

Project 1

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Load require packages

```
library(tidyverse)
```

Data Processing

Question 1: Reading in Data

```
edu01a <- read_csv("EDU01a.csv", show_col_types = FALSE) |>
  select(
    area_name = Area_name, #rename Area_name
    STCOU,
    ends_with("D") #select all columns ending in "D"
  )

#display the first 5 rows
edu01a |>
  slice(1:5)
```

```
# A tibble: 5 x 12
  area_name      STCOU EDU010187D EDU010188D EDU010189D EDU010190D EDU010191D
  <chr>          <chr>      <dbl>      <dbl>      <dbl>      <dbl>      <dbl>
1 UNITED STATES 00000    40024299   39967624   40317775   40737600   41385442
2 ALABAMA       01000     733735    728234     730048     728252     725541
3 Autauga, AL    01001      6829      6900       6920       6847       7008
4 Baldwin, AL   01003     16417     16465     16799     17054     17479
5 Barbour, AL   01005      5071      5098      5068      5156      5173
# i 5 more variables: EDU010192D <dbl>, EDU010193D <dbl>, EDU010194D <dbl>,
#   EDU010195D <dbl>, EDU010196D <dbl>
```

Question 2: Pivot Data

```
edu_long <- edu01a %>%
  pivot_longer(
    cols = ends_with("D"),
    names_to = "surveyID_full", #store original column names (ex. "EST1234D")
    values_to = "enrollment"
  )

#display the first 5 rows
head(edu_long, 5)
```

```
# A tibble: 5 x 4
  area_name      STCOU surveyID_full enrollment
  <chr>          <chr> <chr>          <dbl>
1 UNITED STATES 00000 EDU010187D      40024299
2 UNITED STATES 00000 EDU010188D      39967624
3 UNITED STATES 00000 EDU010189D      40317775
4 UNITED STATES 00000 EDU010190D      40737600
5 UNITED STATES 00000 EDU010191D      41385442
```

Question 3: Extracting the year

```
long_updated <- edu_long %>%
  mutate(
    #extract the 2-digit year from the 8th and 9th characters of surveyID_full
    surveyID_year = substr(surveyID_full, 8, 9),

    #convert the 2-digit year into a 4-digit year (assuming all are 1900s)
    year = as.numeric(paste0("19", surveyID_year)),

    #extract the survey ID (first 7 characters of surveyID_full)
    surveyID = substr(surveyID_full, 1, 7)
  ) %>%
  #remove the temporary intermediate column
  select(-surveyID_year)

#display the first 5 rows
head(long_updated, 5)
```

```
# A tibble: 5 x 6
  area_name      STCOU surveyID_full enrollment   year surveyID
  <chr>          <chr> <chr>          <dbl> <dbl> <chr>
1 UNITED STATES 00000 EDU010187D      40024299 1987 EDU0101
2 UNITED STATES 00000 EDU010188D      39967624 1988 EDU0101
3 UNITED STATES 00000 EDU010189D      40317775 1989 EDU0101
4 UNITED STATES 00000 EDU010190D      40737600 1990 EDU0101
5 UNITED STATES 00000 EDU010191D      41385442 1991 EDU0101
```

Question 4: Identifying County Data

```
#identify county rows: ", XX" (where XX is a two-letter state abbreviation)
county_indices <- grep(pattern = ", \\w\\w", long_updated$area_name)

#create county tibble and assign custom classes
county_tibble <- long_updated[county_indices, ]
class(county_tibble) <- c("county", class(county_tibble))

#create non-county tibble and assign custom classes
state_tibble <- long_updated[-county_indices, ]
class(state_tibble) <- c("state", class(state_tibble))

#display the first 10 rows for both data sets
head(county_tibble, 10)
```

```
# A tibble: 10 x 6
  area_name      STCOU surveyID_full enrollment   year surveyID
  <chr>          <chr> <chr>          <dbl> <dbl> <chr>
1 Autauga, AL 01001 EDU010187D      6829 1987 EDU0101
2 Autauga, AL 01001 EDU010188D      6900 1988 EDU0101
3 Autauga, AL 01001 EDU010189D      6920 1989 EDU0101
4 Autauga, AL 01001 EDU010190D      6847 1990 EDU0101
5 Autauga, AL 01001 EDU010191D      7008 1991 EDU0101
6 Autauga, AL 01001 EDU010192D      7137 1992 EDU0101
7 Autauga, AL 01001 EDU010193D      7152 1993 EDU0101
8 Autauga, AL 01001 EDU010194D      7381 1994 EDU0101
9 Autauga, AL 01001 EDU010195D      7568 1995 EDU0101
10 Autauga, AL 01001 EDU010196D      7834 1996 EDU0101
```

```
head(state_tibble, 10)
```

```
# A tibble: 10 x 6
  area_name      STCOU surveyID_full enrollment   year surveyID
  <chr>         <chr> <chr>          <dbl> <dbl> <chr>
1 UNITED STATES 00000 EDU010187D      40024299 1987 EDU0101
2 UNITED STATES 00000 EDU010188D      39967624 1988 EDU0101
3 UNITED STATES 00000 EDU010189D      40317775 1989 EDU0101
4 UNITED STATES 00000 EDU010190D      40737600 1990 EDU0101
5 UNITED STATES 00000 EDU010191D      41385442 1991 EDU0101
6 UNITED STATES 00000 EDU010192D      42088151 1992 EDU0101
7 UNITED STATES 00000 EDU010193D      42724710 1993 EDU0101
8 UNITED STATES 00000 EDU010194D      43369917 1994 EDU0101
9 UNITED STATES 00000 EDU010195D      43993459 1995 EDU0101
10 UNITED STATES 00000 EDU010196D      44715737 1996 EDU0101
```

Question 5: Add state Variable to the County Tibble

```
county_tibble <- county_tibble |>
  mutate(
    #use nchar to get the last 2 characters of area_name
    state = substr(area_name, nchar(area_name) - 1, nchar(area_name))
  )

#display the first 5 rows
county_tibble |>
  slice(1:5)
```

```
# A tibble: 5 x 7
  area_name      STCOU surveyID_full enrollment   year surveyID state
  <chr>         <chr> <chr>          <dbl> <dbl> <chr> <chr>
1 Autauga, AL 01001 EDU010187D      6829 1987 EDU0101 AL
2 Autauga, AL 01001 EDU010188D      6900 1988 EDU0101 AL
3 Autauga, AL 01001 EDU010189D      6920 1989 EDU0101 AL
4 Autauga, AL 01001 EDU010190D      6847 1990 EDU0101 AL
5 Autauga, AL 01001 EDU010191D      7008 1991 EDU0101 AL
```

Question 6: Add division Variable to the Non-county Tibble

```
state_tibble <- state_tibble %>%
  mutate(
    state = substr(area_name, nchar(area_name) - 1, nchar(area_name)),
    division = case_when(
      state %in% c("CT", "ME", "MA", "NH", "RI", "VT") ~ "New England",
      state %in% c("NJ", "NY", "PA") ~ "Mid-Atlantic",

      state %in% c("IL", "IN", "MI", "OH", "WI") ~ "East North Central",
      state %in% c("IA", "KS", "MN", "MO", "NE",
                  "ND", "SD") ~ "West North Central",

      state %in% c("DE", "DC", "FL", "GA", "MD", "NC",
                  "SC", "VA", "WV") ~ "South Atlantic",
      state %in% c("AL", "KY", "MS", "TN") ~ "East South Central",
      state %in% c("AR", "LA", "OK", "TX") ~ "West South Central",

      state %in% c("AZ", "CO", "ID", "MT", "NV",
                  "NM", "UT", "WY") ~ "Mountain",
      state %in% c("AK", "CA", "HI", "OR", "WA") ~ "Pacific",

      TRUE ~ "ERROR" #return error for non-states like "UNITED STATES"
    )
  ) |>
  #remove the temporary intermediate column
  select(-state)

#display the first 5 rows
state_tibble |>
  slice(1:5)
```

A tibble: 5 x 7

	area_name	STCOU	surveyID_full	enrollment	year	surveyID	division
	<chr>	<chr>	<chr>	<dbl>	<dbl>	<chr>	<chr>
1	UNITED STATES	00000	EDU010187D	40024299	1987	EDU0101	ERROR
2	UNITED STATES	00000	EDU010188D	39967624	1988	EDU0101	ERROR
3	UNITED STATES	00000	EDU010189D	40317775	1989	EDU0101	ERROR
4	UNITED STATES	00000	EDU010190D	40737600	1990	EDU0101	ERROR
5	UNITED STATES	00000	EDU010191D	41385442	1991	EDU0101	ERROR

Requirements: Repeating Process with 2nd Component of Data Set

Create a Function for Steps 1 and 2

```
#read in the data set
edu01b <- read_csv("EDU01b.csv", show_col_types = FALSE)

select_pivot <- function(data, column = "enrollment") {
  data |>
    #step 1
    select(
      area_name = Area_name,
      STCOU,
      ends_with("D")
    ) |>
    #step 2
    pivot_longer(
      cols = ends_with("D"),
      names_to = "surveyID_full",
      values_to = column
    )
}

#test the function to see if it works correctly
edu_long <- select_pivot(edu01b)

#display the first 5 rows
edu_long |>
  slice(1:5)
```

```
# A tibble: 5 x 4
  area_name      STCOU surveyID_full enrollment
  <chr>          <chr> <chr>          <dbl>
1 UNITED STATES 00000 EDU010197D      44534459
2 UNITED STATES 00000 EDU010198D      46245814
3 UNITED STATES 00000 EDU010199D      46368903
4 UNITED STATES 00000 EDU010200D      46818690
5 UNITED STATES 00000 EDU010201D      47127066
```

Create a Function for Taking Output of Step 2 and Step 3

```
extract_year_id <- function(data) {  
  data |>  
    mutate(  
      surveyID_year = substr(surveyID_full, 8, 9),  
      year = as.numeric(paste0("19", surveyID_year)),  
      surveyID = substr(surveyID_full, 1, 7)  
    ) |>  
    select(-surveyID_year)  
}  
  
#test the function to see if it works correctly  
long_updated <- extract_year_id(edu_long)  
  
#display the first 5 rows  
long_updated |>  
  slice(1:5)
```

```
# A tibble: 5 x 6  
  area_name      STCOU surveyID_full enrollment   year surveyID  
  <chr>         <chr> <chr>          <dbl> <dbl> <chr>  
1 UNITED STATES 00000 EDU010197D      44534459 1997 EDU0101  
2 UNITED STATES 00000 EDU010198D      46245814 1998 EDU0101  
3 UNITED STATES 00000 EDU010199D      46368903 1999 EDU0101  
4 UNITED STATES 00000 EDU010200D      46818690 1900 EDU0102  
5 UNITED STATES 00000 EDU010201D      47127066 1901 EDU0102
```

Create a Function for Step 5

```
#only to be used for the county tibble  
extract_state <- function(county_tbl){  
  county_tbl |>  
    mutate(  
      state = substr(area_name, nchar(area_name) - 1, nchar(area_name))  
    )  
}  
  
#test the function to see if it works correctly
```

```
#first repeat steps 4 to get county_tibble
county_indices <- grep(pattern = ", \\w\\w", long_updated$area_name)
county_tibble <- long_updated[county_indices, ]
class(county_tibble) <- c("county", class(county_tibble))

#use the function
county_tibble <- extract_state(county_tibble)

#display the first 5 rows
county_tibble |>
  slice(1:5)
```

```
# A tibble: 5 x 7
  area_name STCOU surveyID_full enrollment   year surveyID state
  <chr>      <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 Autauga, AL 01001 EDU010197D      8099  1997 EDU0101  AL
2 Autauga, AL 01001 EDU010198D      8211  1998 EDU0101  AL
3 Autauga, AL 01001 EDU010199D      8489  1999 EDU0101  AL
4 Autauga, AL 01001 EDU010200D      8912  1900 EDU0102  AL
5 Autauga, AL 01001 EDU010201D      8626  1901 EDU0102  AL
```

Create a Function for Step 6

```
#only to be used for the non-county (state) tibble
assign_division <- function(state_tbl){
  state_tbl |>
    mutate(
      state = substr(area_name, nchar(area_name) - 1, nchar(area_name)),
      division = case_when(
        state %in% c("CT", "ME", "MA", "NH", "RI", "VT") ~ "New England",
        state %in% c("NJ", "NY", "PA") ~ "Mid-Atlantic",

        state %in% c("IL", "IN", "MI", "OH", "WI") ~ "East North Central",
        state %in% c("IA", "KS", "MN", "MO", "NE",
                     "ND", "SD") ~ "West North Central",

        state %in% c("DE", "DC", "FL", "GA", "MD", "NC",
                     "SC", "VA", "WV") ~ "South Atlantic",
        state %in% c("AL", "KY", "MS", "TN") ~ "East South Central",
```



```

    state %in% c("AR", "LA", "OK", "TX") ~ "West South Central",

    state %in% c("AZ", "CO", "ID", "MT", "NV",
                "NM", "UT", "WY") ~ "Mountain",
    state %in% c("AK", "CA", "HI", "OR", "WA") ~ "Pacific",

    TRUE ~ "ERROR"
  )
) |>
select(-state)
}

#test the function to see if it works correctly

#first repeat steps 4 to get state_tibble
county_indices <- grep(pattern = "\b\\w\\b", long_updated$area_name)
state_tibble <- long_updated[-county_indices, ]
class(state_tibble) <- c("state", class(state_tibble))

#use the function
state_tibble <- assign_division(state_tibble)

#display the first 5 rows
state_tibble |>
  slice(1:5)

```

```

# A tibble: 5 x 7
  area_name      STCOU surveyID_full enrollment   year surveyID division
  <chr>          <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 UNITED STATES 00000 EDU010197D      44534459 1997 EDU0101  ERROR
2 UNITED STATES 00000 EDU010198D      46245814 1998 EDU0101  ERROR
3 UNITED STATES 00000 EDU010199D      46368903 1999 EDU0101  ERROR
4 UNITED STATES 00000 EDU010200D      46818690 1900 EDU0102  ERROR
5 UNITED STATES 00000 EDU010201D      47127066 1901 EDU0102  ERROR

```

Create a Function Returning Two Final Tibbles

```

identify_locations <- function(data) {
  #step 4
  county_indices <- grep(pattern = "\b\\w\\b", long_updated$area_name)

```

```

county_tibble <- long_updated[county_indices, ]
class(county_tibble) <- c("county", class(county_tibble))

state_tibble <- long_updated[-county_indices, ]
class(state_tibble) <- c("state", class(state_tibble))

#step 5 using the functions create
county_tibble <- extract_state(county_tibble)
state_tibble <- assign_division(state_tibble)

#return both tibbles as a list
return(list(county = county_tibble, state = state_tibble))
}

#test the function to see if it works correctly

#applied the functions created above first
read_edu <- select_pivot(edu01b)
long_updated <- extract_year_id(read_edu)
edu01b_split <- identify_locations(long_updated)

#display the individual outputs
edu01b_split$county |>
  slice(1:5)

```

```

# A tibble: 5 x 7
  area_name STCOU surveyID_full enrollment year surveyID state
  <chr>      <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 Autauga, AL 01001 EDU010197D      8099  1997 EDU0101 AL
2 Autauga, AL 01001 EDU010198D      8211  1998 EDU0101 AL
3 Autauga, AL 01001 EDU010199D      8489  1999 EDU0101 AL
4 Autauga, AL 01001 EDU010200D      8912  1900 EDU0102 AL
5 Autauga, AL 01001 EDU010201D      8626  1901 EDU0102 AL

```

```

edu01b_split$state |>
  slice(1:5)

```

```

# A tibble: 5 x 7
  area_name STCOU surveyID_full enrollment year surveyID division
  <chr>      <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 UNITED STATES 00000 EDU010197D      44534459  1997 EDU0101 ERROR

```

2	UNITED STATES	00000	EDU010198D	46245814	1998	EDU0101	ERROR
3	UNITED STATES	00000	EDU010199D	46368903	1999	EDU0101	ERROR
4	UNITED STATES	00000	EDU010200D	46818690	1900	EDU0102	ERROR
5	UNITED STATES	00000	EDU010201D	47127066	1901	EDU0102	ERROR

Create All Into One Function Call - Wrapper Function

```
my_wrapper <- function(url, column = "enrollment") {
  result <- read_csv(url, show_col_types = FALSE) |>
    select_pivot(url, column) |>
    extract_year_id() |>
    identify_locations()
  return(result)
}

#test the wrapper function
edu01b <- my_wrapper("https://www4.stat.ncsu.edu/~online/datasets/EDU01b.csv")

#check the display of outputs
edu01b$county |>
  slice(1:5)
```

```
# A tibble: 5 x 7
  area_name STCOU surveyID_full enrollment year surveyID state
  <chr>      <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 Autauga, AL 01001 EDU010197D      8099 1997 EDU0101 AL
2 Autauga, AL 01001 EDU010198D      8211 1998 EDU0101 AL
3 Autauga, AL 01001 EDU010199D      8489 1999 EDU0101 AL
4 Autauga, AL 01001 EDU010200D      8912 1900 EDU0102 AL
5 Autauga, AL 01001 EDU010201D      8626 1901 EDU0102 AL
```

```
edu01b$state |>
  slice(1:5)
```

```
# A tibble: 5 x 7
  area_name STCOU surveyID_full enrollment year surveyID division
  <chr>      <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 UNITED STATES 00000 EDU010197D      44534459 1997 EDU0101 ERROR
2 UNITED STATES 00000 EDU010198D      46245814 1998 EDU0101 ERROR
3 UNITED STATES 00000 EDU010199D      46368903 1999 EDU0101 ERROR
```

```

4 UNITED STATES 00000 EDU010200D      46818690  1900 EDU0102  ERROR
5 UNITED STATES 00000 EDU010201D      47127066  1901 EDU0102  ERROR

```

Call It and Combine Your Data

```

#call wrapper twice for the 2 data sets
edu01a <- my_wrapper("https://www4.stat.ncsu.edu/~online/datasets/EDU01a.csv")
edu01b <- my_wrapper("https://www4.stat.ncsu.edu/~online/datasets/EDU01b.csv")

combine_data <- function(data1, data2){
  combined_county <- bind_rows(data1$county, data2$county)
  combined_state <- bind_rows(data1$state, data2$state)

  return(list(
    county = combined_county,
    state = combined_state
  ))
}

#test and display using the combine function
combine_data(edu01a, edu01b)

```

```

$county
# A tibble: 62,900 x 7
  area_name   STCOU surveyID_full enrollment   year surveyID state
  <chr>       <chr> <chr>          <dbl> <dbl> <chr>    <chr>
1 Autauga, AL 01001 EDU010197D      8099  1997 EDU0101  AL
2 Autauga, AL 01001 EDU010198D      8211  1998 EDU0101  AL
3 Autauga, AL 01001 EDU010199D      8489  1999 EDU0101  AL
4 Autauga, AL 01001 EDU010200D      8912  1900 EDU0102  AL
5 Autauga, AL 01001 EDU010201D      8626  1901 EDU0102  AL
6 Autauga, AL 01001 EDU010202D      8762  1902 EDU0102  AL
7 Autauga, AL 01001 EDU015203D      9105  1903 EDU0152  AL
8 Autauga, AL 01001 EDU015204D      9200  1904 EDU0152  AL
9 Autauga, AL 01001 EDU015205D      9559  1905 EDU0152  AL
10 Autauga, AL 01001 EDU015206D      9652  1906 EDU0152  AL
# i 62,890 more rows

$state
# A tibble: 1,060 x 7

```

	area_name	STCOU	surveyID_full	enrollment	year	surveyID	division
	<chr>	<chr>	<chr>	<dbl>	<dbl>	<chr>	<chr>
1	UNITED STATES	00000	EDU010197D	44534459	1997	EDU0101	ERROR
2	UNITED STATES	00000	EDU010198D	46245814	1998	EDU0101	ERROR
3	UNITED STATES	00000	EDU010199D	46368903	1999	EDU0101	ERROR
4	UNITED STATES	00000	EDU010200D	46818690	1900	EDU0102	ERROR
5	UNITED STATES	00000	EDU010201D	47127066	1901	EDU0102	ERROR
6	UNITED STATES	00000	EDU010202D	47606570	1902	EDU0102	ERROR
7	UNITED STATES	00000	EDU015203D	48506317	1903	EDU0152	ERROR
8	UNITED STATES	00000	EDU015204D	48693287	1904	EDU0152	ERROR
9	UNITED STATES	00000	EDU015205D	48978555	1905	EDU0152	ERROR
10	UNITED STATES	00000	EDU015206D	49140702	1906	EDU0152	ERROR

i 1,050 more rows

Writing a Generic Function for Summarizing

```
plot.state <- function(data, column = "enrollment"){  
  data |>  
    filter()  
}
```