Final Project

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Project description:

In this project, we will deal with some data related to America tuition costs in each state and then find out some correlation between the tuition costs and other relative variables.

Github repository: https://github.com/xicao143/data-wrangling (https://github.com/xicao143/data-wrangling)

1. Data import and data scraped

1.(a) Read data from the first data source. As data in this source has already been cleaned, so we do not have to clean them any more. we import these data from https://github.com/rfordatascience/tidytuesday/tree/master/data/2020/2020-03-10 (https://github.com/rfordatascience/tidytuesday/tree/master/data/2020/2020-03-10), also, I export them as csv files and upload them to my repository.

1.(b) Read data from the second source: https://www.collegetuitioncompare.com/state/ (https://www.collegetuitioncompare.com/state/). Th data read from this source is the tuition fees and living costs by state. This data source need to do some cleaning and change some colnames. We deleted some rows and colnames and renamed the colname names. Export it as a csv file.

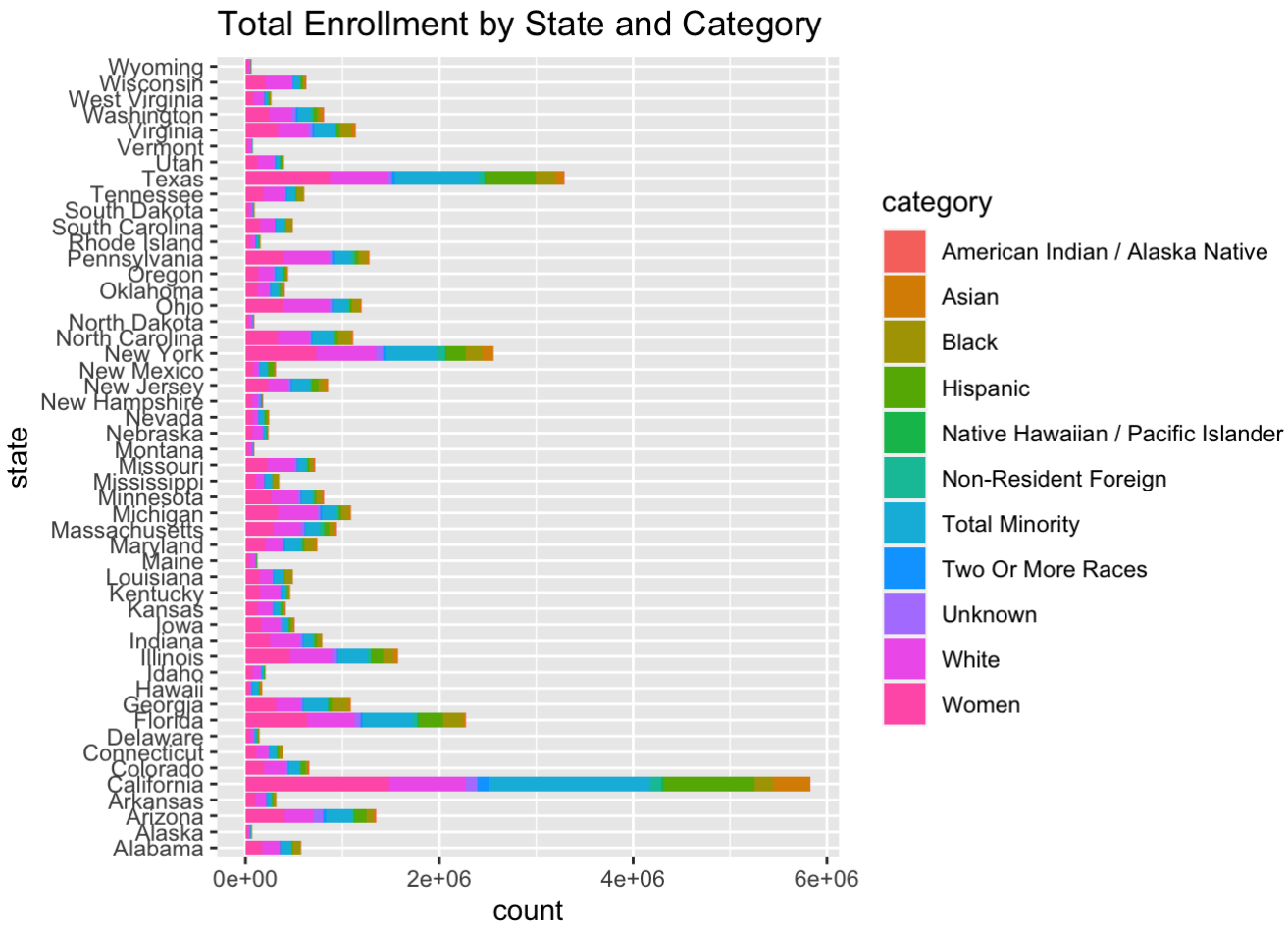
1.(c) Read more specific tuition costs from the website of each state by a loop and store these table into a list.

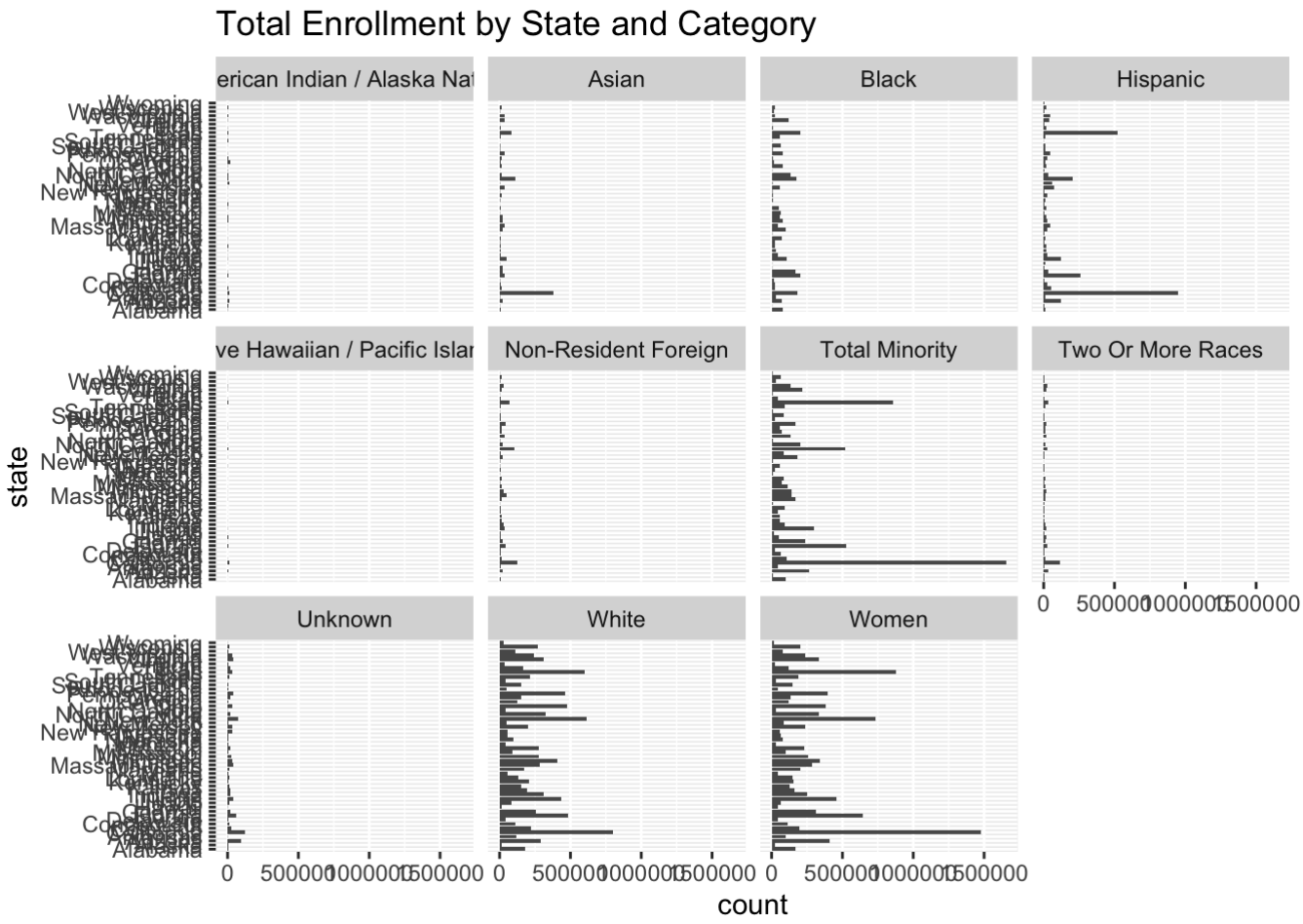
1.(d) Changed the specific data collected from each state to dataframes and select data according to different tuition costs types.

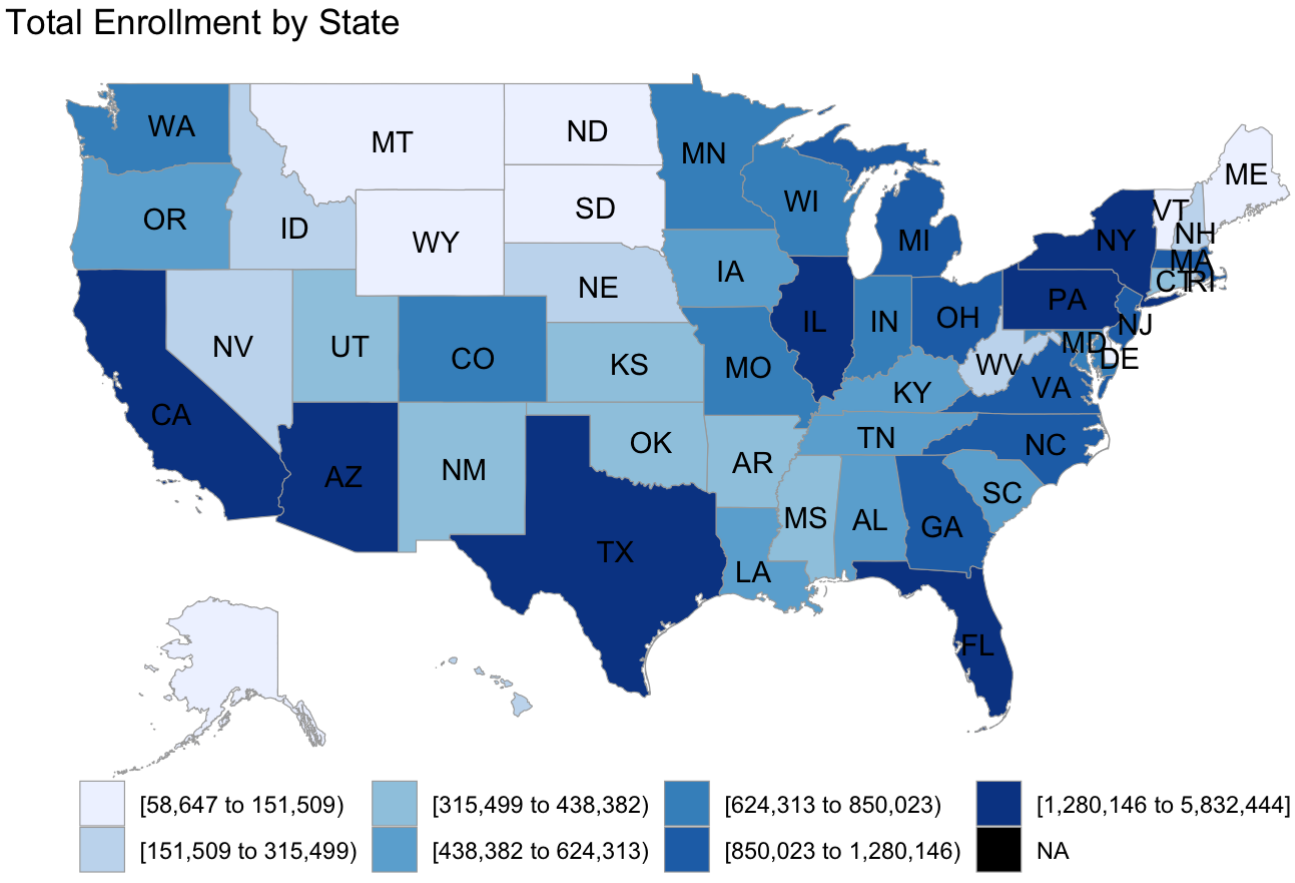
2. Diversity_school wrangling

In the part, we dealt with the diversity_school table to study the difference of enrollment between different states and categories. First, we group this table by state and category and count the total enrollment of different states and categories. Then we make a barplot and a state_choropleth to show it more specific.

```
## # A tibble: 10 x 3
## # Groups:   state [4]
##    state      category         count
##    <chr>      <chr>            <dbl>
##  1 California Total Minority 1654432
##  2 California Women          1476438
##  3 California Hispanic        949890
##  4 Texas      Women           876547
##  5 Texas      Total Minority  857045
##  6 California White           799516
##  7 New York   Women           731847
##  8 Florida    Women           642964
##  9 New York   White           613885
## 10 Texas      White           598209
```


Total Enrollment by State and Category
state
Wyoming
Wisconsin
West Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South Dakota
South Carolina
Rhode Island
Pennsylvania
Oregon
Oklahoma
Ohio
North Dakota
North Carolina
New York
New Mexico
New Jersey
New Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
0e+00
2e+06
4e+06
6e+06
count
category
American Indian / Alaska Native
Asian
Black
Hispanic
Native Hawaiian / Pacific Islander
Non-Resident Foreign
Total Minority
Two Or More Races
Unknown
White
Women


Total Enrollment by State and Category
erican Indian / Alaska Nat
Asian
Black
Hispanic
ve Hawaiian / Pacific Islar
Non-Resident Foreign
Total Minority
Two Or More Races
Unknown
White
Women
state
count
0
5000000
10000000
15000000


Total Enrollment by State
WA
MT
ND
MN
OR
ID
SD
WI
MI
WY
NY
VT
NH
ME
MA
RI
CT
NE
IA
PA
NJ
NV
UT
CO
KS
MO
IL
IN
OH
MD
DE
WV
KY
VA
CA
AZ
NM
OK
AR
TN
NC
SC
MS
AL
GA
TX
LA
FL
[58,647 to 151,509)
[151,509 to 315,499)
[315,499 to 438,382)
[438,382 to 624,313)
[624,313 to 850,023)
[850,023 to 1,280,146)
[1,280,146 to 5,832,444]
NA

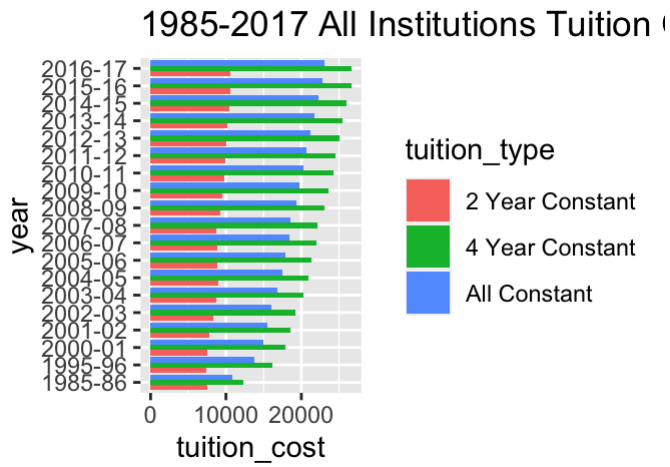
From the table, we can see that, the category of “Total Minority” in California has the highest enrollment, and the second and third rank also come from California, that is “Women” and “Hispanic”. And the fourth and fifth come from Texas which is “Women” and “Total Minority”. Besides, we can learn that from the best 10 enrollment, almost half of them come from the category of “Women”.

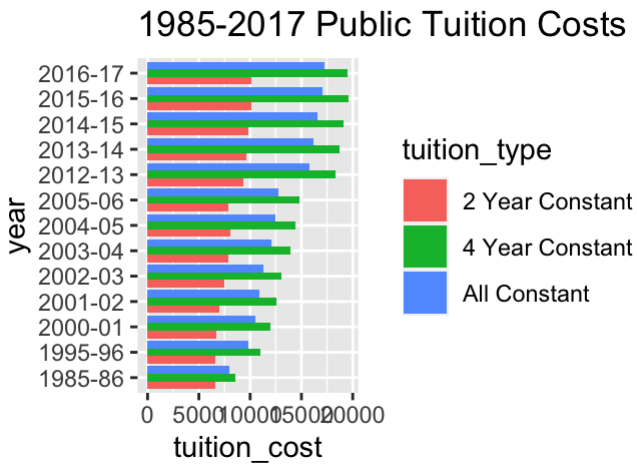
From the first bar plot, we can see that the best 5 high enrollment states are Carlifornia, Texas, New York, Florida, Illinois and they almost have all categories which means these states have more comprehensive universities. And combined with the third plot, we can see that those states with higher total enrollment are mostly spread at the west and east coast of America where economic development is faster.

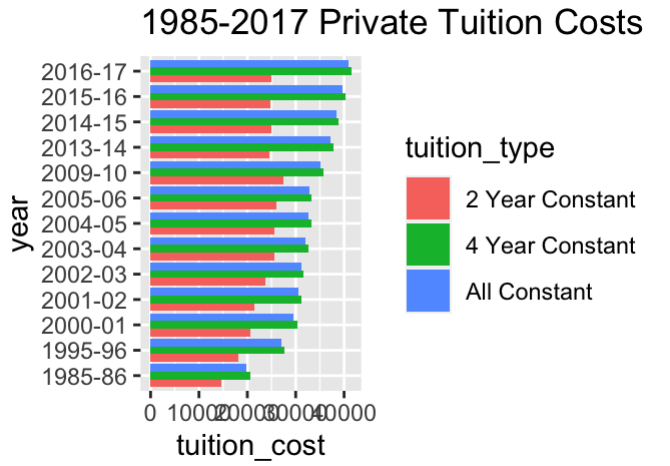
From the second bar plot, we can see that Women, White, Total MInority, Hispanic, Black have more enrollment than other categories and Women has the highest proportion in all of these categories which is same as we have learned from the table.

3. Historical_tuition wrangling

This table show the historical tuition costs from 1985 to 2017. At this table, we only use constant dollars which is more stable with economic status. Then, we make 3 barplot to show the variation of tuition costs between different unversity types and tuition types.



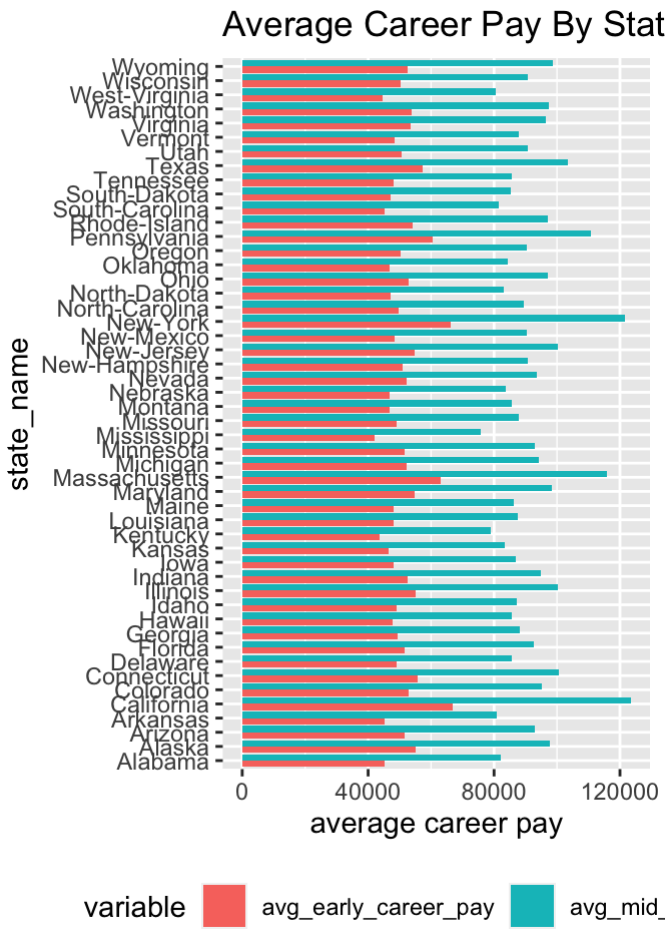


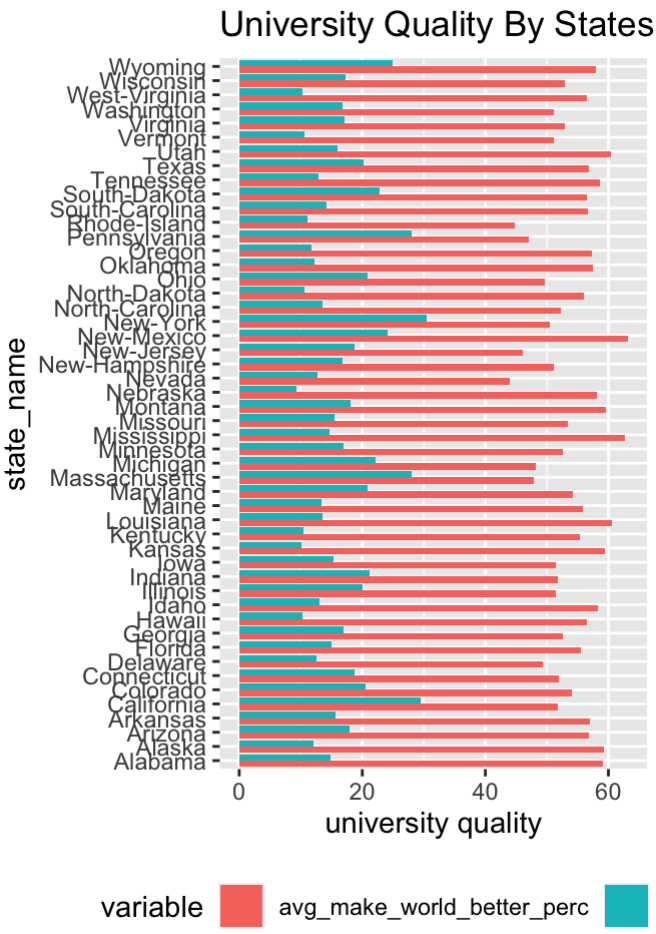


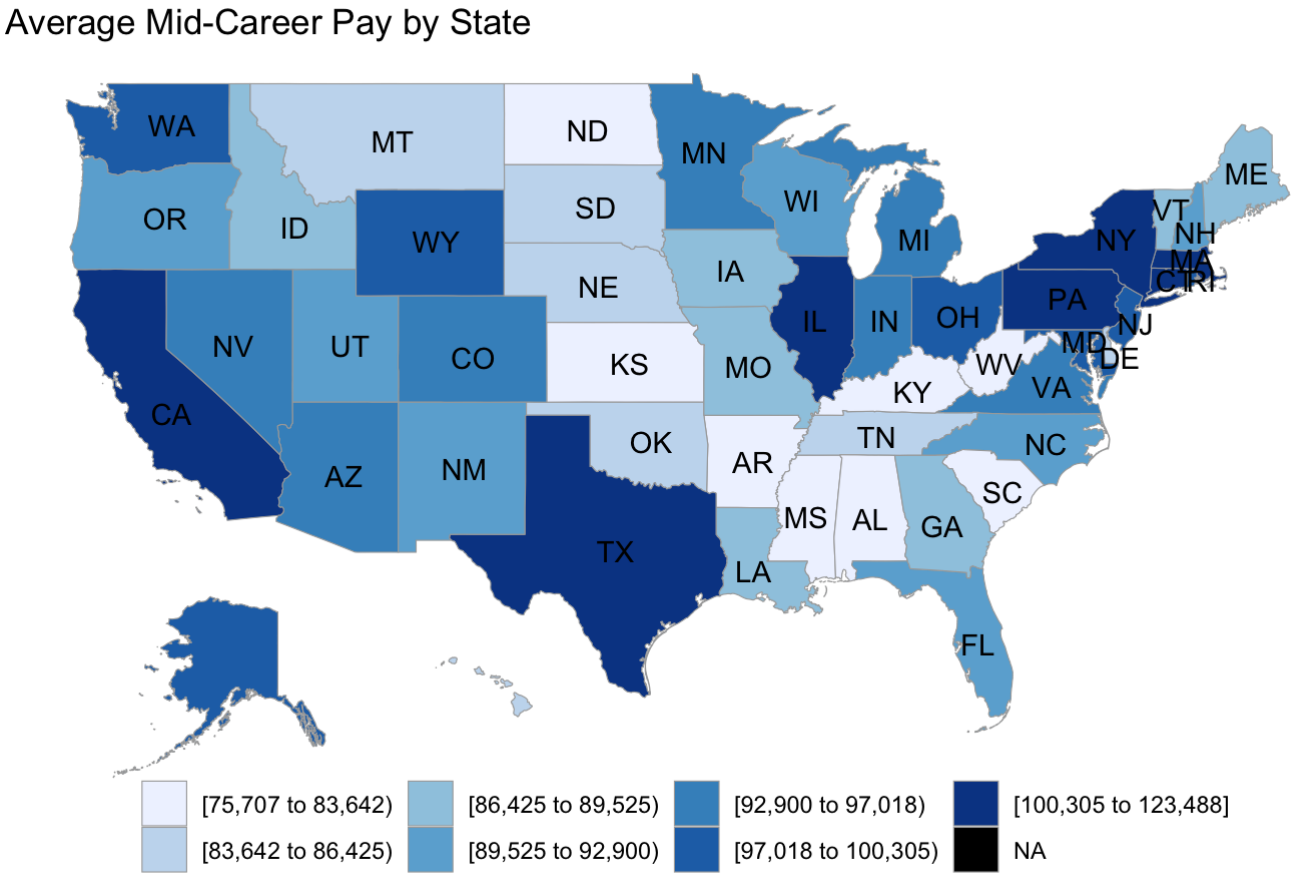
From the plot, although there are some missing values in time in public and private part, basically, the tuition costs has been increasing continuously from 1985 to 2017 no matter which tuition type is. Among these, private universities have the highest tuition cost, and public universities have the lowest tuition cost. Besides, all these three tuition type have increased through years, but “2 year constant” did not increased much while other two types increased over 10000 dollars through these years.

4. salary_potential wrangling

This table shows the estimated salary according to different level of career and we will show that the difference of potential salary and university quality(make_world_better_percent: Percent of alumni who think they are making the world a better place, stem_percent: Percent of student body in STEM) between states. First, do some summarise and cleaning on the table and create two barplots and a state_choropleth which can be used to make a comparison with the plot in step 2.


Average Career Pay By Stat
state_name
Wyoming
Wisconsin
West-Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South-Dakota
South-Carolina
Rhode-Island
Pennsylvania
Oregon
Oklahoma
Ohio
North-Dakota
North-Carolina
New-York
New-Mexico
New-Jersey
New-Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
0
40000
80000
120000
average career pay
variable
avg_early_career_pay
avg_mid_


University Quality By States
state_name
Wyoming
Wisconsin
West-Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South-Dakota
South-Carolina
Rhode-Island
Pennsylvania
Oregon
Oklahoma
Ohio
North-Dakota
North-Carolina
New-York
New-Mexico
New-Jersey
New-Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
0
20
40
60
university quality
variable
avg_make_world_better_perc


Average Mid-Career Pay by State
WA
MT
ND
MN
OR
ID
SD
WI
MI
WY
NY
VT
ME
NH
MA
RI
CT
NE
IA
IL
IN
OH
PA
NJ
NV
UT
CO
KS
MO
MD
DE
WV
KY
VA
CA
AZ
NM
OK
AR
TN
NC
SC
MS
AL
GA
TX
LA
FL
[75,707 to 83,642)
[83,642 to 86,425)
[86,425 to 89,525)
[89,525 to 92,900)
[92,900 to 97,018)
[97,018 to 100,305)
[100,305 to 123,488]
NA

First, from the two barplot, we can see that the estiamted early career pay does not differ greatly among states, it is about 40000 dollars, and the difference of make_world_better_percent between states is also not big, around 55%. But the other two variable have large difference between different states: Carlifornia, Massachusetts, New York and Pennsylvania has the highest estiamted mid-career pay, and correspondingly, these four states also have higher stem percentage compared with other states. This may mean that stem correlated majors need more professors for a university. Besides, combined the next plot with the plot “Total Enrollment by State” in part2, we also know that Carlifornia and New York have more enrollment than other states. This means enrollment and salary may have some connections, but this table only shows the estimated salary, so in the next part, we will show the relationship between enrollment and real tuition income.

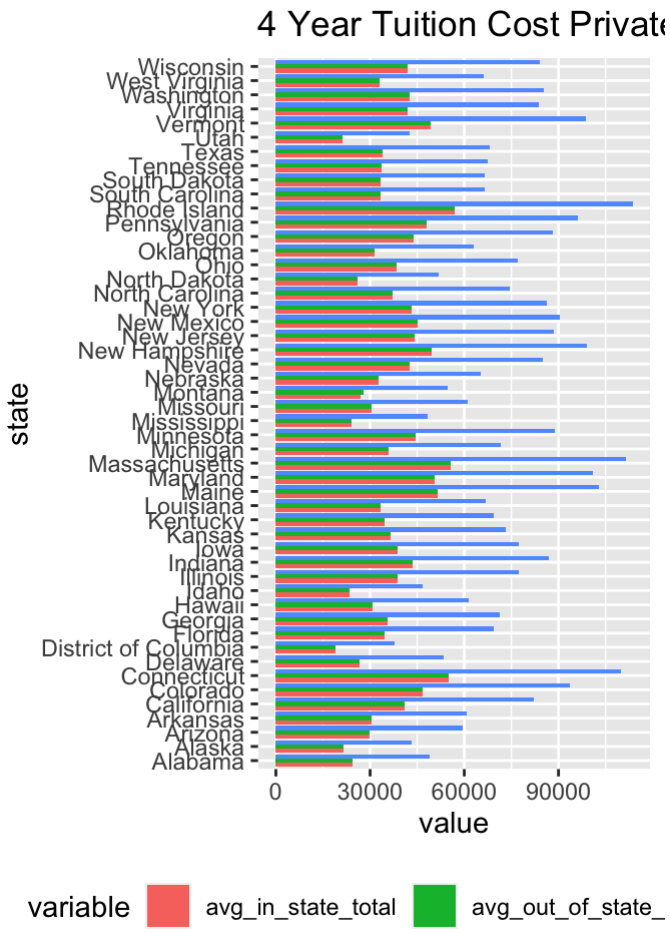
5.(a) tuition_cost wrangling

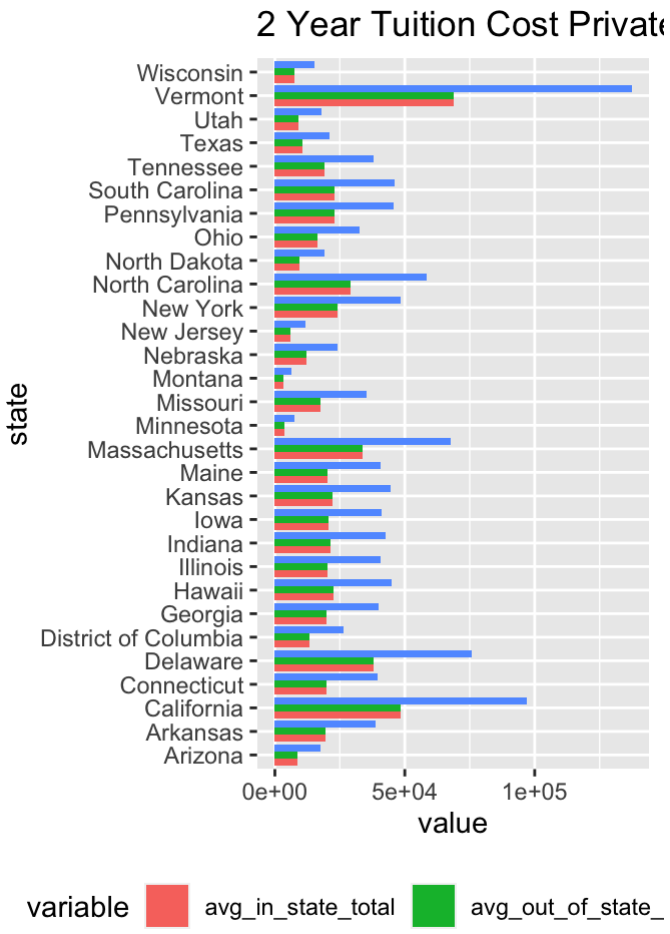
This table shows the tuition cost for 2018-2019. First, we change missing values to zero. And then we analyze the tuition cost according to different classification criterion.

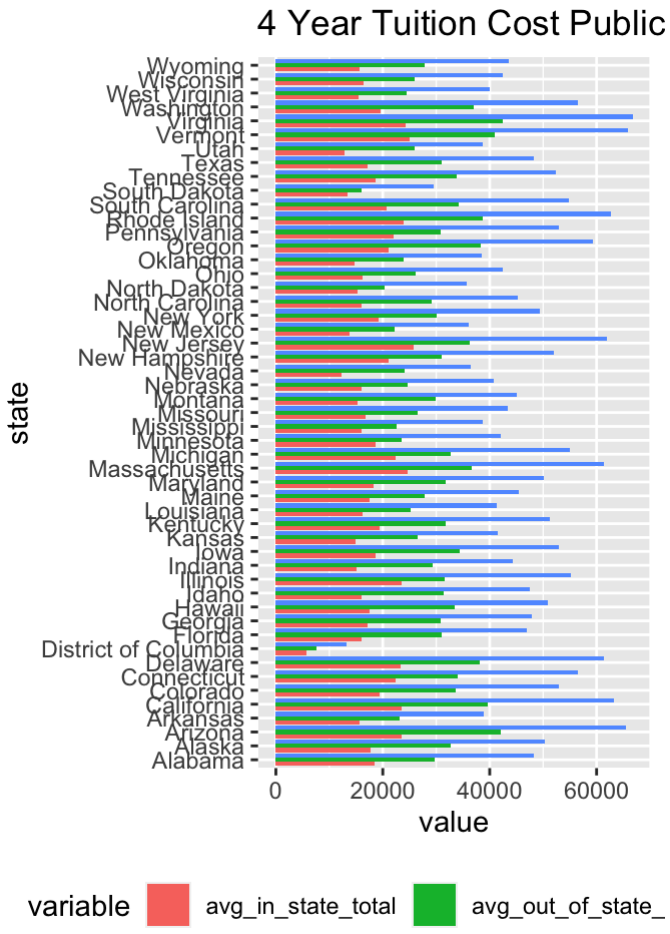
```
## # A tibble: 5 x 5
## # Groups:   state [5]
##   state        degree_length avg_in_state_total avg_out_of_state_total avg_total
##   <chr>        <chr>                      <dbl>                  <dbl>     <dbl>
## 1 Virginia     4 Year                    24331.                 42394.    66726.
## 2 Vermont      4 Year                    25012                  40924     65936
## 3 Arizona      4 Year                    23451                  42010     65461
## 4 California   4 Year                    23592.                 39720.    63312.
## 5 Rhode Island 4 Year                    23923                  38666.    62590.
```

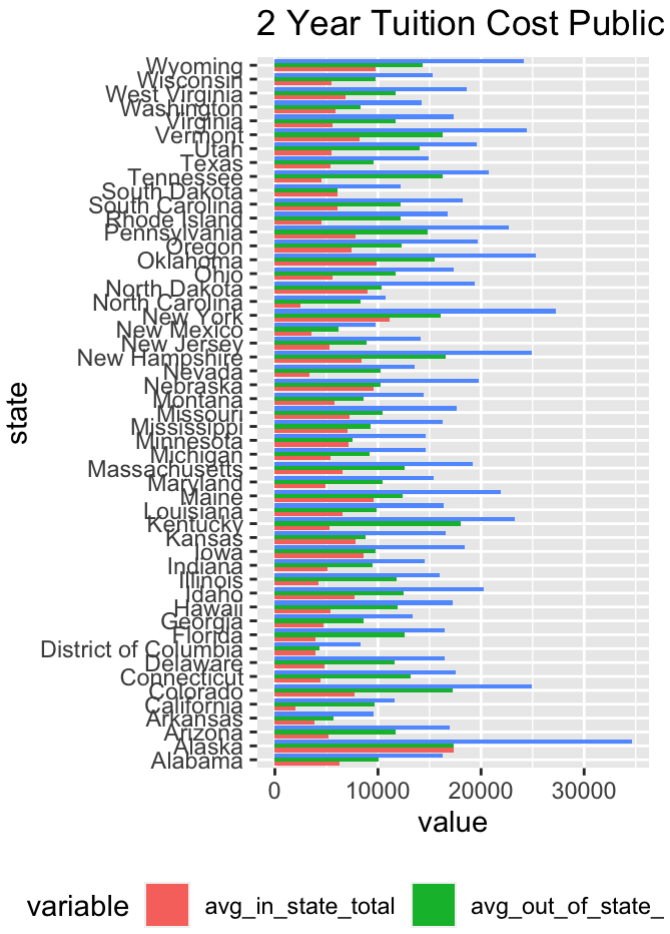
```
## # A tibble: 5 x 5
## # Groups:   state [5]
##   state         degree_length avg_in_state_total avg_out_of_state_tot… avg_total
##   <chr>         <chr>                      <dbl>                  <dbl>     <dbl>
## 1 Vermont       2 Year                     68640                  68640    137280
## 2 Rhode Island  4 Year                     56793.                 56793.   113586.
## 3 Massachusetts 4 Year                     55763                  55763    111526
## 4 Connecticut   4 Year                     55008.                 55008.   110015
## 5 Maine         4 Year                     51419.                 51419.   102837.
```

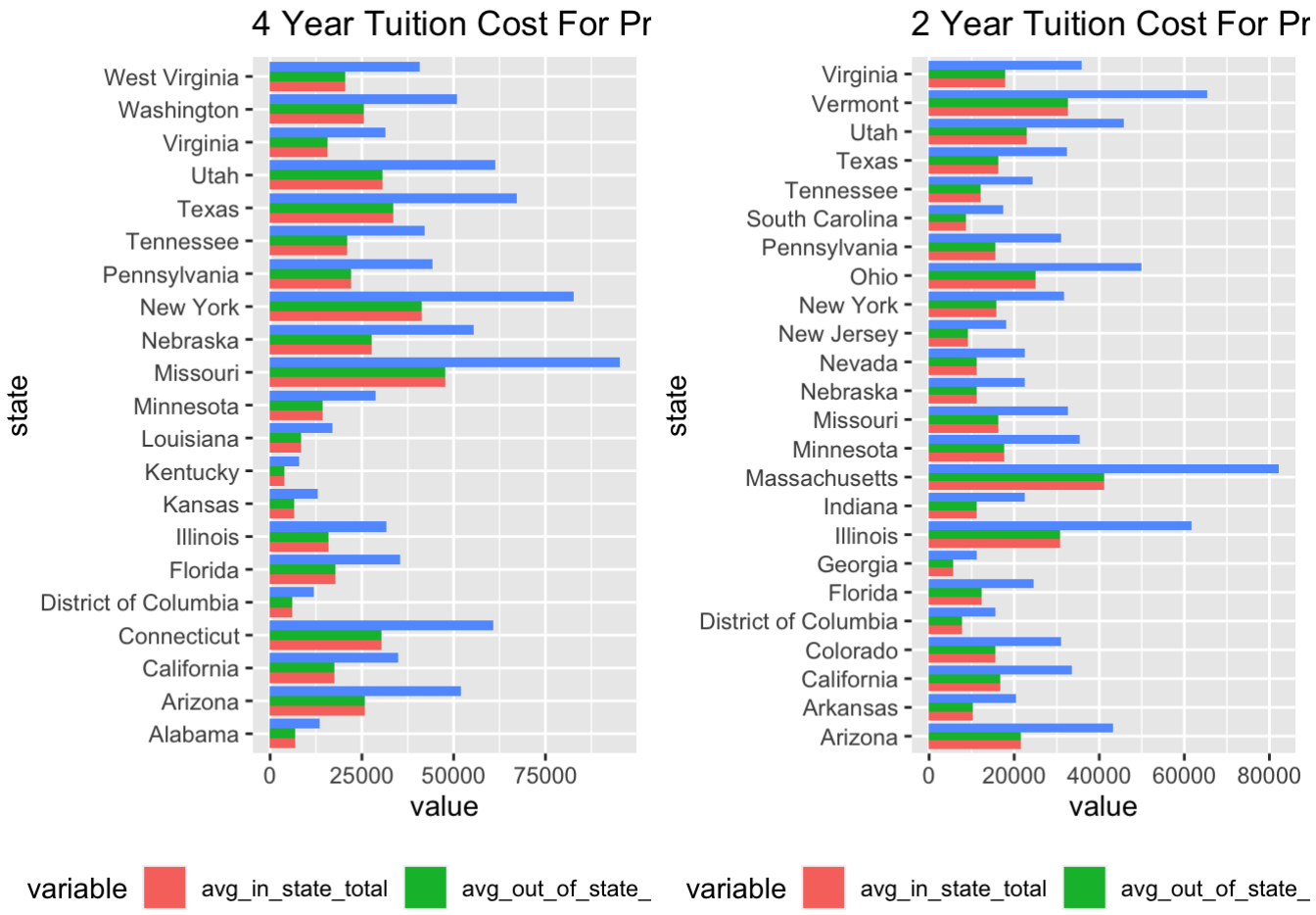
```
## # A tibble: 5 x 5
## # Groups:   state [5]
##   state         degree_length avg_in_state_total avg_out_of_state_tot… avg_total
##   <chr>         <chr>                      <dbl>                  <dbl>     <dbl>
## 1 Missouri      4 Year                     47570                  47570     95140
## 2 New York      4 Year                     41380.                 41380.    82759
## 3 Massachusetts 2 Year                     41050                  41050     82100
## 4 Texas         4 Year                     33624                  33624     67248
## 5 Vermont       2 Year                     32676                  32676     65352
```


4 Year Tuition Cost Private
Wisconsin
West Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South Dakota
South Carolina
Rhode Island
Pennsylvania
Oregon
Oklahoma
Ohio
North Dakota
North Carolina
New York
New Mexico
New Jersey
New Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
District of Columbia
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
state
0
30000
60000
90000
value
variable
avg_in_state_total
avg_out_of_state_


2 Year Tuition Cost Private
Wisconsin
Vermont
Utah
Texas
Tennessee
South Carolina
Pennsylvania
Ohio
North Dakota
North Carolina
New York
New Jersey
Nebraska
Montana
Missouri
Minnesota
Massachusetts
Maine
Kansas
Iowa
Indiana
Illinois
Hawaii
Georgia
District of Columbia
Delaware
Connecticut
California
Arkansas
Arizona
state
0e+00
5e+04
1e+05
value
variable
avg_in_state_total
avg_out_of_state_


4 Year Tuition Cost Public
Wyoming
Wisconsin
West Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South Dakota
South Carolina
Rhode Island
Pennsylvania
Oregon
Oklahoma
Ohio
North Dakota
North Carolina
New York
New Mexico
New Jersey
New Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
District of Columbia
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
state
0
20000
40000
60000
value
variable
avg_in_state_total
avg_out_of_state_


2 Year Tuition Cost Public
Wyoming
Wisconsin
West Virginia
Washington
Virginia
Vermont
Utah
Texas
Tennessee
South Dakota
South Carolina
Rhode Island
Pennsylvania
Oregon
Oklahoma
Ohio
North Dakota
North Carolina
New York
New Mexico
New Jersey
New Hampshire
Nevada
Nebraska
Montana
Missouri
Mississippi
Minnesota
Michigan
Massachusetts
Maryland
Maine
Louisiana
Kentucky
Kansas
Iowa
Indiana
Illinois
Idaho
Hawaii
Georgia
Florida
District of Columbia
Delaware
Connecticut
Colorado
California
Arkansas
Arizona
Alaska
Alabama
state
0
10000
20000
30000
value
variable
avg_in_state_total
avg_out_of_state_



The three tables show the best 5 high tuition cost according to different tuition type. we can see that Vermont always has higher tuition cost in all these three tuition types, and Rhode Island and Massachusetts is close to Vermont in private tuition type. From part4, we also know that Massachusetts has almost highest estimated potential. Besides, we can see that the tuition cost has increased compared with the histirical tuition cost in part3.

In this part, we have also created 6 bar plots to compare the difference of in-state and out-of-state under different situations which is similar to what we have done in part3. Overall, the in-state tuition cost is much small than out-of-state tuition cost.

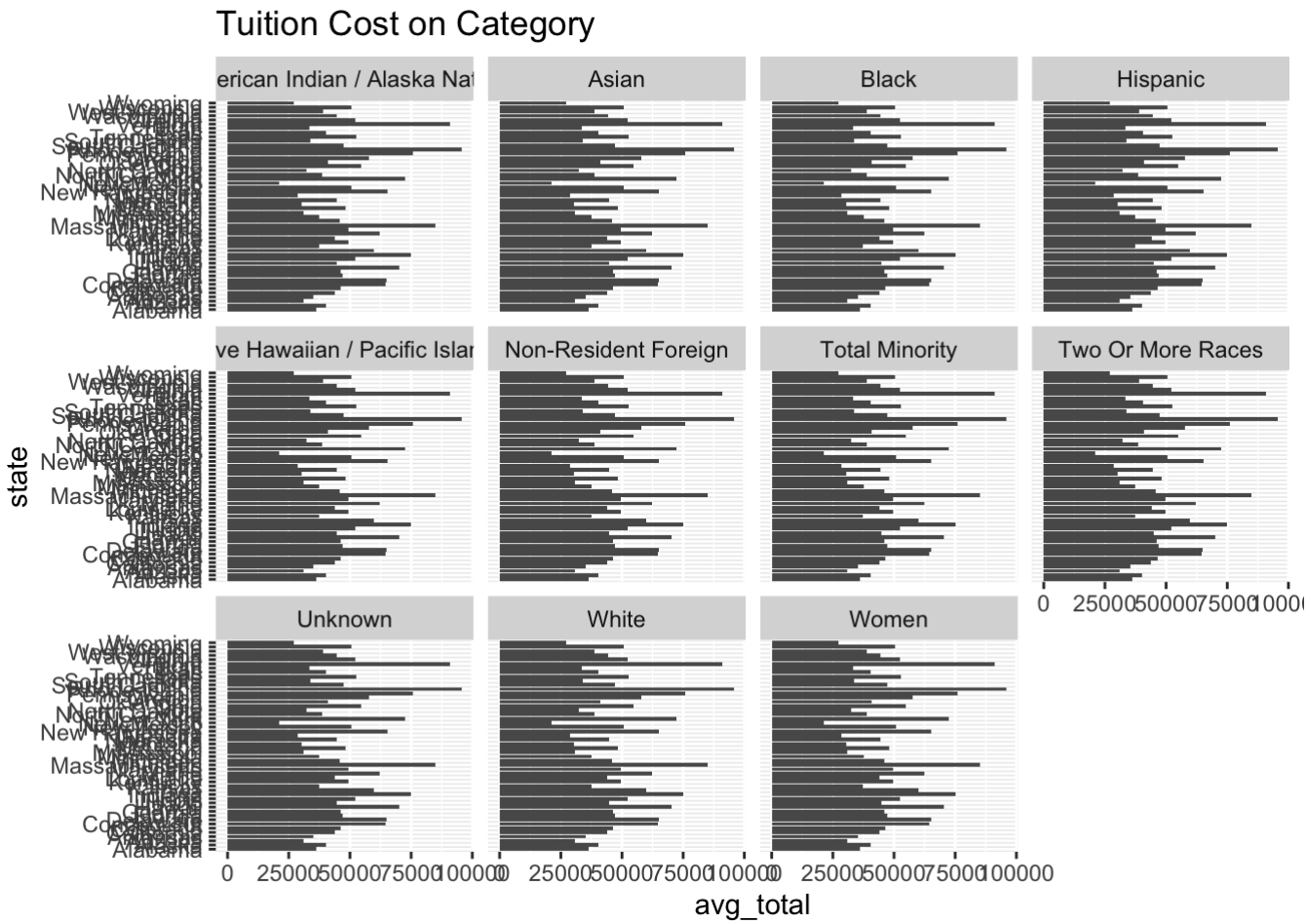
In private type, in-state tuition cost is the same as out-of-state tuition cost ehich is quite different from the public universities no matter 4-year or 2-year, but the 4-year tuition cost is still about twice that of 2-year. And in some states, they do not provide 2-year education.

And compared wthin “Public” type, we can see that 4-year tuition cost is about twice that of 2-year, 4-year tuition cost is about 35000 dollars, but 2-year tuition cost is only about 12500, much smaller than 4-year.Besides, every state have public universities.

For profit type, it’s the same with private type, that is, in-state tuition cost is the same as out-of-state tuition cost no matter what the degree length is. Also, there are some states don’t have universities for profit type.

5.(b) tuition_cost + diversity_school

In this part, we join these two tables to find out whether there are some coorelations between university diversity and tuition cost.



From the plot, we can see that there is no correlation between university diversity and tuition cost, all categories have same tuition cost in each state. But, there is some relationship between total enrollment and tuition cost, for example, Carlifornia, Texas, New York have higher enrollment and correspondingly, these states have higher tuition cost in public and profit type of tuition.

6. 2020 tuition cost data wrangling

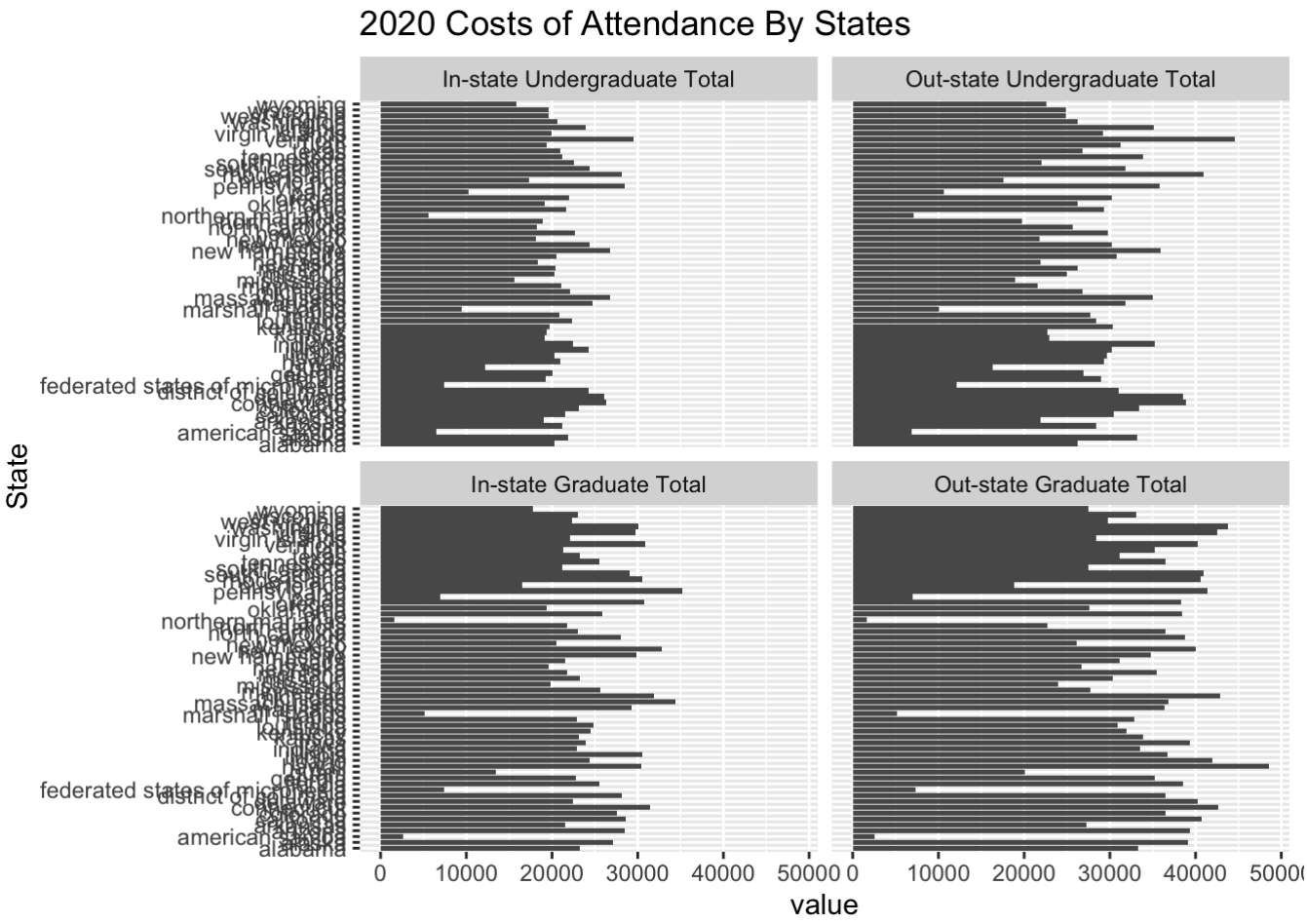
6.(a) In this part, we will deal with the specific data we collected from each state and comibine them together. We also turn costs to numeric type for easy calculation. And also, we output the tidy version of our data as csv files which can be found in my github repository.

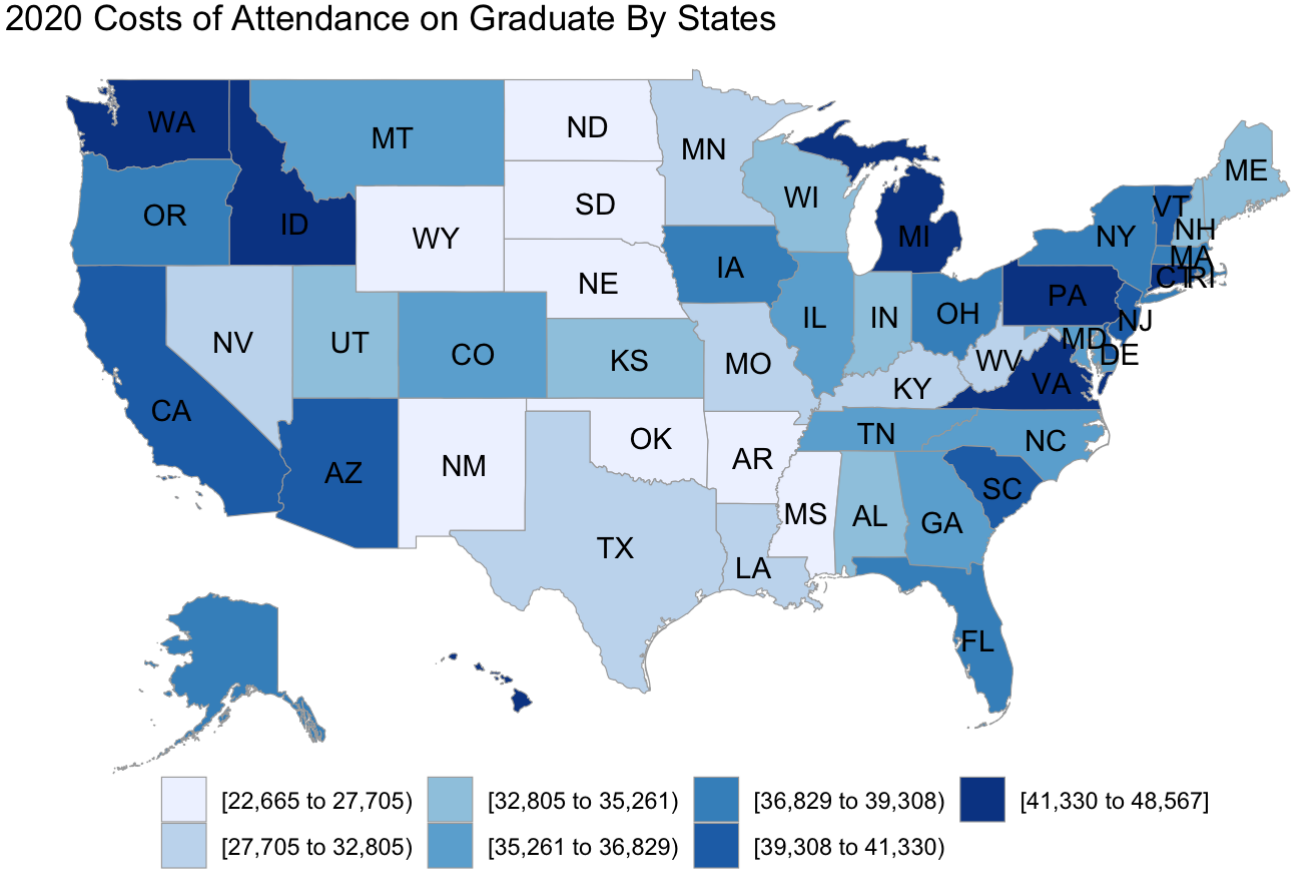
```
##            State Number of Schools In-State Public Tuition Fees
## 3         Alaska                10                         7293
## 4        Alabama                97                         6931
## 5       Arkansas                90                         4877
## 6 American Samoa                 1                         3950
## 7        Arizona               140                         4667
##   Out-State Public Tuition Fees Private Tuition Fees On-Campus Living Costs
## 3                         18608                12891                  13454
## 4                         13348                16852                  12115
## 5                          7743                18518                  12023
## 6                          4250                    0                      0
## 7                         11342                17964                  13820
##   Off-Campus Living Costs
## 3                   16356
## 4                   12092
## 5                   12972
## 6                    4000
## 7                   14597
```

```
##            State In-state Undergraduate Total Out-state Undergraduate Total
## 1         alaska                       21822                         33137
## 2        alabama                       20328                         26222
## 3       arkansas                       19003                         21868
## 4 american samoa                        6550                          6850
## 5        arizona                       21161                         28374
##   In-state Graduate Total Out-state Graduate Total
## 1                   27070                    39145
## 2                   23198                    33250
## 3                   21549                    27222
## 4                    2600                     2600
## 5                   28452                    39308
##   In-state Undergraduate Tuition Fee Out-state Undergraduate Tuition Fee
## 1                               7293                               18608
## 2                               6770                               12664
## 3                               4877                                7743
## 4                               3950                                4250
## 5                               5180                               12393
##   In-state Graduate Tuition Fee Out-state Graduate Tuition Fee
## 1                         12541                         24616
## 2                          9639                         19692
## 3                          7423                         13096
## 4                             0                             0
## 5                         12471                         23327
##   Undergraduate-room Graduate-room Undergraduate-books Graduate-books
## 1              13454         13454                1074           1074
## 2              12115         12115                1443           1443
## 3              12023         12023                2102           2102
## 4                  0             0                2600           2600
## 5              13820         13820                2161           2161
```

These two tables are come from the second data source.

6.(b) Do some analysis with the data we collected from the website and find some connection with the previous analysis.


2020 Costs of Attendance By States
In-state Undergraduate Total
Out-state Undergraduate Total
In-state Graduate Total
Out-state Graduate Total
State
federated states of micronesia
district of columbia
american samoa
alabama
0
10000
20000
30000
40000
50000
value


2020 Costs of Attendance on Graduate By States
WA
MT
ND
MN
OR
ID
SD
WI
MI
WY
NY
VT
NH
ME
MA
CT
RI
IA
NE
IL
IN
OH
PA
NJ
NV
UT
CO
KS
MO
MD
DE
WV
KY
VA
CA
AZ
NM
OK
AR
TN
NC
SC
MS
AL
GA
TX
LA
FL
[22,665 to 27,705)
[27,705 to 32,805)
[32,805 to 35,261)
[35,261 to 36,829)
[36,829 to 39,308)
[39,308 to 41,330)
[41,330 to 48,567]

From the first two barplot, we can know that, the cost of private type tuition is still higher than that of public type of tuition, but the difference is smaller in some states. And Vermont has the highest tuition costs both in public and private, which is similar as we have learned from part5.(a). As for living costs, there is slightly difference between on-campus living and off-campus living, Carlifornia and Hawaii have relatively higher off-campus living cost and District of Columbia, Massachusetts and Rhode Island have relatively higher on-campus living. But no matter on-campus or off-campus, it's seems like these are some relationship between tuition costs and living costs: basically, higher tuition costs may lead to higher living costs, and in these states where mostly are coastal states, the potential salary would be higher either according to Part4.

From the third barplot, we can see that the COA of graduate study is more higher than that of undergraduate study, and obviously, students who are not resident of this state need to pay more than those who are resident of this state. And from the last plot, we caan see that, those states with higher COA are basically coastal states where have more international students and the economic development is faster.

7. Conclusion

From this project, we can learn that, basically, coastal states have higher tuition costs in America where are known to have better universities and more international students. But also, the salary in these regions is also higher. And in general, private universities have higher tuition fees than public universities, but the tuition costs have no relationship with the university diversity: tuition costs is same for all kinds of diversities.