

# Lecture 4 problem set

*INSERT YOUR NAME HERE*

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## General instructions

In this homework, you will specify `pdf_document` as the output format. You must have LaTeX installed in order to create pdf documents.

If you have not yet installed MiKTeX/MacTeX, I recommend installing TinyTeX, which is much simpler to install!

- Instructions for installation of TinTeX can be found [HERE](#)
- General Instructions for Problem Sets [Here](#)

## Make changes to YAML header

Read XAG section 3.3 before answering these questions

1. Add a table of contents to YAML header
2. table of contents should have “depth” of 2
3. Add section numbering to headers
4. Change “data frame printing” option to “tibble”

## Load packages, load data, and rename variables

1. Load the tidyverse package

```
#install.packages("tidyverse") #install if you do not have tidyverse installed
```

```
library(tidyverse)
```

```
#> -- Attaching packages ----- tidyverse
```

```
#> v ggplot2 3.2.1      v purrr 0.3.2
```

```
#> v tibble 2.1.3       v dplyr 0.8.3
```

```
#> v tidyr 1.0.0        v stringr 1.4.0
```

```
#> v readr 1.3.1        v forcats 0.4.0
```

```
#> -- Conflicts ----- tidyverse
```

```
#> x dplyr::filter() masks stats::filter()
```

```
#> x dplyr::lag() masks stats::lag()
```

2. Load the data frame data frame `df_school_all`

- The URL for this data frame is: ([https://github.com/ozanj/rclass/raw/master/data/recruiting/recruit\\_school\\_allvars.RData](https://github.com/ozanj/rclass/raw/master/data/recruiting/recruit_school_allvars.RData))
- The data frame `df_school_all` has one observation for each high school (public and private).
- The variables that begin with `visits_by_...` identify how many off-campus recruiting visits the high school received from a particular public university. For example, UC Berkeley has the ID 110635 so the variable `visits_by_110635` identifies how many visits the high school received from UC Berkeley.
- The variable `total_visits` identifies the number of visits the high school received from all (16) public research universities in this data collection sample.

```
load(url("https://github.com/ozanj/rclass/raw/master/data/recruiting/recruit_school_allvars.RData"))
```

- Run the following code which drops some variables, renames other variables, and assigns these changes to the existing object `df_school_all` and then print the names of all the variables using the `names()` function.

```
df_school_all <- df_school_all %>%
  select(-contains("inst_")) %>% # remove vars that start with "inst_"
  rename(
    visits_by_berkeley = visits_by_110635,
    visits_by_boulder = visits_by_126614,
    visits_by_bama = visits_by_100751,
    visits_by_stonybrook = visits_by_196097,
    visits_by_rutgers = visits_by_186380,
    visits_by_pitt = visits_by_215293,
    visits_by_cinci = visits_by_201885,
    visits_by_nebraska = visits_by_181464,
    visits_by_georgia = visits_by_139959,
    visits_by_scarolina = visits_by_218663,
    visits_by_ncstate = visits_by_199193,
    visits_by_irvine = visits_by_110653,
    visits_by_kansas = visits_by_155317,
    visits_by_arkansas = visits_by_106397,
    visits_by_sillinois = visits_by_149222,
    visits_by_umass = visits_by_166629,
    num_took_read = num_took_rla,
    num_prof_read = num_prof_rla,
    med_inc = avgmedian_inc_2564
  )

names(df_school_all)
#> [1] "state_code"      "school_type"      "necessch"
#> [4] "name"            "address"           "city"
#> [7] "zip_code"        "pct_white"         "pct_black"
#> [10] "pct_hispanic"    "pct_asian"         "pct_amerindian"
#> [13] "pct_other"       "num_fr_lunch"      "total_students"
#> [16] "num_took_math"   "num_prof_math"     "num_took_read"
#> [19] "num_prof_read"   "med_inc"           "latitude"
#> [22] "longitude"       "visits_by_stonybrook" "visits_by_rutgers"
#> [25] "visits_by_pitt"   "visits_by_cinci"   "visits_by_nebraska"
#> [28] "visits_by_georgia" "visits_by_scarolina" "visits_by_bama"
#> [31] "visits_by_ncstate" "visits_by_berkeley" "visits_by_irvine"
#> [34] "visits_by_boulder" "visits_by_kansas"   "visits_by_arkansas"
#> [37] "visits_by_sillinois" "visits_by_umass"    "total_visits"
```

## Filter and arrange questions

For the questions below, imagine that you have been asked by a major news outlet to identify which high schools receive the most off-campus recruiting visits from the 16 public universities in the sample. Therefore, you will focus on the variable `total_visits`, which counts the total number of visits to the high school across all public 16 public research universities in the sample

- For questions that ask you to print the “top 10” observations, you can either:
  - just print the object and rely on the fact that the default option for printing tibbles is to print the first 10 observations
  - OR you can wrap the command in the `head()` function and explicitly tell R to print 10 observa-

tions.

1. Without using pipes (`%>%`), sort (i.e., `arrange()` function) descending by `total_visits` and print the following variables for the top 10 schools in terms of total number of visits:
  - variables to print: `name`, `state_code`, `city`, `school_type`, `total_visits`, `med_inc`, `pct_white`, `pct_black`, `pct_hispanic`, `pct_asian`, `pct_amerindian`
  - Note: You can do this in one step by wrapping the `select()` function around the `arrange()` (i.e., sort) function; or you can do this in two steps by creating a new data frame first.
2. Answer the question above, but this time use pipes (`%>%`) to answer the question in one line of code
3. Without using pipes, print the following (same variables as above):
  - (A) the top 10 public high schools in terms of total number of visits and then
  - (B) the top 10 private high schools in terms of total number of visits
4. Answer the question above, but this time using pipes (`%>%`) to answer the question in one line of code for part (A) and one line of code for part (B)
5. Using pipe operator (`%>%`), print the following (same variables as above; one line of code for each part (A), (B), (C), (D)):
  - (A) the top 10 public high schools in Massachusetts in terms of total number of visits and then
  - (B) the top 10 private high schools in Massachusetts in terms of total number of visits
  - (C) the top 10 public high schools in California in terms of total number of visits and then
  - (D) the top 10 private high schools in California in terms of total number of visits

## Creating variables using `mutate()`

The focus of this set of questions will be practicing creating some variables from the data frame `df_school_all`. You will be using the `mutate()` function, often combined with the `if_else()` function. Additionally, questions will ask you to investigate the values of “input” variables before creating new “analysis” variables using `mutate()`

Before presenting questions, here are some examples of code that may be useful in checking variable values. The below lines of code count:

- the number of observations in the data frame `df_school_all`
- the number of observations that have missing values for the variable `state_code`
- the number of observations that have missing values for the variable `school_type`
- a frequency count of the variable `school_type`

```
df_school_all %>% count()
#> # A tibble: 1 x 1
#>       n
#>   <int>
#> 1 21301
count(df_school_all) # same as above
#> # A tibble: 1 x 1
#>       n
#>   <int>
#> 1 21301
df_school_all %>% filter(is.na(state_code)) %>% count() # number with NA for state_code
#> # A tibble: 1 x 1
#>       n
#>   <int>
```

```

#> 1      0
df_school_all %>% filter(is.na(school_type)) %>% count() # number with NA for school_type
#> # A tibble: 1 x 1
#>       n
#>   <int>
#> 1      0
df_school_all %>% count(school_type) # frequency count of school_type
#> # A tibble: 2 x 2
#>   school_type     n
#>   <chr>       <int>
#> 1 private     3822
#> 2 public     17479

```

1. Using `mutate()` with `ifelse()` create a 0/1 indicator called `ca_school` that indicates whether the high school is in California and then use `count()` to create a frequency table for the values of `ca_school` (you don't need to assign/retain the new variable)
2. Using `mutate()` with `ifelse()` create a 0/1 indicator called `ca_pub_school` that indicates whether the school is a public high school in California and then use `count()` to create a frequency table for the values of `ca_pub_school` (you don't need to assign/retain the new variable)
3. By combining the `is.na()` function with the `filter()` function, identify the number of observations that have missing values for the following variables:
  - `pct_black`, `pct_hispanic`, `pct_amerindian`
4. Create a new variable `pct_bl_hisp_nat` that represents the percent of students at the school that identify as black, hispanic, or american indian. Retain this variable by assigning it to the object `df_school_all`
5. Create a new 0/1 indicator variable `gt50pct_bl_hisp_nat` that identifies whether more than 50% of students identify as black, hispanic, or american indian and create a frequency count of this variable (no need to retain this variable)
6. Create the following 0/1 indicator variables, retain them (assign to object `df_school_all`), and then create frequency counts of these variables:
  - Variable `miss_took_math` for whether the school has missing values for the variable `num_took_math`
  - Variable `miss_prof_math` for whether the school has missing values for the variable `num_prof_math`
  - Variable `miss_took_or_prof_math` for whether the school has missing values for the variable `num_took_math` OR `num_prof_math`
7. create a variable of `pct_prof_math` that measures the percent of students who score proficient in the state math assessment(assign to object `df_school_all`).
8. create a frequency count of value of the variable `pct_prof_math` separately for the three following filters:
  - Observations where `miss_took_math==1`
  - Observations where `miss_prof_math==1`
  - Observations where `miss_took_or_prof_math==1`

## Using `case_when()` function within `mutate()`

For this set of questions, you will work with the data frame `wvlist` which has one observation for each prospective student purchased by Western Washington University from the College Board.

The objective of this set of questions is to create a three-category variable that identifies whether the prospect lives: - (1) in-state (i.e., in Washington), (2) out-of-state but in a US state/territory; (3) not in the US

1. Load the data frame `wwlist` which has information on prospects purchased by Western Washington University

```
load(url("https://github.com/ozanj/rclass/raw/master/data/prospect_list/wwlist_merged.RData"))
```

2. Apply the `str()` function to the variables `state` and `for_country`; and using the `count()` function to create frequency tables for the variables `state`
  - `state`
  - `for_country`
3. Using the `filter()` function and `is.na()` function do the following:
  - count how many missing observations (NAs) the variable `state` has
  - count how many missing observations the variable `for_country` has
4. Create a frequency count for the variable `for_country` for the observations where `state` equals NA (hint: use the `is.na()` function)
5. Create a frequency count for the variable `for_country` for the observations where `state` does not equal NA (hint: use `!is.na()` function)
6. Count the number of observations that have the value “No Response” for the variable `for_country`
7. Using the `case_when` function within `mutate()` create a character variable called `residency` that has the following values: “in\_state”; “out\_state\_us”; “not\_in\_us”
  - This variable should have the value NA for observations where `for_country=="No Response"`
  - Retain this variable (assign to object `wwlist`) and create a frequency count of this variable

Once finished, knit to (pdf) and upload both .Rmd and PDF files to class website under the week 3 tab  
*Remember to use this naming convention “lastname\_firstname\_ps3”*