Lecture 8: Acquiring data

EDUC 263: Managing and Manipulating Data Using R

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1 Introduction

Logistics

Reading to do before next class:

- ADD

Questions on Problem set #7

What we will do today

1. Introduction
2. Relative file paths
3. Common data formats
4. readr package
   - 4.1 readr functions
   - 4.2 readr column specification
   - 4.3 readr arguments
5. Set variable and value labels
6. readxl package
   - 6.1 readxl arguments
7. Reading in data from the web
   - 7.1 download.file function
   - 7.2 download.file function
8. haven package

Load the packages we will use today (output omitted)

- **you must run this code chunk after installing these packages**

```
library(dplyr)
library(readr)
library(haven)
library(readxl)
library(labelled)
```

If package not yet installed, then must install before you load. Install in "console" rather than .Rmd file

- Generic syntax: `install.packages("package_name")`
- Install "tidyverse": `install.packages("tidyverse")`

Note: when we load package, name of package is not in quotes; but when we install package, name of package is in quotes:

- `install.packages("tidyverse")`
- `library(tidyverse)`

2 Relative file paths

Save data for lecture

- First make sure to save **lecture8.Rmd** in your lectures folder
  - If you do not have class folder structure, you can download it here
- Download and unzip data folder we are using for this lecture here
- Save data files in the corresponding data folder
  - `ipeds_hd_2017_small.csv` should go in the **ic** folder inside the ipeds folder
  - `peps300.xlsx` should go in the **fsa** folder
  - `hsls_sch_small.dta` should go in the **hsls** folder

Working directory

- Your working directory will change depending on if you are using an R script or R markdown.
- **R script**
  - The default working directory is your computer's home directory
  - You only need to set your working directory `setwd()` in an r script once.
- **R markdown**
  - The default working directory is where the current r markdown file you are using is saved.
  - If you set your working directory in a code chunk, it will be reset to the default directory after the code chunk is finished running.
  - To avoid setting your working directory every time you read in data, you can read in data using a link to the data file or use the relative file path to save time.

Absolute vs. relative filepath

Absolute file path: The absolute file path is the complete list of directories needed to locate a file or folder.

```
setwd("/Users/pm/Desktop/rclass/lectures/lecture8")
```

Relative file path: The relative file path is the path relative to your current location/directory. Assuming your current working directory is in the "lecture8" folder and you want to change your directory to the data folder, your relative file path would look something like this:

```
setwd("../../data")
```

File path shortcuts

Key	Description
~	tilde is a shortcut for user's home directory (mine is my name pm)
../	moves up a level
../../	moves up two level

Practice using relative file paths

1. Using the code chunk below, get your working directory `getwd()`
2. Using your relative file path, set your working directory to fsa folder inside the data folder. `setwd("filepath")`
3. Using your relative file path, set your working directory to the ef folder inside the ipeds folder inside the data folder. `setwd("filepath")`

3 Common data formats

Common data formats

Format	Package	Function
Comma-separated values (.csv)	readr	read_csv
Text-formated data (.txt)	readr	read_table
Tab-separated values (.tsv)	readr	read_tsv
Stata (.dta)	haven	read_dta
SPSS (.sav)	haven	read_sav
SAS (.sas)	haven	read_sas
Excel (.xls or .xlsx)	readxl	read_excel
R (.Rdata or .rds)	base R	load()

- Source: Professor Darin Christensen

4 readr package

readr

The readr package is part of tidyverse, which is designed to read in flat data files in R and transform them into data frames.

- We could load **library(tidyverse)** if we wanted to load all packages in tidyverse (e.g. ggplot2, dplyr, tidyr, stringr, readr, etc...)

```
library(tidyverse)
#> -- Attaching packages ---------------------------------------
#>  ggplot2 3.0.0      purrr   0.2.5
#>  tibble  1.3.4      dplyr   0.7.6
#>  tidyr   0.8.1      stringr 1.3.1
#>  readr   1.1.1      forcats 0.3.0
#> Warning: package 'tibble' was built under R version 3.3.2
#> Warning: package 'readr' was built under R version 3.3.2
#> -- Conflicts ------------------------------------------------
#> x dplyr::filter() masks stats::filter()
#> x dplyr::lag()    masks stats::lag()
```

- For the purpose of this lecture, we will just need to load **library(readr)**

4.1 readr functions

readr functions

`readr` (tidyverse) functions

Format	Function
Comma-separated values (csv)	`read_csv`
Semicolon separated files	`read_csv2`
Tab-separated values (tsv)	`read_tsv`
Any delimiter	`read_delim`
Fixed width files	`read_fwf`
Text-formated data (txt)	`read_table`
Web log files	`read_log`

4.2 readr column specification

readr column specification

`readr` is pretty good at guessing each column's data type by looking at the first 1,000 rows (e.g. character, double, etc.), however it is good practice to manually specify the data type for each column.

```
mtcars <- read_csv(readr_example("mtcars.csv"))
#> Parsed with column specification:
#> cols(
#>   mpg = col_double(),
#>   cyl = col_integer(),
#>   disp = col_double(),
#>   hp = col_integer(),
#>   drat = col_double(),
#>   wt = col_double(),
#>   qsec = col_double(),
#>   vs = col_integer(),
#>   am = col_integer(),
#>   gear = col_integer(),
#>   carb = col_integer()
#> )
```

readr column specification

The output of the previous example shows us the column specification readr gave us. However, we could manually change column specification if we do not like readr's guess.

```
mtcars <- read_csv(readr_example("mtcars.csv"), col_types =
  cols(
    mpg = col_double(),
    cyl = col_integer(),
    disp = col_double(),
    hp = col_integer(),
    drat = col_double(),
    vs = col_integer(),
    wt = col_double(),
    qsec = col_double(),
    am = col_integer(),
    gear = col_integer(),
    carb = col_integer()
  )
)
```

4.3 readr arguments

readr arguments

- **skip**: `read_csv` (csv file, skip = n)
- **comment**: `read_csv` (csv file, comment = “#”)
- **col_names**: `read_csv` (csv file, col_names = c(“x”, “y”, “z”))
  - To save csv data use the function `write_csv(dataframe, "path")`

readr demonstration csv

`readr` automatically treats the first line of data as column names.

```
read_csv("column 1, column 2, column 3
         1,2,3
         4,5,6"
         )
#> # A tibble: 2 x 3
#>   `column 1` `column 2` `column 3`
#>        <int>      <int>      <int>
#> 1          1          2          3
#> 2          4          5          6
```

There are instances where you may want to tell R from what line to begin reading in data.

readr skip argument

Notice the example below. The first two lines are comments about the data. We would need to use **skip = n** to skip n lines.

```
read_csv("This file contains data on student charges for the acdemic year.
         File name: IC2016_AY
         a, b, c
         1,2,3
         4,5,6", skip = 2
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

readr comment argument

We could also tell R to drop lines we specify as comments. With **comment = n**

```
read_csv("# This file contains data on student charges for the acdemic year.
         a, b, c
         1,2,3
         4,5,6", comment = "#"
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

```
read_csv("* This file contains data on student charges for the acdemic year.
         a, b, c
         1,2,3
         4,5,6", comment = "*"
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

readr column names argument

We could tell R there are no column names with **col_names = FALSE** or we could manually give R column names with **col_names = c("", "", "")**

```
read_csv("1,2,3
         4,5,6", col_names = FALSE
         )
#> # A tibble: 2 x 3
#>      X1    X2    X3
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

```
read_csv("1,2,3
         4,5,6", col_names = c("column 1", "column 2", "column 3")
         )
#> # A tibble: 2 x 3
#>   `column 1` `column 2` `column 3`
#>        <int>      <int>      <int>
#> 1          1          2          3
#> 2          4          5          6
```

readr Student exercise

1. Create a 3x3 tibble like the examples above (e.g. read_csv("a,b,c.…")), treating the first line as column names
2. Now on the first line add a sentence and use the `skip` argument to skip this line
3. This time add a special character (*, #, !) at the beginning of the sentence and indicate it is a comment
4. Delete the sentence and column names (should have a 2x2 tibble) and manually tell R column names

readr Student exercise solutions

1. Create a 3x3 tibble like the examples above (e.g. read_csv("a,b,c…")), treating the first line as column names

```
read_csv("a, b, c
         1,2,3
         4,5,6"
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

2. Now on the first line add a sentence and use the `skip` argument to skip this line

```
read_csv("Do not read this sentence
         a, b, c
         1,2,3
         4,5,6", skip = 1
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

readr Student exercise solutions continued

3. This time add a special character (*, #, !) at the beginning of the sentence and indicate it is a comment

```
read_csv("#This is a comment
         a, b, c
         1,2,3
         4,5,6",comment = "#"
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

4. Delete the sentence and column names (should have a 2x3 tibble) and manually tell R column names

```
read_csv("1,2,3
         4,5,6",col_names = c("a", "b", "c")
         )
#> # A tibble: 2 x 3
#>       a     b     c
#>   <int> <int> <int>
#> 1     1     2     3
#> 2     4     5     6
```

1. readr Running into errors

1. Make sure you have downloaded and saved flat file
2. Make sure to know the file path of where data is downloaded or saved ("../../data")
3. Make sure you set your working `setwd()` directory in R. To check your current working directory type `getwd()` in console.

read_csv demonstration using IPEDS data

Integrated Postsecondary Education Data System (IPEDS)

- Postsecondary education data from NCES
- There are 12 survey components and 3 collection periods

We will be working with Institutional Characteristics data of 2017

read_csv demonstration using IPEDS data

Tying it all together

Use `read_csv()` function from `readr` to import csv dataset into R without column specification. Follow along on your computers.

```
ipeds <- read_csv(file="~/Desktop/GitHub/rclass/data/ipeds/ic/ipeds_hd_2017_smal
#> Parsed with column specification:
#> cols(
#>   unitid = col_integer(),
#>   instnm = col_character(),
#>   stabbr = col_character(),
#>   sector = col_integer(),
#>   iclevel = col_integer(),
#>   control = col_integer()
#> )
# glimpse(ipeds)
```

read_csv demonstration using IPEDS data

Use `read_csv()` function from `readr` to import csv dataset into R with column specification

```
ipeds <- read_csv(file="~/Desktop/GitHub/rclass/data/ipeds/ic/ipeds_hd_2017_smal
                  col_types =
                    cols(
                      unitid = col_character(),
                      instnm = col_character(),
                      stabbr = col_character(),
                      sector = col_integer(),
                      iclevel = col_integer(),
                      control = col_integer()
  )
)
```

We changed unitid to number, but could be left as is or changed to character type for example.

readr variable and value labels

Let's view variable and value labels

```
ipeds %>% select(sector) %>% var_label()
#> $sector
#> NULL
ipeds %>% select(sector) %>% val_labels()
#> $sector
#> NULL
```

There are no variable and value labels for this data. IPEDS has a separate do file with variable and value labels.

- Let's practice manually adding variable and value labels using the `labelled` package.

5 Set variable and value labels

Set variable and value labels

Use these functions from the `labelled` package to manually set variable and value labels

- Use `set_variable_labels` function to manually set variable labels
  - `df %>% set_variable_labels(variable = "Variable label")`
  - `ipeds %>% set_variable_labels(unitid = "Unit identification number")`
- Use `set_value_labels` function to manually set value labels
  - `df %>% set_value_labels(variable = c("Value label" = 1, "Value label" = 2))`
  - `ipeds %>% set_value_labels(sector = "Administrative Unit" = 0)`

readr labelled data

- Open the data dictionary file for hd2017 data and select “Frequencies” sheet
- We are only working with these 6 variables (unitid, instnm, stabbr, sector, iclevel, control)

```
# Lets view values for sector
ipeds %>%
  count(sector)
#> # A tibble: 11 x 2
#>    sector     n
#>     <int> <int>
#>  1      0    75
#>  2      1   775
#>  3      2  1701
#>  4      3   661
#>  5      4   981
#>  6      5   169
#>  7      6   864
#>  8      7   248
#>  9      8    85
#> 10      9  1562
#> 11     99    32
```

readr variable and value labels student exercise

1. Using the codebook for hd2017 data, add variable labels for all 6 variables (unitid, instnm, stabbr, sector, iclevel, control)
2. Add value labels for sector, iclevel, and control

readr variable and value labels student exercise solution

```
# Need to manually assign variable and value labels using labelled package
ipeds_labelled <- ipeds %>%
  set_variable_labels(unitid = "Unit identification number",
                      instnm = "Institution name",
                      stabbr = "State abbreviation",
                      sector = "Sector of institution",
                      iclevel = "Level of institution",
                      control = "Control of institution") %>%
  set_value_labels(sector = c("Administrative Unit" = 0,
                              "Public, 4-year or above" = 1,
                              "Private not-for-profit, 4-year or above" = 2,
                              "Private for-profit, 4-year or above" = 3,
                              "Public, 2-year" = 4,
                              "Private not-for-profit, 2-year" = 5,
                              "Private for-profit, 2-year" = 6,
                              "Public, less-than 2-year" = 7,
                              "Private not-for-profit, less-than 2-year" = 8,
                              "Private for-profit, less-than 2-year" = 9,
                              "Sector unknown (not active)" = 99),
                   iclevel = c("Four or more years" = 1,
                               "At least 2 but less than 4 years" = 2,
                               "Less than 2 years (below associate)" = 3,
                               "{Not available}" = -3),
                   control = c("Public" = 1, "Private not-for-profit" = 2,
                               "Private for-profit" = 3,
                               "{Not available}" = -3))
```

readr Let's view new labelled data

```
typeof(ipeds_labelled$iclevel)
#> [1] "integer"
class(ipeds_labelled$iclevel)
#> [1] "labelled"
attributes(ipeds_labelled$iclevel)
#> $label
#> [1] "Level of institution"
#>
#> $labels
#>                  Four or more years    At least 2 but less than 4 years
#>                                   1                                   2
#> Less than 2 years (below associate)                   {Not available}
#>                                   3                                  -3
#>
#> $class
#> [1] "labelled"
```

readr labelled data to factor

Let's change class to factor

```
ipeds_factor <- as_factor(ipeds_labelled, only_labelled = TRUE)
typeof(ipeds_factor$sector)
#> [1] "integer"
class(ipeds_factor$sector)
#> [1] "factor"
attributes(ipeds_factor$sector)
#> $levels
#>  [1] "Administrative Unit"
#>  [2] "Public, 4-year or above"
#>  [3] "Private not-for-profit, 4-year or above"
#>  [4] "Private for-profit, 4-year or above"
#>  [5] "Public, 2-year"
#>  [6] "Private not-for-profit, 2-year"
#>  [7] "Private for-profit, 2-year"
#>  [8] "Public, less-than 2-year"
#>  [9] "Private not-for-profit, less-than 2-year"
#> [10] "Private for-profit, less-than 2-year"
#> [11] "Sector unknown (not active)"
#>
#> $class
#> [1] "factor"
#>
#> $label
#> [1] "Sector of institution"
```

6 readxl package

readxl

The `readxl` package is part of tidyverse, which is designed to read data from Excel and into R.

- We could install tidyverse **install.package("tidyverse")** to access `readxl`, but have to explicitly load `readxl` because it is not a core tidyverse package
  - `library(readxl)`
- Or install `readxl` **install.packages("readxl")** and load it
  - `library(readxl)`
- For the purpose of this lecture, we just need to load **library(readxl)**.

readxl

`readxl` supports both .xls and .xlsx formats and is designed to work with tabular data. It does not require dependencies– making installing and operating fairly simple.

`readxl` has several example files where we could use as practice. The files include:

```
readxl_example()
#>  [1] "clippy.xls"    "clippy.xlsx"   "datasets.xls"  "datasets.xlsx"
#>  [5] "deaths.xls"    "deaths.xlsx"   "geometry.xls"  "geometry.xlsx"
#>  [9] "type-me.xls"   "type-me.xlsx"
```

For now, lets use “datasets.xlsx”

```
excel_example <- readxl_example("datasets.xlsx")
```

6.1 readxl arguments

readxl sheet

Select the excel sheet you want to work with.

```
#To view sheets in excel file
excel_sheets(excel_example)
#> [1] "iris"     "mtcars"   "chickwts" "quakes"
```

```
xl_example <- read_excel(excel_example, sheet = "quakes")
head(xl_example)
#> # A tibble: 6 x 5
#>     lat  long depth   mag stations
#>   <dbl> <dbl> <dbl> <dbl>    <dbl>
#> 1 -20.4  182.   562   4.8       41
#> 2 -20.6  181.   650   4.2       15
#> 3 -26    184.    42   5.4       43
#> 4 -18.0  182.   626   4.1       19
#> 5 -20.4  182.   649   4         11
#> 6 -19.7  184.   195   4         12
```

readxl n_max

Maximum number of rows to read

```
read_excel(excel_example, sheet = "quakes", n_max = 3)
#> # A tibble: 3 x 5
#>     lat  long depth   mag stations
#>   <dbl> <dbl> <dbl> <dbl>    <dbl>
#> 1 -20.4  182.   562   4.8       41
#> 2 -20.6  181.   650   4.2       15
#> 3 -26    184.    42   5.4       43
```

readxl range

A cell range to read from

```
read_excel(excel_example, sheet = "quakes", range = "C1:E4")
#> # A tibble: 3 x 3
#>   depth   mag stations
#>   <dbl> <dbl>    <dbl>
#> 1   562   4.8       41
#> 2   650   4.2       15
#> 3    42   5.4       43

read_excel(excel_example, sheet = "quakes", range = cell_rows(1:3))
#> # A tibble: 2 x 5
#>     lat  long depth   mag stations
#>   <dbl> <dbl> <dbl> <dbl>    <dbl>
#> 1 -20.4  182.   562   4.8       41
#> 2 -20.6  181.   650   4.2       15

head(read_excel(excel_example, sheet = "quakes", range = cell_cols("A:C")))
#> # A tibble: 6 x 3
#>     lat  long depth
#>   <dbl> <dbl> <dbl>
#> 1 -20.4  182.   562
#> 2 -20.6  181.   650
#> 3 -26    184.    42
#> 4 -18.0  182.   626
#> 5 -20.4  182.   649
#> 6 -19.7  184.   195
```

readxl na

Character vector of strings to interpret as missing values

```
read_excel(excel_example, sheet = "quakes", na = "-20.42")
#> # A tibble: 1,000 x 5
#>      lat  long depth   mag stations
#>    <dbl> <dbl> <dbl> <dbl>    <dbl>
#>  1  NA    182.   562   4.8       41
#>  2 -20.6  181.   650   4.2       15
#>  3 -26    184.    42   5.4       43
#>  4 -18.0  182.   626   4.1       19
#>  5  NA    182.   649   4         11
#>  6 -19.7  184.   195   4         12
#>  7 -11.7  166.    82   4.8       43
#>  8 -28.1  182.   194   4.4       15
#>  9 -28.7  182.   211   4.7       35
#> 10 -17.5  180.   622   4.3       19
#> # ... with 990 more rows
```

read_excel using FSA data

Federal Student Aid

- Federal Student Aid Data Center provides information for federal assistance programs and is divided into four categories:
  - Student Aid Data
  - School Data
  - Federal Family Education Loan (FFEL) Program
  - Business Information Resources

We will be working with School Data

read_excel student exercise using FSA data

Read in Federal Student Aid data using `readxl` function
- Excel file “peps300.xlsx” is saved in the fsa folder inside the data folder
1. Use relative file path to read in data
- `read_excel("filepath/excelfile")`

1. Read in first four rows (n_max)
2. Read in columns from range Names to State **hint** `cell_cols`
3. Set value “A” to missing (na) **note** : you need to investigate in detail before setting anything to missing

read_excel Student exercise solutions

1. Use relative file path to read in data

```
#Read in data using readxl function
#getwd()
fsa <- read_excel("../../data/fsa/peps300.xlsx")
```

2. Read in first four rows (n_max)

```
#Read in first four rows (n_max)
#setwd("~/Desktop/GitHub/rclass/data/fsa")
read_excel("../../data/fsa/peps300.xlsx", n_max = 4)
#> # A tibble: 4 x 29
#>   OPEID Name  Address City  State `State Desc` `Zip Code` `Zip Ext`
#>   <chr> <chr> <chr>   <chr> <chr> <chr>        <chr>      <chr>
#> 1 0010~ ALAB~ 4900 M~ NORM~ AL    ALABAMA      35762      1357
#> 2 0010~ FAUL~ 5345 A~ MONT~ AL    ALABAMA      36109      3398
#> 3 0010~ UNIV~ PALMER~ MONT~ AL    ALABAMA      35115      6000
#> 4 0010~ ALAB~ 915 SO~ MONT~ AL    ALABAMA      36104      5714
#> # ... with 21 more variables: `Prog\r\nLength` <dbl>,
#> #   `School\r\nType` <dbl>, `Year 1` <dbl>, `Dual\r\nNum 1` <dbl>,
#> #   `Dual\r\nDenom 1` <dbl>, `DRate 1` <dbl>, `PRate 1` <chr>, `Ethnic
#> #   Code` <chr>, Program <chr>, `Cong Dis` <chr>, Region <chr>, `Year
#> #   2` <dbl>, `Dual\r\nNum 2` <dbl>, `Dual\r\nDenom 2` <dbl>, `DRate
#> #   2` <dbl>, `PRate 2` <chr>, `Year 3` <dbl>, `Dual\r\nNum 3` <dbl>,
#> #   `Dual\r\nDenom 3` <dbl>, `DRate 3` <dbl>, `PRate 3` <chr>
```

read_excel Student exercise solutions continued

3. Read in columns from range Names to State **hint** `cell_cols`

```
#Read in column Names to column State
#setwd("~/Desktop/GitHub/rclass/data/fsa")
head(read_excel("../../data/fsa/peps300.xlsx", range = cell_cols("B:E")))
#> # A tibble: 6 x 4
#>   Name                                Address             City        State
#>   <chr>                               <chr>               <chr>       <chr>
#> 1 ALABAMA AGRICULTURAL & MECHANICAL~ 4900 MERIDIAN STRE~ NORMAL      AL
#> 2 FAULKNER UNIVERSITY                5345 ATLANTA HIGHW~ MONTGOMERY  AL
#> 3 UNIVERSITY OF MONTEVALLO           PALMER CIRCLE       MONTEVALLO  AL
#> 4 ALABAMA STATE UNIVERSITY           915 SOUTH JACKSON ~ MONTGOMERY  AL
#> 5 CENTRAL ALABAMA COMMUNITY COLLEGE  1675 CHEROKEE ROAD  ALEXANDER ~ AL
#> 6 ATHENS STATE UNIVERSITY            300 NORTH BEATY ST~ ATHENS      AL
```

read_excel Student exercise solutions continued

4. Set value “P” to missing (na) **note** : you need to investigate in detail before setting anything to missing

```
#setwd("~/Desktop/GitHub/rclass/data/fsa")
read_excel("../../data/fsa/peps300.xlsx", n_max = 4,  na = "P")
#> # A tibble: 4 x 29
#>   OPEID Name  Address City  State `State Desc` `Zip Code` `Zip Ext`
#>   <chr> <chr> <chr>   <chr> <chr> <chr>        <chr>      <chr>
#> 1 0010~ ALAB~ 4900 M~ NORM~ AL    ALABAMA      35762      1357
#> 2 0010~ FAUL~ 5345 A~ MONT~ AL    ALABAMA      36109      3398
#> 3 0010~ UNIV~ PALMER~ MONT~ AL    ALABAMA      35115      6000
#> 4 0010~ ALAB~ 915 SO~ MONT~ AL    ALABAMA      36104      5714
#> # ... with 21 more variables: `Prog\r\nLength` <dbl>,
#> #   `School\r\nType` <dbl>, `Year 1` <dbl>, `Dual\r\nNum 1` <dbl>,
#> #   `Dual\r\nDenom 1` <dbl>, `DRate 1` <dbl>, `PRate 1` <chr>, `Ethnic
#> #   Code` <chr>, Program <chr>, `Cong Dis` <chr>, Region <chr>, `Year
#> #   2` <dbl>, `Dual\r\nNum 2` <dbl>, `Dual\r\nDenom 2` <dbl>, `DRate
#> #   2` <dbl>, `PRate 2` <chr>, `Year 3` <dbl>, `Dual\r\nNum 3` <dbl>,
#> #   `Dual\r\nDenom 3` <dbl>, `DRate 3` <dbl>, `PRate 3` <chr>
```

readxl Running into problems

1. Make sure you have downloaded and saved excel file
2. Make sure to know the file path of where data is downloaded or saved ("../../data")
3. Make sure you set your working `setwd()` directory in R. To check your current working directory type `getwd()` in console.
4. Make sure to choose the correct sheet (if applicable)
5. Pay attention to column names when setting range

7 Reading in data from the web

Reading in data from the web

- Save time
  - Reduce the steps of downloading, saving, and reading in data
  - Read in data directly from internet
  - **note** not all packages will working with downloading data from the web (read_excel)

For example, rather than downloading Raj Chetty data and saving it in a folder, we could download the data directly from the web.

Reading in data from web example using Raj Chetty data

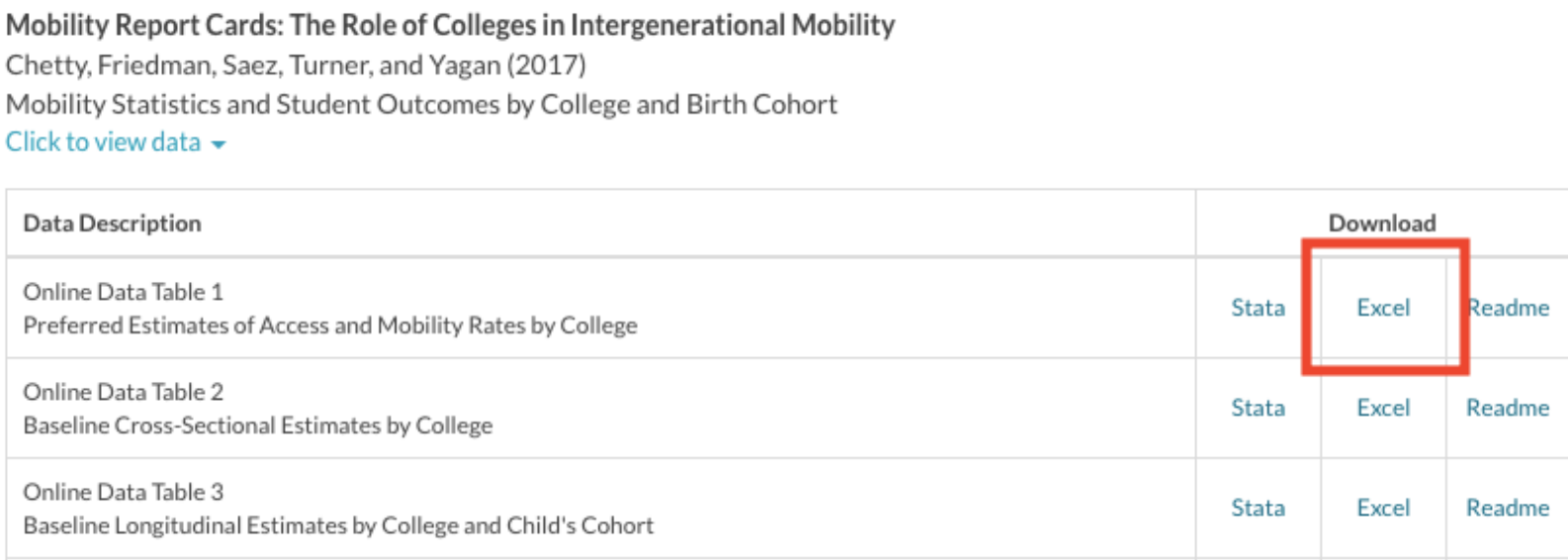
Equality of Opportunity Project

- Equality of Opportunity Project uses two data sources– federal tax recoards and Department of Education records (1999-2013)– to investigate intergenerational income mobility at colleges in the US.

We will use Mobility Report Cards: The Role of Colleges in Intergenerational Mobility data

Reading in data from web example using Raj Chetty data

1. Follow this link and under the "Mobility Report Cards…" tab select "click to view data".
2. Choose "Online Data Table 1"
3. Right click and copy link address for "Excel" (Note: it is actually a csv file)



Mobility Report Cards: The Role of Colleges in Intergenerational Mobility
Chetty, Friedman, Saez, Turner, and Yagan (2017)
Mobility Statistics and Student Outcomes by College and Birth Cohort
Click to view data

Data Description	Download		
Online Data Table 1 Preferred Estimates of Access and Mobility Rates by College	Stata	Excel	Readme
Online Data Table 2 Baseline Cross-Sectional Estimates by College	Stata	Excel	Readme
Online Data Table 3 Baseline Longitudinal Estimates by College and Child's Cohort	Stata	Excel	Readme

Reading in data from the web

Approach #1

```
#Paste url to excel "csv" file
data_url <- "http://www.equality-of-opportunity.org/data/college/mrc_table1.csv"

#Download data and read in using read_csv (readr)
mrc <- read_csv(data_url)

#View first 4 rows and 4 columns
mrc[1:4, 1:4]
#> # A tibble: 4 x 4
#>   super_opeid name                                          czname   state
#>         <int> <chr>                                         <chr>    <chr>
#> 1        2665 Vaughn College Of Aeronautics And Technology New York NY
#> 2        7273 CUNY Bernard M. Baruch College               New York NY
#> 3        2688 City College Of New York - CUNY              New York NY
#> 4        7022 CUNY Lehman College                          New York NY
```

Reading in data from the web

Approach #2

```
#Download data and read in link directly using read_csv (readr)
mrc <- read_csv("http://www.equality-of-opportunity.org/data/college/mrc_table1.
#> Parsed with column specification:
#> cols(
#>   super_opeid = col_integer(),
#>   name = col_character(),
#>   czname = col_character(),
#>   state = col_character(),
#>   par_median = col_integer(),
#>   k_median = col_integer(),
#>   par_q1 = col_double(),
#>   par_top1pc = col_double(),
#>   kq5_cond_parq1 = col_double(),
#>   ktop1pc_cond_parq1 = col_double(),
#>   mr_kq5_pq1 = col_double(),
#>   mr_ktop1_pq1 = col_double(),
#>   trend_parq1 = col_double(),
#>   trend_bottom40 = col_double(),
#>   count = col_double()
#> )
```

Reading in data from the web

```
#View first 4 rows and 4 columns
mrc[1:4, 1:4]
#> # A tibble: 4 x 4
#>   super_opeid name                                          czname   state
#>         <int> <chr>                                         <chr>    <chr>
#> 1        2665 Vaughn College Of Aeronautics And Technology New York NY
#> 2        7273 CUNY Bernard M. Baruch College               New York NY
#> 3        2688 City College Of New York - CUNY              New York NY
#> 4        7022 CUNY Lehman College                          New York NY
```

Problems downloading data (zip files) using IPEDS

1. Follow this link and under the "Survey Data" tab select "Complete data files".
2. Choose "All years" and "All surveys" and click continue
3. Right click and copy link address for "IC2017_AY"

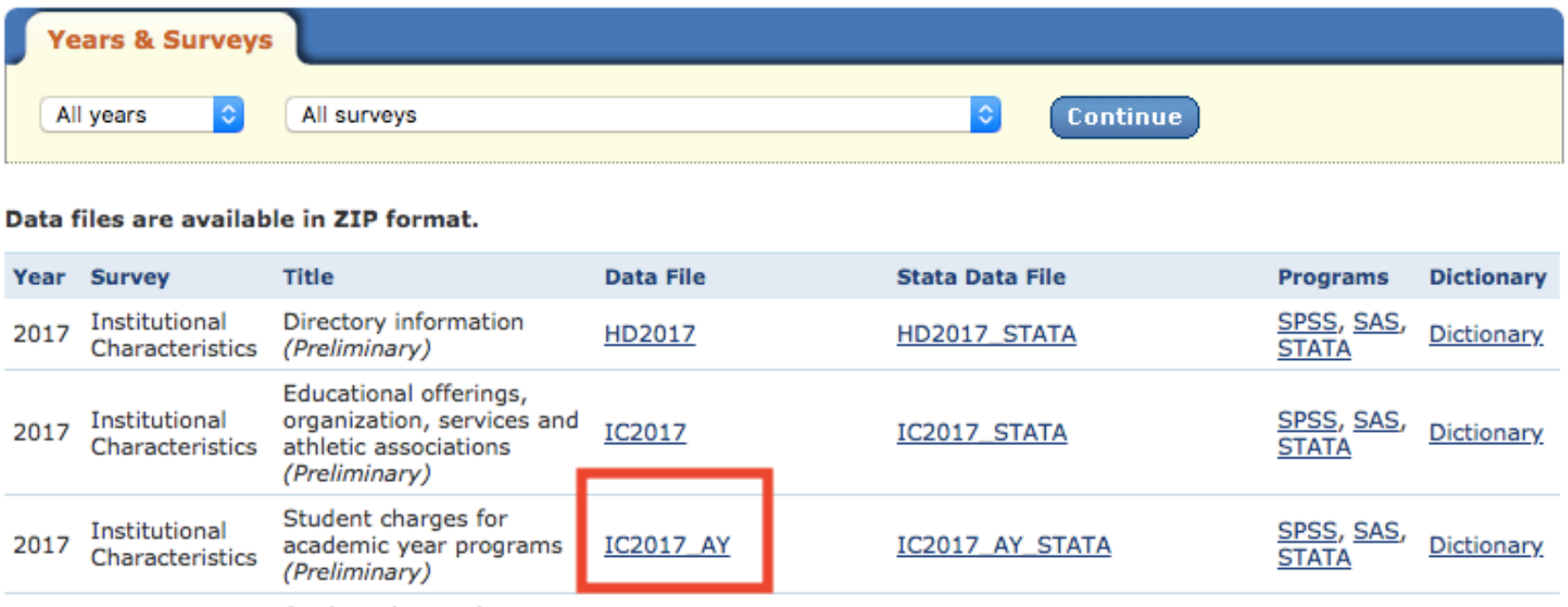


Figure 1: ipeds data center

Downloading data (zip files) using IPEDS

- Paste url and read in using `read_csv`
  - `ipeds <- read_csv("link")` What happens when you try reading in this file?

Need to download **and** unzip

7.1 download.file function

7.2 download.file function

Downloading data (zip files) using IPEDS

```
#Set path to where data will be saved
#setwd("~/Desktop/lecture8")
#download file and pa
download.file("https://nces.ed.gov/ipeds/datacenter/data/IC2017_AY.zip",
              destfile = "ic2017_ay", mode = "wb")
#unzip zip file and keep original name
unzip(zipfile = "ic2017_ay" , unzip = "unzip")

ic2017_ay <- read_csv("ic2017_ay.csv")
#> Parsed with column specification:
#> cols(
#>   .default = col_character(),
#>   UNITID = col_integer()
#> )
#> See spec(...) for full column specifications.
```

Student exercise

Tying it all together

- Using everything we learned today read in a csv data file from the web
- Go back to the ipeds data center here
- Right click and copy the link address to a different data file (“HD2017”, “EFFY2017”)
- Make sure to download the link first (download.file) before reading in
- Change column names to lowercase
- Report dimensions of data
- Create a subset of your data (filter, select, etc.)

8 haven package

haven

Recap from lecture 5

haven is part of tidyverse, which enables users to import and export data from the following statistical packages:

- SAS
- SPSS
- Stata

Similar to `readr`, we could load the entire **library(tidyverse)** package to get `haven`. For the purpose of this lecture, we will just need to load **library(haven)**.

haven functions

haven's (tidyverse) functions

Format	Function
SPSS	`read_sav`
SAS	`read_sas`
Stata	`read_dta`

haven read and write Stata arguments

```
read_dta(file, encoding = NULL)
```

```
write_data(data, path, version = 14)
```

Arguments
- **file**: file path to data
- **encoding**: files prior to Stata 14 did not declare text encoding, files after Stata 14 do not need to declare encoding value
- **data**: data frame to save (write)
- **path**: file path to where data will be saved
- **version**: file version

Link

haven Student exercise using HSLS data

High school longitudinal surveys from National Center for Education Statistics (NCES)

- Follow U.S. students from high school through college, labor market

We will be working with High School Longitudinal Study of 2009 (HSLS:09)

- Follows 9th graders from 2009
- Data collection waves
  - Base Year (2009)
  - First Follow-up (2012)
  - 2013 Update (2013)
  - High School Transcripts (2013-2014)
  - Second Follow-up (2016)

1. Use `read_dta()` function from `haven` to import Stata dataset into R
2. Use `write_dta()` funtction from `haven` to save Stata dataset
3. If you have time, explore data (View, glimpse, head, etc.)
   - View variable and value labels
   - Change class == labelled to class == factor

haven Student exercise solutions

Use `read_dta` function from `haven` to import State data

```
hsls <- read_dta("https://github.com/ozanj/rclass/raw/master/data/hsls/hsls_sch_

# View data
head(hsls)
glimpse(hsls)
```

Use `write_dta` function from `haven` to write State data

```
write_dta(dataframe, path = ""
```

```
write_dta(hsls, path = "~/Desktop/hsls_sch_small.dta")
```

haven Student exercise Solution continued...

Variable and Value labels

```
# View variable labels
hsls %>% var_label()
#> $sch_id
#> [1] "School ID"
#>
#> $x1control
#> [1] "X1 School control"
#>
#> $x1locale
#> [1] "X1 School locale (urbanicity)"
#>
#> $x1region
#> [1] "X1 School geographic region"
#>
#> $a1schcontrol
#> [1] "A1 A02 School control"
```

haven Student exercise Solution cont...

```
#View value label for x1locale
hsls %>% select(x1locale) %>% val_labels()
#> $x1locale
#>                                     Missing
#>                                           1
#> Unit non-response/component not applicable
#>                                           2
#>                     Item legitimate skip/NA
#>                                           3
#>                                        City
#>                                           4
#>                                      Suburb
#>                                           5
#>                                       Town
#>                                           6
#>                                       Rural
#>                                           7
```

haven Student exercise Solution cont...

```
# Change class == labelled to class == factor
hsls <- as_factor(hsls, only_labelled = TRUE)

typeof(hsls$x1region)
#> [1] "integer"
class(hsls$x1region)
#> [1] "factor"
attributes(hsls$x1region)
#> $levels
#> [1] "Missing"
#> [2] "Unit non-response/component not applicable"
#> [3] "Item legitimate skip/NA"
#> [4] "Northeast"
#> [5] "Midwest"
#> [6] "South"
#> [7] "West"
#>
#> $class
#> [1] "factor"
#>
#> $label
#> [1] "X1 School geographic region"
```