7.803192e+06 7.917513e+06
## 136                  New Caledonia 4.587712e+04 4.868702e+04 5.183153e+04
## 137                    New Zealand 2.173205e+06 2.204526e+06 2.236624e+06
## 138                      Nicaragua 9.730101e+05 1.022348e+06 1.073928e+06
## 139                          Niger 3.039535e+05 3.295439e+05 3.563980e+05
## 140                        Nigeria 1.131884e+07 1.186224e+07 1.242960e+07
## 141       Northern Mariana Islands 7.518953e+03 8.073316e+03 8.655527e+03
## 142                         Norway 2.297185e+06 2.376327e+06 2.456007e+06
## 143                           Oman 1.682955e+05 1.833677e+05 1.995581e+05
## 144                       Pakistan 1.316562e+07 1.366756e+07 1.419101e+07
## 145                          Palau 6.521346e+03 6.627161e+03 6.736073e+03
## 146                         Panama 6.330562e+05 6.609825e+05 6.897512e+05
## 147                Papua New Guinea 1.626460e+05 1.865556e+05 2.117910e+05
## 148                       Paraguay 8.397317e+05 8.662660e+05 8.931292e+05
## 149                           Peru 6.560955e+06 6.884271e+06 7.220337e+06
## 150                    Philippines 1.045064e+07 1.085199e+07 1.126489e+07
## 151                         Poland 1.628965e+07 1.657536e+07 1.683567e+07
## 152                       Portugal 3.340476e+06 3.360472e+06 3.364395e+06
## 153                    Puerto Rico 1.435077e+06 1.480203e+06 1.529021e+06
## 154                          Qatar 7.500451e+04 8.116982e+04 8.804065e+04
## 155                        Romania 7.568698e+06 7.775433e+06 7.962558e+06
## 156                         Russia 7.677947e+07 7.832602e+07 7.988771e+07
## 157                         Rwanda 1.005126e+05 1.065866e+05 1.129610e+05
## 158            St. Kitts and Nevis 1.516557e+04 1.522598e+04 1.528050e+04
## 159                        St. Lucia 2.232508e+04 2.291663e+04 2.351565e+04
## 160 St. Vincent and the Grenadines 2.564178e+04 2.633043e+04 2.703429e+04
## 161                           Samoa 2.636036e+04 2.727841e+04 2.815593e+04
## 162                      San Marino 1.030941e+04 1.071427e+04 1.109522e+04
## 163          Sao Tome and Principe 1.684635e+04 1.841719e+04 2.006490e+04
## 164                    Saudi Arabia 2.195007e+06 2.382635e+06 2.586258e+06
## 165                         Senegal 1.035987e+06 1.096955e+06 1.161241e+06
## 166                          Serbia 2.505613e+06 2.595006e+06 2.683242e+06
## 167                      Seychelles 1.771880e+04 1.876104e+04 1.983538e+04
## 168                    Sierra Leone 5.281695e+05 5.535685e+05 5.797787e+05
## 169                       Singapore 1.978000e+06 2.012000e+06 2.043000e+06
## 170                  Slovak Republic 1.719618e+06 1.768967e+06 1.818929e+06
## 171                        Slovenia 5.795047e+05 6.000206e+05 6.187531e+05
## 172                 Solomon Islands 1.151482e+04 1.237527e+04 1.329659e+04
## 173                         Somalia 7.047038e+05 7.433007e+05 7.810217e+05
## 174                    South Africa 9.830232e+06 1.006591e+07 1.030848e+07
## 175                           Spain 2.064974e+07 2.123678e+07 2.176544e+07
## 176                       Sri Lanka 2.151152e+06 2.249555e+06 2.344592e+06
## 177                           Sudan 1.466502e+06 1.571927e+06 1.683562e+06
## 178                        Suriname 1.638993e+05 1.673102e+05 1.698198e+05
## 179                       Swaziland 3.199762e+04 3.554773e+04 3.929612e+04
## 180                          Sweden 6.187907e+06 6.285731e+06 6.393453e+06
```

```
## 181                    Switzerland 3.324087e+06 3.404449e+06 3.481651e+06
## 182                          Syria 2.377889e+06 2.499429e+06 2.626816e+06
## 183                     Tajikistan 9.611929e+05 1.000669e+06 1.041608e+06
## 184                       Tanzania 8.384494e+05 9.108258e+05 9.872961e+05
## 185                       Thailand 6.919690e+06 7.176231e+06 7.440174e+06
## 186                    Timor-Leste 6.802067e+04 7.108209e+04 7.435281e+04
## 187                           Togo 3.221940e+05 3.621139e+05 4.040164e+05
## 188                          Tonga 1.563131e+04 1.614767e+04 1.661674e+04
## 189            Trinidad and Tobago 1.232921e+05 1.208498e+05 1.181071e+05
## 190                        Tunisia 1.992479e+06 2.070869e+06 2.149857e+06
## 191                         Turkey 1.191986e+07 1.244807e+07 1.299329e+07
## 192                   Turkmenistan 9.517698e+05 9.822601e+05 1.013434e+06
## 193       Turks and Caicos Islands 2.798837e+03 2.804887e+03 2.829033e+03
## 194                         Tuvalu 1.415014e+03 1.480186e+03 1.545270e+03
## 195                         Uganda 5.120829e+05 5.499091e+05 5.891064e+05
## 196                        Ukraine 2.416635e+07 2.475757e+07 2.534887e+07
## 197           United Arab Emirates 1.280378e+05 1.390527e+05 1.555970e+05
## 198                 United Kingdom 4.260294e+07 4.273308e+07 4.283308e+07
## 199                  United States 1.442017e+08 1.463404e+08 1.484759e+08
## 200                        Uruguay 2.247503e+06 2.273438e+06 2.295858e+06
## 201                     Uzbekistan 3.913188e+06 4.067599e+06 4.227790e+06
## 202                        Vanuatu 9.208354e+03 9.621427e+03 1.005774e+04
## 203                      Venezuela 6.678933e+06 6.994264e+06 7.324840e+06
## 204                        Vietnam 6.865532e+06 7.169607e+06 7.487421e+06
## 205          Virgin Islands (U.S.) 3.342853e+04 3.661847e+04 4.004103e+04
## 206                          Yemen 6.973814e+05 7.369436e+05 7.769681e+05
## 207                         Zambia 9.841980e+05 1.069557e+06 1.160044e+06
## 208                       Zimbabwe 7.416051e+05 7.927728e+05 8.467739e+05
## 209                    South Sudan 3.157901e+05 3.210970e+05 3.268101e+05
##            X1970        X1971        X1972        X1973        X1974
## 1   1.319849e+06 1.409001e+06 1.502402e+06 1.598835e+06 1.696445e+06
## 2   6.778391e+05 6.989322e+05 7.202066e+05 7.416810e+05 7.633855e+05
## 3   5.429743e+06 5.619042e+06 5.815734e+06 6.020647e+06 6.235114e+06
## 4   1.920639e+04 1.975202e+04 2.026267e+04 2.074197e+04 2.119438e+04
## 5   1.952896e+04 2.092873e+04 2.240584e+04 2.393705e+04 2.548198e+04
## 6   8.864016e+05 9.550101e+05 1.027397e+06 1.103830e+06 1.184486e+06
## 7   2.218087e+04 2.256087e+04 2.290776e+04 2.322129e+04 2.350292e+04
## 8   1.891807e+07 1.932972e+07 1.976308e+07 2.021142e+07 2.066473e+07
## 9   1.507620e+06 1.564368e+06 1.622104e+06 1.680498e+06 1.739063e+06
## 10  2.990157e+04 3.008136e+04 3.027976e+04 3.046742e+04 3.060287e+04
## 11  1.066409e+07 1.104771e+07 1.126995e+07 1.146112e+07 1.177293e+07
## 12  4.872871e+06 4.895910e+06 4.925699e+06 4.954325e+06 4.964026e+06
## 13  2.586413e+06 2.660993e+06 2.734825e+06 2.807955e+06 2.880447e+06
## 14  1.130101e+05 1.171566e+05 1.209989e+05 1.246644e+05 1.283499e+05
## 15  1.775008e+05 1.844398e+05 1.923163e+05 2.014935e+05 2.124162e+05
## 16  5.078286e+06 5.456170e+06 5.812548e+06 6.161815e+06 6.530579e+06
## 17  8.956543e+04 9.055245e+04 9.164208e+04 9.277639e+04 9.387156e+04
## 18  3.978504e+06 4.132164e+06 4.286801e+06 4.440936e+06 4.592935e+06
## 19  9.061057e+06 9.089909e+06 9.137946e+06 9.179155e+06 9.220531e+06
## 20  6.114133e+04 6.183991e+04 6.240329e+04 6.294338e+04 6.362671e+04
## 21  4.756114e+05 5.158195e+05 5.579376e+05 6.020932e+05 6.484097e+05
## 22  5.500000e+04 5.460000e+04 5.420000e+04 5.380000e+04 5.340000e+04
## 23  1.838141e+04 2.017266e+04 2.209976e+04 2.415974e+04 2.634254e+04
## 24  1.677184e+06 1.731437e+06 1.787719e+06 1.845894e+06 1.905749e+06
```

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## 25  9.695495e+05 1.008630e+06 1.048738e+06 1.089648e+06 1.130966e+06
## 26  5.428641e+04 6.186900e+04 6.992963e+04 7.852997e+04 8.775392e+04
## 27  5.371642e+07 5.600051e+07 5.834048e+07 6.074473e+07 6.322438e+07
## 28  7.714802e+04 8.088400e+04 8.478142e+04 8.880798e+04 9.291945e+04
## 29  4.440047e+06 4.554372e+06 4.665864e+06 4.780947e+06 4.904324e+06
## 30  3.336985e+05 3.475107e+05 3.618362e+05 3.767243e+05 3.922410e+05
## 31  8.369155e+04 9.049313e+04 9.717071e+04 1.038732e+05 1.108747e+05
## 32  1.107998e+06 9.614523e+05 8.076237e+05 6.470452e+05 4.811320e+05
## 33  1.388878e+06 1.523689e+06 1.665342e+06 1.814545e+06 1.972201e+06
## 34  1.613246e+07 1.637385e+07 1.663528e+07 1.691758e+07 1.722167e+07
## 35  5.364682e+04 5.638241e+04 5.931521e+04 6.221562e+04 6.475257e+04
## 36  9.545000e+03 1.000400e+04 1.058100e+04 1.125300e+04 1.199000e+04
## 37  4.997496e+05 5.268630e+05 5.546158e+05 5.832534e+05 6.131560e+05
## 38  4.229151e+05 4.628673e+05 5.049060e+05 5.488032e+05 5.940966e+05
## 39  4.371195e+04 4.368323e+04 4.363962e+04 4.355859e+04 4.341204e+04
## 40  7.204920e+06 7.398470e+06 7.592419e+06 7.785880e+06 7.977602e+06
## 41  1.423868e+08 1.463523e+08 1.499932e+08 1.534576e+08 1.566609e+08
## 42  1.169300e+07 1.214719e+07 1.260270e+07 1.306371e+07 1.353659e+07
## 43  4.615440e+04 4.811136e+04 5.012270e+04 5.227286e+04 5.468356e+04
## 44  6.140904e+06 6.282834e+06 6.425372e+06 6.570538e+06 6.721175e+06
## 45  5.224066e+05 5.497894e+05 5.786398e+05 6.088504e+05 6.402364e+05
## 46  7.067986e+05 7.335459e+05 7.604308e+05 7.879183e+05 8.166588e+05
## 47  1.525425e+06 1.638738e+06 1.760508e+06 1.891241e+06 2.031395e+06
## 48  1.773046e+06 1.826422e+06 1.879428e+06 1.932436e+06 1.984976e+06
## 49  5.244279e+06 5.407254e+06 5.572975e+06 5.738231e+06 5.898512e+06
## 50  2.501645e+05 2.612132e+05 2.724080e+05 2.837749e+05 2.953798e+05
## 51  6.348795e+06 6.437055e+06 6.572632e+06 6.718466e+06 6.873458e+06
## 52  3.930043e+06 3.981360e+06 4.028248e+06 4.076867e+06 4.120201e+06
## 53  9.984522e+04 1.077997e+05 1.160982e+05 1.253916e+05 1.366062e+05
## 54  3.332825e+04 3.476152e+04 3.604999e+04 3.726005e+04 3.850147e+04
## 55  1.814060e+06 1.915590e+06 2.020157e+06 2.127714e+06 2.238204e+06
## 56  2.345864e+06 2.453818e+06 2.565645e+06 2.681525e+06 2.801693e+06
## 57  1.516286e+07 1.560366e+07 1.604781e+07 1.649863e+07 1.696083e+07
## 58  1.472181e+06 1.527985e+06 1.584758e+06 1.642099e+06 1.699471e+06
## 59  7.841107e+04 7.705529e+04 7.459606e+04 7.143896e+04 6.817926e+04
## 60  2.325927e+05 2.420318e+05 2.517894e+05 2.620127e+05 2.729047e+05
## 61  8.847697e+05 9.015668e+05 9.191148e+05 9.354101e+05 9.510326e+05
## 62  2.487032e+06 2.609266e+06 2.738496e+06 2.870320e+06 2.998291e+06
## 63  1.077427e+04 1.106567e+04 1.135462e+04 1.164494e+04 1.194279e+04
## 64  1.809345e+05 1.868715e+05 1.929448e+05 1.991372e+05 2.054102e+05
## 65  2.934402e+06 2.976176e+06 3.032239e+06 3.088022e+06 3.142947e+06
## 66  3.691751e+07 3.740758e+07 3.790747e+07 3.840573e+07 3.888504e+07
## 67  6.125900e+04 6.368624e+04 6.613374e+04 6.861999e+04 7.117748e+04
## 68  1.694483e+05 1.845557e+05 2.007952e+05 2.181618e+05 2.365466e+05
## 69  8.942094e+04 9.676352e+04 1.047188e+05 1.132281e+05 1.221660e+05
## 70  1.904782e+06 1.943501e+06 2.058124e+06 2.096168e+06 2.134461e+06
## 71  5.649607e+07 5.664462e+07 5.696131e+07 5.718614e+07 5.725360e+07
## 72  2.515296e+06 2.601135e+06 2.695926e+06 2.795186e+06 2.892229e+06
## 73  4.616575e+06 4.686154e+06 4.766545e+06 4.838297e+06 4.906384e+06
## 74  3.375322e+04 3.449046e+04 3.545317e+04 3.612819e+04 3.665970e+04
## 75  3.040587e+04 3.039084e+04 3.037836e+04 3.034479e+04 3.025489e+04
## 76  5.291621e+04 5.791466e+04 6.308539e+04 6.843879e+04 7.399464e+04
## 77  1.936380e+06 2.002850e+06 2.071676e+06 2.142378e+06 2.214270e+06
## 78  6.636291e+05 7.000651e+05 7.353800e+05 7.696670e+05 8.032624e+05
```

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## 79  9.123325e+04 9.389158e+04 9.722136e+04 1.011893e+05 1.057146e+05
## 80  2.120772e+05 2.155336e+05 2.181112e+05 2.201426e+05 2.221226e+05
## 81  9.307198e+05 9.535772e+05 9.764460e+05 9.996672e+05 1.023722e+06
## 82  7.769459e+05 8.163257e+05 8.577454e+05 9.014120e+05 9.475283e+05
## 83  3.473191e+06 3.564807e+06 3.650021e+06 3.771147e+06 3.870519e+06
## 84  6.214324e+06 6.276071e+06 6.338877e+06 6.403550e+06 6.476603e+06
## 85  1.735679e+05 1.757064e+05 1.790372e+05 1.825107e+05 1.857581e+05
## 86  1.094455e+08 1.137519e+08 1.182288e+08 1.228790e+08 1.277043e+08
## 87  2.020553e+07 2.127053e+07 2.237329e+07 2.351361e+07 2.469105e+07
## 88  1.181219e+07 1.239191e+07 1.299286e+07 1.362195e+07 1.428880e+07
## 89  5.627633e+06 5.924798e+06 6.232252e+06 6.551369e+06 6.884387e+06
## 90  1.529549e+06 1.558990e+06 1.593945e+06 1.631517e+06 1.670769e+06
## 91  3.166567e+04 3.182827e+04 3.189547e+04 3.190477e+04 3.190731e+04
## 92  2.503959e+06 2.598970e+06 2.681284e+06 2.808059e+06 2.909400e+06
## 93  3.459238e+07 3.490238e+07 3.525021e+07 3.564021e+07 3.602531e+07
## 94  7.723456e+05 7.935444e+05 8.162612e+05 8.398898e+05 8.633533e+05
## 95  7.500006e+07 7.678337e+07 7.868950e+07 8.017343e+07 8.256444e+07
## 96  8.440427e+05 8.861825e+05 9.252900e+05 9.628976e+05 1.001686e+06
## 97  6.585936e+06 6.756162e+06 6.928193e+06 7.100036e+06 7.268241e+06
## 98  1.158426e+06 1.261182e+06 1.370525e+06 1.486815e+06 1.610388e+06
## 99  1.177903e+04 1.253191e+04 1.329569e+04 1.407663e+04 1.488213e+04
## 100 7.721750e+06 8.009574e+06 8.299056e+06 8.584095e+06 8.857069e+06
## 101 1.299394e+07 1.374559e+07 1.451567e+07 1.530510e+07 1.611498e+07
## 102 6.451490e+05 7.009110e+05 7.585954e+05 8.180756e+05 8.792009e+05
## 103 1.108956e+06 1.136687e+06 1.165919e+06 1.195227e+06 1.226436e+06
## 104 2.590287e+05 2.739823e+05 2.898053e+05 3.060341e+05 3.219629e+05
## 105 1.432319e+06 1.459146e+06 1.487488e+06 1.516637e+06 1.546838e+06
## 106 1.465634e+06 1.541721e+06 1.622874e+06 1.705275e+06 1.783166e+06
## 107 8.892443e+04 9.542557e+04 1.021606e+05 1.091860e+05 1.165855e+05
## 108 3.746759e+05 3.980213e+05 4.225051e+05 4.482161e+05 4.752605e+05
## 109 9.904397e+05 1.087657e+06 1.191671e+06 1.302852e+06 1.421573e+06
## 110 3.941192e+03 4.016945e+03 4.084375e+03 4.146087e+03 4.206141e+03
## 111 1.555873e+06 1.614349e+06 1.671308e+06 1.727112e+06 1.782930e+06
## 112 2.522550e+05 2.566740e+05 2.618327e+05 2.667899e+05 2.723674e+05
## 113 2.435455e+05 2.467800e+05 2.476067e+05 2.466418e+05 2.448335e+05
## 114 7.381837e+05 7.584522e+05 7.793806e+05 8.010906e+05 8.237298e+05
## 115 9.233980e+05 9.783692e+05 1.035964e+06 1.096280e+06 1.159402e+06
## 116 2.742784e+05 2.974752e+05 3.221866e+05 3.484584e+05 3.762949e+05
## 117 3.649615e+06 3.835042e+06 4.026657e+06 4.224277e+06 4.427442e+06
## 118 1.376876e+04 1.548045e+04 1.732799e+04 1.930163e+04 2.137255e+04
## 119 8.646754e+05 9.031346e+05 9.433393e+05 9.851630e+05 1.028372e+06
## 120 2.714740e+05 2.715449e+05 2.713466e+05 2.711483e+05 2.709913e+05
## 121 1.091076e+04 1.170290e+04 1.258814e+04 1.354212e+04 1.452511e+04
## 122 1.650886e+05 1.839591e+05 2.038400e+05 2.247698e+05 2.467774e+05
## 123 3.471843e+05 3.551136e+05 3.629438e+05 3.708224e+05 3.789698e+05
## 124 3.061321e+07 3.194150e+07 3.333305e+07 3.478046e+07 3.627178e+07
## 125 1.523980e+04 1.553743e+04 1.571629e+04 1.584482e+04 1.602333e+04
## 126 9.764706e+05 1.015915e+06 1.056411e+06 1.097293e+06 1.137827e+06
## 127 2.368900e+04 2.396800e+04 2.428200e+04 2.460500e+04 2.490200e+04
## 128 5.773571e+05 6.041172e+05 6.320703e+05 6.610724e+05 6.908953e+05
## 129 1.392938e+05 1.454891e+05 1.521163e+05 1.591069e+05 1.663149e+05
## 130 5.278427e+06 5.516718e+06 5.759042e+06 6.006727e+06 6.261899e+06
## 131 5.464057e+05 6.150199e+05 6.864334e+05 7.611387e+05 8.399119e+05
## 132 5.973271e+06 6.178716e+06 6.392781e+06 6.613581e+06 6.838424e+06
```

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## 133 1.739636e+05 1.814829e+05 1.894921e+05 1.977924e+05 2.060961e+05
## 134 4.714710e+05 5.035432e+05 5.369944e+05 5.718580e+05 6.081574e+05
## 135 8.039946e+06 8.176234e+06 8.299848e+06 8.409656e+06 8.516996e+06
## 136 5.533056e+04 5.909833e+04 6.291106e+04 6.663068e+04 7.014487e+04
## 137 2.279646e+06 2.323472e+06 2.374612e+06 2.431429e+06 2.492750e+06
## 138 1.127855e+06 1.171246e+06 1.216288e+06 1.263026e+06 1.311513e+06
## 139 3.845578e+05 4.198226e+05 4.568167e+05 4.956246e+05 5.363483e+05
## 140 1.302354e+07 1.367088e+07 1.434773e+07 1.506111e+07 1.582041e+07
## 141 9.250286e+03 9.855667e+03 1.050168e+04 1.115197e+04 1.175108e+04
## 142 2.534594e+06 2.574218e+06 2.615935e+06 2.656406e+06 2.695182e+06
## 143 2.170597e+05 2.378383e+05 2.603733e+05 2.850917e+05 3.125531e+05
## 144 1.473699e+07 1.533278e+07 1.595552e+07 1.661011e+07 1.730286e+07
## 145 6.855879e+03 6.993553e+03 7.145486e+03 7.295512e+03 7.421072e+03
## 146 7.192792e+05 7.438996e+05 7.689286e+05 7.943853e+05 8.203103e+05
## 147 2.385030e+05 2.558776e+05 2.743358e+05 2.938021e+05 3.141259e+05
## 148 9.201416e+05 9.528178e+05 9.860213e+05 1.020057e+06 1.055359e+06
## 149 7.570234e+06 7.894058e+06 8.229659e+06 8.577138e+06 8.936488e+06
## 150 1.169151e+07 1.222076e+07 1.276980e+07 1.333929e+07 1.392968e+07
## 151 1.702627e+07 1.729526e+07 1.764742e+07 1.801889e+07 1.840518e+07
## 152 3.368354e+06 3.388266e+06 3.417132e+06 3.452290e+06 3.535363e+06
## 153 1.585301e+06 1.635614e+06 1.693250e+06 1.755806e+06 1.818827e+06
## 154 9.580697e+04 1.046010e+05 1.144858e+05 1.249279e+05 1.351680e+05
## 155 8.164758e+06 8.352698e+06 8.536653e+06 8.714774e+06 8.901463e+06
## 156 8.146468e+07 8.297123e+07 8.449242e+07 8.602837e+07 8.757920e+07
## 157 1.196576e+05 1.296515e+05 1.401857e+05 1.513041e+05 1.630587e+05
## 158 1.532931e+04 1.530592e+04 1.531596e+04 1.529062e+04 1.526421e+04
## 159 2.424170e+04 2.484224e+04 2.542559e+04 2.606504e+04 2.668730e+04
## 160 2.775738e+04 2.852298e+04 2.931059e+04 3.011692e+04 3.093551e+04
## 161 2.897331e+04 2.960049e+04 3.015656e+04 3.065566e+04 3.112000e+04
## 162 1.144333e+04 1.199178e+04 1.250465e+04 1.300464e+04 1.352865e+04
## 163 2.173410e+04 2.255666e+04 2.335055e+04 2.415061e+04 2.501460e+04
## 164 2.809100e+06 3.050817e+06 3.315971e+06 3.607779e+06 3.929807e+06
## 165 1.228874e+06 1.300559e+06 1.375866e+06 1.453826e+06 1.533013e+06
## 166 2.770952e+06 2.834711e+06 2.898614e+06 2.962223e+06 3.025922e+06
## 167 2.094045e+04 2.221236e+04 2.351875e+04 2.485369e+04 2.620824e+04
## 168 6.067908e+05 6.355432e+05 6.652061e+05 6.959255e+05 7.279029e+05
## 169 2.075000e+06 2.113000e+06 2.152000e+06 2.193000e+06 2.230000e+06
## 170 1.863258e+06 1.918549e+06 1.982845e+06 2.050451e+06 2.120507e+06
## 171 6.382787e+05 6.619232e+05 6.860343e+05 7.106715e+05 7.335425e+05
## 172 1.429003e+04 1.487728e+04 1.550905e+04 1.617813e+04 1.687314e+04
## 173 8.166815e+05 8.475888e+05 8.745210e+05 9.078108e+05 9.626845e+05
## 174 1.055957e+07 1.081953e+07 1.108419e+07 1.135223e+07 1.162297e+07
## 175 2.233044e+07 2.282103e+07 2.327235e+07 2.373034e+07 2.420854e+07
## 176 2.441982e+06 2.475540e+06 2.508101e+06 2.552143e+06 2.588945e+06
## 177 1.802344e+06 1.912728e+06 2.030472e+06 2.155450e+06 2.287267e+06
## 178 1.710630e+05 1.743836e+05 1.764727e+05 1.777444e+05 1.788532e+05
## 179 4.325858e+04 4.845133e+04 5.395107e+04 5.977098e+04 6.591935e+04
## 180 6.517403e+06 6.589874e+06 6.636926e+06 6.675974e+06 6.723052e+06
## 181 3.545846e+06 3.564515e+06 3.591810e+06 3.618437e+06 3.637988e+06
## 182 2.760217e+06 2.878588e+06 3.002034e+06 3.130344e+06 3.263171e+06
## 183 1.084708e+06 1.111673e+06 1.139645e+06 1.168044e+06 1.196054e+06
## 184 1.068227e+06 1.195298e+06 1.330036e+06 1.472583e+06 1.622882e+06
## 185 7.711257e+06 8.156822e+06 8.618420e+06 9.093762e+06 9.579568e+06
## 186 7.788066e+04 8.202655e+04 8.651331e+04 9.088243e+04 9.445747e+04
```

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## 187 4.462997e+05 4.679159e+05 4.881497e+05 5.073627e+05 5.262916e+05
## 188 1.703157e+04 1.728917e+04 1.748268e+04 1.763734e+04 1.779015e+04
## 189 1.149191e+05 1.151237e+05 1.150568e+05 1.148504e+05 1.146878e+05
## 190 2.229322e+06 2.307379e+06 2.389032e+06 2.475875e+06 2.569238e+06
## 191 1.355938e+07 1.410119e+07 1.466411e+07 1.524684e+07 1.584676e+07
## 192 1.045665e+06 1.075185e+06 1.105506e+06 1.136380e+06 1.167443e+06
## 193 2.878290e+03 2.961101e+03 3.073893e+03 3.205822e+03 3.342540e+03
## 194 1.611030e+03 1.683666e+03 1.756818e+03 1.830905e+03 1.905153e+03
## 195 6.294769e+05 6.557359e+05 6.822662e+05 7.093838e+05 7.375558e+05
## 196 2.594411e+07 2.648578e+07 2.703029e+07 2.757233e+07 2.810411e+07
## 197 1.800752e+05 2.128010e+05 2.533435e+05 3.021131e+05 3.593418e+05
## 198 4.292583e+07 4.316876e+07 4.337887e+07 4.352637e+07 4.361748e+07
## 199 1.509224e+08 1.528638e+08 1.545305e+08 1.560341e+08 1.574881e+08
## 200 2.313813e+06 2.326524e+06 2.334879e+06 2.341153e+06 2.348533e+06
## 201 4.395765e+06 4.595966e+06 4.805551e+06 5.022305e+06 5.242853e+06
## 202 1.052469e+04 1.103796e+04 1.158368e+04 1.215890e+04 1.275908e+04
## 203 7.674281e+06 8.023652e+06 8.391094e+06 8.777606e+06 9.184011e+06
## 204 7.819407e+06 8.043735e+06 8.277023e+06 8.518466e+06 8.766839e+06
## 205 4.384296e+04 5.021305e+04 5.460843e+04 6.130639e+04 6.670296e+04
## 206 8.172839e+05 8.485446e+05 8.800627e+05 9.133326e+05 9.504883e+05
## 207 1.256178e+06 1.337898e+06 1.424498e+06 1.515871e+06 1.611725e+06
## 208 9.039055e+05 9.620288e+05 1.023588e+06 1.088377e+06 1.155992e+06
## 209 3.330133e+05 3.396491e+05 3.466912e+05 3.542318e+05 3.623528e+05
```

Build connection to urbanpop.xlsx

```
my_book <- loadWorkbook("urbanpop.xlsx")
```

Import columns 3, 4, and 5 from second sheet in my_book: urbanpop_sel

```
urbanpop_sel <- readWorksheet(my_book, sheet = 2, startCol = 3, endCol = 5)
```

Import first column from second sheet in my_book: countries

```
countries <- readWorksheet(my_book, sheet = 2, startCol = 1, endCol = 1)
```

cbind() urbanpop_sel and countries together: selection

```
selection <- cbind(countries, urbanpop_sel)

# create new sheets
createSheet(my_book, name="data_summary")
```

```
createSheet(my_book, "data_summary") # Add a worksheet to my_book, named "data_summary"
```

Create data frame: summ

```
sheets <- getSheets(my_book)[1:3]
dims <- sapply(sheets, function(x) dim(readWorksheet(my_book, sheet = x)), USE.NAMES = FALSE)
summ <- data.frame(sheets = sheets,
                   nrows = dims[1, ],
                   ncols = dims[2, ])
writeWorksheet(my_book, summ, "data_summary") # Add data in summ to "data_summary" sheet

saveWorkbook(my_book, "summary.xlsx") # Save workbook as summary.xlsx
```

```
renameSheet(my_book, "data_summary", "summary") # Rename "data_summary" sheet to "summary"

getSheets(my_book) # Print out sheets of my_book
```

```
## [1] "1960-1966" "1967-1974" "1975-2011" "summary"
```

```
saveWorkbook(my_book, "renamed.xlsx")
removeSheet(my_book, 4)

saveWorkbook(my_book, "clean.xlsx") # Save workbook to "renamed.xlsx"
```