RANKING US STATES ON A YEARLY BASIS AND ON 10 YEAR AVERAGE FROM 2011 TO 2020

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R Markdown

```
library(tidyverse)
```

```
## -- Attaching packages -------------------------------------- tidyverse 1.3.1 --
```

```
## v ggplot2 3.3.4     v purrr   0.3.4
## v tibble  3.1.2     v dplyr   1.0.7
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1
```

```
## -- Conflicts ----------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

R loading data on infrastructure:

metric Road quality

```
road_quality_data <- read_csv("road_quality_data.csv")
```

```
##
## -- Column specification -------------------------------------------------------
## cols(
##   Year = col_double(),
##   Class = col_character(),
##   System = col_character(),
##   `International Roughness Index` = col_logical(),
##   State = col_character(),
##   `Pivot Field Names` = col_character(),
##   Value = col_double()
## )
```

```
## Warning: 6 parsing failures.
##  row                           col            expected                        actual
## 1405 Year                          a double           Year                          'road_quality_da
## 1405 International Roughness Index 1/0/T/F/TRUE/FALSE International Roughness Index 'road_quality_da
## 1405 Value                         a double           Value                         'road_quality_da
## 2054 Year                          a double           Year                          'road_quality_da
## 2054 International Roughness Index 1/0/T/F/TRUE/FALSE International Roughness Index 'road_quality_da
## .... ............................. .................. ............................. ................
## See problems(...) for more details.
```

```
road_quality_data
```

```
## # A tibble: 2,756 x 7
##     Year Class     System  `International Rough~ State  `Pivot Field Na~   Value
##    <dbl> <chr>     <chr>   <lgl>                 <chr>  <chr>              <dbl>
##  1  2020 Acceptab~ Overall NA                    Alaba~ Acceptable       2.35e+4
##  2  2020 Percent ~ Overall NA                    Alaba~ Percent Accepta~ 9.09e-1
##  3  2020 Total (m~ Overall NA                    Alaba~ Total            2.59e+4
##  4  2019 Acceptab~ Overall NA                    Alaba~ Acceptable       2.32e+4
##  5  2019 Percent ~ Overall NA                    Alaba~ Percent Accepta~ 8.87e-1
##  6  2019 Total (m~ Overall NA                    Alaba~ Total            2.62e+4
##  7  2018 Acceptab~ Overall NA                    Alaba~ Acceptable       2.29e+4
##  8  2018 Percent ~ Overall NA                    Alaba~ Percent Accepta~ 8.81e-1
##  9  2018 Total (m~ Overall NA                    Alaba~ Total            2.60e+4
## 10  2017 Acceptab~ Overall NA                    Alaba~ Acceptable       2.13e+4
## # ... with 2,746 more rows
```

filtering out unwanted rows

renaming the states

select the required columns

```
wrangled_data_roads <- road_quality_data %>%
filter(grepl('Percent Acceptable', Class))%>%
rename(International_Roughness_Index = Value) %>%
select(Year,State,International_Roughness_Index )


wrangled_data_roads
```

```
## # A tibble: 918 x 3
##     Year State   International_Roughness_Index
##    <dbl> <chr>                           <dbl>
##  1  2020 Alabama                         0.909
##  2  2019 Alabama                         0.887
##  3  2018 Alabama                         0.881
##  4  2017 Alabama                         0.861
##  5  2016 Alabama                         0.864
##  6  2015 Alabama                         0.976
##  7  2014 Alabama                         0.901
##  8  2013 Alabama                         0.891
##  9  2012 Alabama                         0.922
## 10  2011 Alabama                         0.915
## # ... with 908 more rows
```

Using pivot wider to tidy the data

```
final_road_data1 <- wrangled_data_roads %>%
pivot_wider(names_from = Year, values_from = International_Roughness_Index)

final_road_data1
```

```
## # A tibble: 51 x 19
##    State   `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama 0.909  0.887  0.881  0.861  0.864  0.976  0.901  0.891  0.922  0.915
##  2 Alaska  0.809  0.830  0.769  0.775  0.767  0.789  0.767  0.793  0.790  0.760
##  3 Arizona 0.775  0.791  0.814  0.803  0.858  0.852  0.878  0.921  0.932  0.854
##  4 Arkans~ 0.920  0.933  0.797  0.912  0.882  0.793  0.818  0.771  0.800  0.774
##  5 Colora~ 0.781  0.778  0.781  0.777  0.763  0.792  0.785  0.765  0.792  0.806
##  6 Califo~ 0.670  0.648  0.587  0.550  0.563  0.496  0.630  0.601  0.609  0.608
##  7 Connec~ 0.670  0.660  0.649  0.656  0.652  0.435  0.555  0.537  0.478  0.520
##  8 Delawa~ 0.837  0.840  0.817  0.816  0.826  0.841  0.810  0.832  0.806  0.798
##  9 Distri~ 0.0861 0.0724 0.0676 0.0671 0.0766 0.0463 0.0396 0.0619 0.0374 0.0315
## 10 Florida 0.877  0.871  0.882  0.904  0.900  0.905  0.920  0.834  0.928  0.891
## # ... with 41 more rows, and 8 more variables: 2010 <dbl>, 2009 <dbl>,
## #   2008 <dbl>, 2007 <dbl>, 2006 <dbl>, 2005 <dbl>, 2000 <dbl>, 1995 <dbl>
```

replacing NA cell

```
final_road_data1 [22, 8] = 0.634656894
```

Deleting unwanted columns using dplyr select

using mutate to get the sum and average

```
ten_year_roadmean <- final_road_data1 %>%
select(-c(12:19)) %>%
mutate("10year_mean" =rowMeans(select(.,`2011`,`2012`,`2013`,`2014`,`2015`,`2016`,`2017`,`2018`,`2019`,

ten_year_roadmean
```

```
## # A tibble: 51 x 12
##    State   `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama 0.909  0.887  0.881  0.861  0.864  0.976  0.901  0.891  0.922  0.915
##  2 Alaska  0.809  0.830  0.769  0.775  0.767  0.789  0.767  0.793  0.790  0.760
##  3 Arizona 0.775  0.791  0.814  0.803  0.858  0.852  0.878  0.921  0.932  0.854
##  4 Arkans~ 0.920  0.933  0.797  0.912  0.882  0.793  0.818  0.771  0.800  0.774
##  5 Colora~ 0.781  0.778  0.781  0.777  0.763  0.792  0.785  0.765  0.792  0.806
##  6 Califo~ 0.670  0.648  0.587  0.550  0.563  0.496  0.630  0.601  0.609  0.608
##  7 Connec~ 0.670  0.660  0.649  0.656  0.652  0.435  0.555  0.537  0.478  0.520
##  8 Delawa~ 0.837  0.840  0.817  0.816  0.826  0.841  0.810  0.832  0.806  0.798
##  9 Distri~ 0.0861 0.0724 0.0676 0.0671 0.0766 0.0463 0.0396 0.0619 0.0374 0.0315
## 10 Florida 0.877  0.871  0.882  0.904  0.900  0.905  0.920  0.834  0.928  0.891
## # ... with 41 more rows, and 1 more variable: 10year_mean <dbl>
```

using mutate to get the 10yr road data mean

```
rankedroad_data_2011to2020 <-ten_year_roadmean %>%
arrange(desc(`10year_mean`)) %>%
mutate('2011_ranking' =min_rank(desc(`2011`))) %>%
mutate('2012_ranking' = min_rank(desc(`2012`) )) %>%
mutate('2013_ranking' = min_rank(desc(`2013`)) ) %>%
mutate('2014_ranking' = min_rank(desc(`2014`)) ) %>%
mutate('2015_ranking' = min_rank(desc(`2015`)) ) %>%
mutate('2016_ranking' = min_rank(desc(`2016`)) ) %>%
mutate('2017_ranking' = min_rank(desc(`2017`)) ) %>%
mutate('2018_ranking' = min_rank(desc(`2018`)) ) %>%
mutate('2019_ranking' = min_rank(desc(`2019`)) ) %>%
mutate('2020_ranking' = min_rank(desc(`2020`)) ) %>%
mutate('10year_ranking' = min_rank(desc(`10year_mean`)) )

rankedroad_data_2011to2020
```

```
## # A tibble: 51 x 23
##    State   `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Idaho    0.902  0.964  0.969  0.964  0.953  0.955  0.952  0.949  0.887  0.985
##  2 Georgia  0.928  0.929  0.968  0.952  0.965  0.964  0.887  0.867  0.995  0.995
##  3 Tennes~  0.946  0.947  0.946  0.953  0.936  0.916  0.941  0.926  0.952  0.953
##  4 North ~  0.941  0.941  0.934  0.901  0.972  0.904  0.951  0.946  0.964  0.941
##  5 Nebras~  0.929  0.889  0.899  0.923  0.918  0.925  0.947  0.952  0.938  0.927
##  6 Wyoming  0.943  0.947  0.804  0.920  0.933  0.912  0.918  0.918  0.917  0.939
##  7 Kentuc~  0.926  0.901  0.920  0.903  0.899  0.920  0.926  0.910  0.898  0.921
##  8 Alabama  0.909  0.887  0.881  0.861  0.864  0.976  0.901  0.891  0.922  0.915
##  9 Montana  0.873  0.883  0.880  0.885  0.883  0.899  0.907  0.894  0.927  0.929
## 10 Oregon   0.886  0.899  0.898  0.893  0.880  0.883  0.884  0.895  0.896  0.931
## # ... with 41 more rows, and 12 more variables: 10year_mean <dbl>,
## #   2011_ranking <int>, 2012_ranking <int>, 2013_ranking <int>,
## #   2014_ranking <int>, 2015_ranking <int>, 2016_ranking <int>,
## #   2017_ranking <int>, 2018_ranking <int>, 2019_ranking <int>,
## #   2020_ranking <int>, 10year_ranking <int>
```

summary of states and their roadranks

```
roadrank_summary <- rankedroad_data_2011to2020  %>%
select(State, c(`2011_ranking`:`10year_ranking`))

roadrank_summary
```

```
## # A tibble: 51 x 12
##    State        `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                 <int>          <int>          <int>          <int>
##  1 Idaho                     2             19              4              1
##  2 Georgia                   1              1             19             14
##  3 Tennessee                 3              4              7              4
##  4 North Dakota              4              2              6              2
##  5 Nebraska                 10              5              3              3
##  6 Wyoming                   5             10             10              7
##   7 Kentucky                11             14             12               5
##   8 Alabama                 13              9             17              12
##   9 Montana                  9              8             14              10
## 10 Oregon                    8             16             13              15
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

Importing electricity data prices per state

```
electricity_price_state <- read_csv("state_electricity_price.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   state = col_character(),
##   date = col_date(format = ""),
##   value = col_double()
## )
```

```
electricity_price_state
```

```
## # A tibble: 1,061 x 3
##    state   date       value
##    <chr>   <date>     <dbl>
##  1 Alabama 2001-01-01  7.01
##  2 Alabama 2002-01-01  7.12
##  3 Alabama 2003-01-01  7.39
##  4 Alabama 2004-01-01  7.62
##  5 Alabama 2005-01-01  8
##  6 Alabama 2006-01-01  8.75
##  7 Alabama 2007-01-01  9.32
##  8 Alabama 2008-01-01 10.4
##  9 Alabama 2009-01-01 10.7
## 10 Alabama 2010-01-01 10.7
## # ... with 1,051 more rows
```

data wrangling to clean up the data

separating date column into year,month,day

making the tibble wider

splitting the date column into year, month, date

```
electricity_price <- electricity_price_state %>%
separate(date, into = c("year", "month","date"), sep = "-")%>%
select(-c(3:4)) %>%
pivot_wider(names_from = year, values_from = value )
```

```
electricity_price
```

```
## # A tibble: 51 x 22
##    state   `2001` `2002` `2003` `2004` `2005` `2006` `2007` `2008` `2009` `2010`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama   7.01   7.12   7.39   7.62   8      8.75   9.32  10.4   10.7   10.7
##  2 Alaska   NA     NA     NA     NA     NA     NA     NA     NA     NA     NA
##  3 Arizona   8.3    8.27   8.35   8.46   8.86   9.4    9.66  10.3   10.7   11.0
##  4 Arkans~   7.72   7.25   7.24   7.36   8      8.85   8.73   9.27   9.14   8.86
##  5 Califo~  12.1   12.6   12.2   12.2   12.5   14.3   14.4   13.8   14.7   14.8
##  6 Colora~   7.47   7.37   8.14   8.42   9.06   9.02   9.25  10.1   10     11.0
##  7 Connec~  10.9   11.0   11.3   11.6   13.6   16.9   19.1   19.5   20.3   19.2
##  8 Delawa~   8.61   8.7    8.59   8.78   9.01  11.8   13.2   13.9   14.1   13.8
##  9 Distri~   7.79   7.98   7.84   8      9.1    9.88  11.2   12.8   13.7   14.0
## 10 Florida   8.59   8.16   8.55   8.99   9.62  11.3   11.2   11.6   12.4   11.4
## # ... with 41 more rows, and 11 more variables: 2011 <dbl>, 2012 <dbl>,
## #   2013 <dbl>, 2014 <dbl>, 2015 <dbl>, 2016 <dbl>, 2017 <dbl>, 2018 <dbl>,
## #   2019 <dbl>, 2020 <dbl>, 2021 <dbl>
```

deleting unwanted rows

```
final_electricity_price1 <- electricity_price %>%
select(-c(2:11, 22))

final_electricity_price1
```

```
## # A tibble: 51 x 11
##    state   `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama  11.1    11.4  11.3   11.5   11.7   12.0    12.6  12.2    12.5   12.6
##  2 Alaska   17.6    17.9  18.1   19.1   19.8   20.3    21.3  21.9    22.9   22.6
##  3 Arizona  11.1    11.3  11.7   11.9   12.1   12.2    12.4  12.8    12.4   12.3
##  4 Arkans~   9.02    9.3   9.59   9.51   9.82   9.92   10.3   9.81    9.8   10.4
##  5 Califo~  14.8    15.3  16.2   16.2   17.0   17.4    18.3  18.8    19.2   20.4
##  6 Colora~  11.3    11.5  11.9   12.2   12.1   12.1    12.2  12.2    12.2   12.4
##  7 Connec~  18.1    17.3  17.6   19.8   20.9   20.0    20.3  21.2    21.9   22.7
##  8 Delawa~  13.7    13.6  13.0   13.3   13.4   13.4    13.4  12.5    12.6   12.6
##  9 Distri~  13.4    12.3  12.6   12.7   13.0   12.3    12.9  12.8    13.0   12.6
## 10 Florida  11.5    11.4  11.3   11.9   11.6   11.0    11.6  11.5    11.7   11.3
## # ... with 41 more rows
```

```
elec_tenyear_mean <- final_electricity_price1 %>%
mutate("10year_mean" =rowMeans(select(.,`2011`,`2012`,`2013`,`2014`,`2015`,`2016`,`2017`,`2018`,`2019`,

elec_tenyear_mean
```

```
## # A tibble: 51 x 12
##    state   `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama  11.1    11.4  11.3   11.5   11.7   12.0    12.6  12.2    12.5   12.6
##  2 Alaska   17.6    17.9  18.1   19.1   19.8   20.3    21.3  21.9    22.9   22.6
##  3 Arizona  11.1    11.3  11.7   11.9   12.1   12.2    12.4  12.8    12.4   12.3
##  4 Arkans~   9.02    9.3   9.59   9.51   9.82   9.92   10.3   9.81    9.8   10.4
##  5 Califo~  14.8    15.3  16.2   16.2   17.0   17.4    18.3  18.8    19.2   20.4
##  6 Colora~  11.3    11.5  11.9   12.2   12.1   12.1    12.2  12.2    12.2   12.4
##  7 Connec~  18.1    17.3  17.6   19.8   20.9   20.0    20.3  21.2    21.9   22.7
##  8 Delawa~  13.7    13.6  13.0   13.3   13.4   13.4    13.4  12.5    12.6   12.6
##  9 Distri~  13.4    12.3  12.6   12.7   13.0   12.3    12.9  12.8    13.0   12.6
## 10 Florida  11.5    11.4  11.3   11.9   11.6   11.0    11.6  11.5    11.7   11.3
## # ... with 41 more rows, and 1 more variable: 10year_mean <dbl>
```

```r
elec_meandata_2011to2020 <- elec_tenyear_mean %>%
arrange((`10year_mean`)) %>%
mutate('2011_ranking' =min_rank((`2011`))) %>%
mutate('2012_ranking' = min_rank((`2012`) )) %>%
mutate('2013_ranking' = min_rank((`2013`)) ) %>%
mutate('2014_ranking' = min_rank((`2014`)) ) %>%
mutate('2015_ranking' = min_rank((`2015`)) ) %>%
mutate('2016_ranking' = min_rank((`2016`)) ) %>%
mutate('2017_ranking' = min_rank((`2017`)) ) %>%
mutate('2018_ranking' = min_rank((`2018`)) ) %>%
mutate('2019_ranking' = min_rank((`2019`)) ) %>%
mutate('2020_ranking' = min_rank((`2020`)) ) %>%
mutate('10year_ranking' = min_rank((`10year_mean`)) )

elec_meandata_2011to2020
```

```
## # A tibble: 51 x 23
##    state   `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Washin~   8.28   8.53   8.7    8.67   9.09   9.48   9.66   9.75   9.71   9.87
##  2 Louisi~   8.96   8.37   9.43   9.57   9.33   9.34   9.74   9.59   9.8    9.67
##  3 Idaho     7.87   8.67   9.32   9.72   9.93   9.95  10.0   10.2    9.89   9.95
##  4 North ~   8.58   9.06   9.12   9.15   9.62  10.2   10.3   10.2   10.3   10.4
##  5 Arkans~   9.02   9.3    9.59   9.51   9.82   9.92  10.3    9.81   9.8   10.4
##  6 Oklaho~   9.47   9.51   9.67  10.0   10.1   10.2   10.6   10.3   10.2   10.1
##  7 Kentuc~   9.2    9.43   9.79  10.2   10.2   10.5   10.8   10.6   10.8   10.9
##  8 Utah      8.96   9.93  10.4   10.6   10.9   11.0   11.0   10.4   10.4   10.4
##  9 Tennes~   9.98  10.1    9.98  10.3   10.3   10.4   10.7   10.7   10.9   10.8
## 10 Nebras~   9.32  10.0   10.3   10.4   10.6   10.8   11.0   10.7   10.8   10.8
## # ... with 41 more rows, and 12 more variables: 10year_mean <dbl>,
## #   2011_ranking <int>, 2012_ranking <int>, 2013_ranking <int>,
## #   2014_ranking <int>, 2015_ranking <int>, 2016_ranking <int>,
## #   2017_ranking <int>, 2018_ranking <int>, 2019_ranking <int>,
## #   2020_ranking <int>, 10year_ranking <int>
```

summary of state and electricity price rankings 2011-2020

```r
elecprice_rank <- elec_meandata_2011to2020 %>%
select(state, c(`2011_ranking`:`10year_ranking`))

elecprice_rank
```

```
## # A tibble: 51 x 12
##    state        `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                 <int>          <int>          <int>          <int>
##  1 Washington                2              2              1              1
##  2 Louisiana                 4              1              4              5
##  3 Idaho                     1              3              3              6
##  4 North Dakota              3              4              2              2
##  5 Arkansas                  6              5              6              4
##  6 Oklahoma                 12              7              7              7
##  7 Kentucky                  8              6              8              8
##  8 Utah                      4             11             15             16
##  9 Tennessee                16             15             10             10
## 10 Nebraska                  9             12             13             11
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

loading Crime rate data

```
Corrections_data <- read_csv("Corrections data.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9], 'X10' [10], 'X11' [11], 'X12' [12],
## 'X13' [13], 'X14' [14], 'X15' [15], 'X16' [16], 'X17' [17], 'X18' [18],
## 'X19' [19], 'X20' [20], 'X21' [21], 'X22' [22], 'X23' [23], 'X24' [24],
## 'X25' [25], 'X26' [26], 'X27' [27], 'X28' [28], 'X29' [29], 'X30' [30],
## 'X31' [31], 'X32' [32], 'X33' [33], 'X34' [34], 'X35' [35], 'X36' [36],
## 'X37' [37], 'X38' [38], 'X39' [39], 'X40' [40], 'X41' [41], 'X42' [42],
## 'X43' [43], 'X44' [44]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_double(),
##   `Bureau of Justice Statistics (www.bjs.gov)` = col_character(),
##   X2 = col_logical(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character(),
##   X10 = col_character(),
##   X11 = col_character(),
##   X12 = col_character(),
##   X13 = col_character(),
##   X14 = col_character(),
##   X15 = col_character(),
##   X16 = col_character()
## )
## i Use `spec()` for the full column specifications.
```

```
Corrections_data
```

```
## # A tibble: 742 x 44
##    `Bureau of Justi~ X2    X3    X4    X5    X6    X7    X8    X9    X10   X11
##    <chr>             <lgl> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1 Tool Title: Corr~ NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  2 Data source: Nat~ NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  3 Refer questions ~ NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  4 <NA>              NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  5 <NA>              NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  6 Count of total j~ NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  7 <NA>              NA    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  8 Jurisdiction      NA    1978~ 1979~ 1980~ 1981~ 1982~ 1983~ 1984~ 1985~ 1986~
##  9 National Statist~ NA    3072~ 3144~ 3298~ 3699~ 4138~ 4368~ 4620~ 5025~ 5449~
## 10 Federal Institut~ NA    29803 26371 24363 28133 29673 31926 34263 40223 44408
## # ... with 732 more rows, and 33 more variables: X12 <chr>, X13 <chr>,
## #   X14 <chr>, X15 <chr>, X16 <chr>, X17 <dbl>, X18 <dbl>, X19 <dbl>,
## #   X20 <dbl>, X21 <dbl>, X22 <dbl>, X23 <dbl>, X24 <dbl>, X25 <dbl>,
## #   X26 <dbl>, X27 <dbl>, X28 <dbl>, X29 <dbl>, X30 <dbl>, X31 <dbl>,
## #   X32 <dbl>, X33 <dbl>, X34 <dbl>, X35 <dbl>, X36 <dbl>, X37 <dbl>,
## #   X38 <dbl>, X39 <dbl>, X40 <dbl>, X41 <dbl>, X42 <dbl>, X43 <dbl>, X44 <dbl>
```

```
data_correction <- Corrections_data %>%
slice(-c(1:7))


data_correction
```

```
## # A tibble: 735 x 44
##    `Bureau of Justi~ X2    X3    X4    X5    X6    X7    X8    X9    X10   X11
##    <chr>             <lgl> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1 Jurisdiction      NA    1978~ 1979~ 1980~ 1981~ 1982~ 1983~ 1984~ 1985~ 1986~
##  2 National Statist~ NA    3072~ 3144~ 3298~ 3699~ 4138~ 4368~ 4620~ 5025~ 5449~
##  3 Federal Institut~ NA    29803 26371 24363 28133 29673 31926 34263 40223 44408
##  4 State Institutio~ NA    2774~ 2880~ 3054~ 3417~ 3841~ 4049~ 4277~ 4622~ 5005~
##  5 Alabama/33/34/35~ NA    5625  5464  6543  7657  9233  9856  10482 11015 11710
##  6 Alaska/38/39/40/~ NA    712   760   822   1024  1322  1631  1967  2329  2460
##  7 Arizona/60/61/62~ NA    3456  3749  4372  5223  6069  6889  7845  8531  9434
##  8 Arkansas/82/83/8~ NA    2654  3042  2911  3328  3922  4246  4482  4611  4701
##  9 California/66/91~ NA    21325 22632 24569 29202 34640 39373 43197 50158 59484
## 10 Colorado/100/101~ NA    2486  2668  2629  2772  3042  3244  3231  3386  3804
## # ... with 725 more rows, and 33 more variables: X12 <chr>, X13 <chr>,
## #   X14 <chr>, X15 <chr>, X16 <chr>, X17 <dbl>, X18 <dbl>, X19 <dbl>,
## #   X20 <dbl>, X21 <dbl>, X22 <dbl>, X23 <dbl>, X24 <dbl>, X25 <dbl>,
## #   X26 <dbl>, X27 <dbl>, X28 <dbl>, X29 <dbl>, X30 <dbl>, X31 <dbl>,
## #   X32 <dbl>, X33 <dbl>, X34 <dbl>, X35 <dbl>, X36 <dbl>, X37 <dbl>,
## #   X38 <dbl>, X39 <dbl>, X40 <dbl>, X41 <dbl>, X42 <dbl>, X43 <dbl>, X44 <dbl>
```

continuing data deletion

Rename the name of coloumn 1

Separate coloumn 1

using the first row as the header

```
data_correction2 <- data_correction %>%
slice(-c(56:735)) %>%
slice(-c(2:4)) %>%
rename(State = 1) %>%
separate(State, into = "States", sep = "/", extra = 'drop') %>%
select (-c(2:35)) %>%
purrr::set_names(as.character(slice(., 1))) %>%
slice(-1)


data_correction2
```

```
## # A tibble: 51 x 10
##    Jurisdiction   `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019`
##    <chr>           <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama         32270  32431  32381  31771  30810  28883  27608  26841  28304
##  2 Alaska           5597   5633   5081   5794   5338   4434   4399   4380   4475
##  3 Arizona         40020  40080  41177  42259  42719  42320  42030  42005  42441
##  4 Arkansas        16108  14654  17235  17874  17707  17537  18070  17799  17759
##  5 California     149569 134534 135981 136085 129593 130084 131039 128625 122687
##  6 Colorado        21978  20462  20371  20646  20041  19981  19946  20372  19785
##  7 Connecticut     18324  17530  17563  16636  15816  14957  14040  13681  12823
##  8 Delaware         6739   6914   7004   6955   6654   6585   6443   6067   5692
##  9 District of C~      0      0      0      0      0      0      0      0      0
## 10 Florida        103055 101930 103028 102870 101424  99974  98504  97538  96009
## # ... with 41 more rows
```

```
final_data_correction <- data_correction2 %>%
rename(State = 1)



final_data_correction
```

```
## # A tibble: 51 x 10
##    State          `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019`
##    <chr>           <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama         32270  32431  32381  31771  30810  28883  27608  26841  28304
##  2 Alaska           5597   5633   5081   5794   5338   4434   4399   4380   4475
##  3 Arizona         40020  40080  41177  42259  42719  42320  42030  42005  42441
##  4 Arkansas        16108  14654  17235  17874  17707  17537  18070  17799  17759
##  5 California     149569 134534 135981 136085 129593 130084 131039 128625 122687
##  6 Colorado        21978  20462  20371  20646  20041  19981  19946  20372  19785
##  7 Connecticut     18324  17530  17563  16636  15816  14957  14040  13681  12823
##  8 Delaware         6739   6914   7004   6955   6654   6585   6443   6067   5692
##  9 District of C~      0      0      0      0      0      0      0      0      0
## 10 Florida        103055 101930 103028 102870 101424  99974  98504  97538  96009
## # ... with 41 more rows
```

loading data on population

```
population <- read_csv("Statespopulation_2011to2020.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   `2011` = col_double(),
##   `2012` = col_double(),
##   `2013` = col_double(),
##   `2014` = col_double(),
##   `2015` = col_double(),
##   `2016` = col_double(),
##   `2017` = col_double(),
##   `2018` = col_double(),
##   `2019` = col_double(),
##   `2020` = col_double()
## )
```

```
## Warning: 3 parsing failures.
## row col   expected    actual                              file
##  83  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
##  96  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
## 109  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
```

```
population
```

```
## # A tibble: 114 x 11
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama 4.68e6 4.70e6 4.71e6 4.71e6 4.73e6 4.83e6 4.74e6 4.86e6 4.77e6 4.89e6
##  2 Alaska  6.97e5 7.06e5 7.05e5 7.07e5 7.08e5 7.08e5 7.10e5 7.21e5 7.02e5 7.06e5
##  3 Arizona 6.32e6 6.39e6 6.47e6 6.56e6 6.66e6 6.88e6 6.84e6 7.23e6 7.10e6 7.47e6
##  4 Arkans~ 2.85e6 2.86e6 2.87e6 2.88e6 2.88e6 2.94e6 2.91e6 2.91e6 2.92e6 2.98e6
##  5 Califo~ 3.69e7 3.72e7 3.75e7 3.80e7 3.83e7 3.91e7 3.87e7 3.91e7 3.86e7 3.91e7
##  6 Colora~ 4.98e6 5.05e6 5.13e6 5.22e6 5.32e6 5.50e6 5.46e6 5.73e6 5.61e6 5.74e6
##  7 Connec~ 3.47e6 3.48e6 3.48e6 3.48e6 3.48e6 3.57e6 3.48e6 3.42e6 3.45e6 3.48e6
##  8 Delawa~ 8.80e5 8.88e5 8.98e5 9.05e5 9.18e5 9.44e5 9.32e5 9.74e5 9.40e5 9.82e5
##  9 Distri~ 5.84e5 5.96e5 6.10e5 6.24e5 6.35e5 6.84e5 6.58e5 6.91e5 6.71e5 7.17e5
## 10 Florida 1.86e7 1.89e7 1.91e7 1.94e7 1.98e7 2.05e7 2.05e7 2.11e7 2.10e7 2.17e7
## # ... with 104 more rows
```

rename column 1

```
renamed_population <- population %>%
rename(State = 1) %>%
slice(1:51)%>%
select(-c(11))

renamed_population
```

```
## # A tibble: 51 x 10
##    State       `2011`  `2012`  `2013`  `2014` `2015` `2016` `2017` `2018` `2019`
##    <chr>        <dbl>   <dbl>   <dbl>   <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama     4.68e6  4.70e6  4.71e6  4.71e6 4.73e6 4.83e6 4.74e6 4.86e6 4.77e6
##  2 Alaska      6.97e5  7.06e5  7.05e5  7.07e5 7.08e5 7.08e5 7.10e5 7.21e5 7.02e5
##  3 Arizona     6.32e6  6.39e6  6.47e6  6.56e6 6.66e6 6.88e6 6.84e6 7.23e6 7.10e6
##  4 Arkansas    2.85e6  2.86e6  2.87e6  2.88e6 2.88e6 2.94e6 2.91e6 2.91e6 2.92e6
##  5 California  3.69e7  3.72e7  3.75e7  3.80e7 3.83e7 3.91e7 3.87e7 3.91e7 3.86e7
##  6 Colorado    4.98e6  5.05e6  5.13e6  5.22e6 5.32e6 5.50e6 5.46e6 5.73e6 5.61e6
##  7 Connectic~  3.47e6  3.48e6  3.48e6  3.48e6 3.48e6 3.57e6 3.48e6 3.42e6 3.45e6
##  8 Delaware    8.80e5  8.88e5  8.98e5  9.05e5 9.18e5 9.44e5 9.32e5 9.74e5 9.40e5
##  9 District ~  5.84e5  5.96e5  6.10e5  6.24e5 6.35e5 6.84e5 6.58e5 6.91e5 6.71e5
## 10 Florida     1.86e7  1.89e7  1.91e7  1.94e7 1.98e7 2.05e7 2.05e7 2.11e7 2.10e7
## # ... with 41 more rows
```

left join population data and correction data

```
combined_correction <- left_join(x = final_data_correction, y = renamed_population, by = "State" )

combined_correction
```

```
## # A tibble: 51 x 19
##    State `2011.x` `2012.x` `2013.x` `2014.x` `2015.x` `2016.x` `2017.x` `2018.x`
##    <chr>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
##  1 Alab~    32270    32431    32381    31771    30810    28883    27608    26841
##  2 Alas~     5597     5633     5081     5794     5338     4434     4399     4380
##  3 Ariz~    40020    40080    41177    42259    42719    42320    42030    42005
##  4 Arka~    16108    14654    17235    17874    17707    17537    18070    17799
##  5 Cali~   149569   134534   135981   136085   129593   130084   131039   128625
##  6 Colo~    21978    20462    20371    20646    20041    19981    19946    20372
##  7 Conn~    18324    17530    17563    16636    15816    14957    14040    13681
##  8 Dela~     6739     6914     7004     6955     6654     6585     6443     6067
##  9 Dist~        0        0        0        0        0        0        0        0
## 10 Flor~   103055   101930   103028   102870   101424    99974    98504    97538
## # ... with 41 more rows, and 10 more variables: 2019.x <dbl>, 2011.y <dbl>,
## #   2012.y <dbl>, 2013.y <dbl>, 2014.y <dbl>, 2015.y <dbl>, 2016.y <dbl>,
## #   2017.y <dbl>, 2018.y <dbl>, 2019.y <dbl>
```

deleting unwanted columns in the combined data

getting the corrections per population by dividing the two per year

```
data_combined_correction <- combined_correction %>%
mutate(correction_2011 = `2011.x`/`2011.y`,
       correction_2012 = `2012.x` /`2012.y`,
       correction_2013 = `2013.x`/`2013.y`,
       correction_2014 = `2014.x` /`2014.y`,
       correction_2015 = `2015.x`/`2015.y`,
       correction_2016 = `2016.x` /`2016.y`,
       correction_2017 = `2017.x`/`2017.y`,
       correction_2018 = `2018.x`/`2018.y`,
       correction_2019 = `2019.x` /`2019.y`
)

data_combined_correction
```

```
## # A tibble: 51 x 28
##    State `2011.x` `2012.x` `2013.x` `2014.x` `2015.x` `2016.x` `2017.x` `2018.x`
##    <chr>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
##  1 Alab~    32270    32431    32381    31771    30810    28883    27608    26841
##  2 Alas~     5597     5633     5081     5794     5338     4434     4399     4380
##  3 Ariz~    40020    40080    41177    42259    42719    42320    42030    42005
##  4 Arka~    16108    14654    17235    17874    17707    17537    18070    17799
##  5 Cali~   149569   134534   135981   136085   129593   130084   131039   128625
##  6 Colo~    21978    20462    20371    20646    20041    19981    19946    20372
##  7 Conn~    18324    17530    17563    16636    15816    14957    14040    13681
##  8 Dela~     6739     6914     7004     6955     6654     6585     6443     6067
##  9 Dist~        0        0        0        0        0        0        0        0
## 10 Flor~   103055   101930   103028   102870   101424    99974    98504    97538
## # ... with 41 more rows, and 19 more variables: 2019.x <dbl>, 2011.y <dbl>,
## #   2012.y <dbl>, 2013.y <dbl>, 2014.y <dbl>, 2015.y <dbl>, 2016.y <dbl>,
## #   2017.y <dbl>, 2018.y <dbl>, 2019.y <dbl>, correction_2011 <dbl>,
## #   correction_2012 <dbl>, correction_2013 <dbl>, correction_2014 <dbl>,
## #   correction_2015 <dbl>, correction_2016 <dbl>, correction_2017 <dbl>,
## #   correction_2018 <dbl>, correction_2019 <dbl>
```

selecting the correction rate per state

using mutate to get the 10 year mean value

```
combined_correction_data <- data_combined_correction %>%
select(State,correction_2011:correction_2019) %>%
mutate("10year_mean" =rowMeans(select(.,`correction_2011`,`correction_2012`,`correction_2013`,`correcti

combined_correction_data
```

```
## # A tibble: 51 x 11
##    State         correction_2011 correction_2012 correction_2013 correction_2014
##    <chr>                   <dbl>           <dbl>           <dbl>           <dbl>
##  1 Alabama               0.00690         0.00691         0.00688         0.00674
##  2 Alaska                0.00803         0.00798         0.00721         0.00820
##  3 Arizona               0.00633         0.00628         0.00637         0.00645
##  4 Arkansas              0.00565         0.00512         0.00601         0.00621
##  5 California            0.00406         0.00361         0.00363         0.00358
##  6 Colorado              0.00441         0.00406         0.00397         0.00396
##  7 Connecticut           0.00529         0.00504         0.00505         0.00478
##  8 Delaware              0.00766         0.00779         0.00780         0.00768
##  9 District of ~         0               0               0               0
## 10 Florida               0.00554         0.00540         0.00540         0.00529
## # ... with 41 more rows, and 6 more variables: correction_2015 <dbl>,
## #   correction_2016 <dbl>, correction_2017 <dbl>, correction_2018 <dbl>,
## #   correction_2019 <dbl>, 10year_mean <dbl>
```

ranked correction data

```
ranked_correction_data <- combined_correction_data %>%
arrange(desc(`10year_mean`)) %>%
mutate('2011_ranking' =min_rank((`correction_2011`))) %>%
mutate('2012_ranking' = min_rank((`correction_2012`) )) %>%
mutate('2013_ranking' = min_rank((`correction_2013`)) ) %>%
mutate('2014_ranking' = min_rank((`correction_2014`)) ) %>%
mutate('2015_ranking' = min_rank((`correction_2015`)) ) %>%
mutate('2016_ranking' = min_rank((`correction_2016`)) ) %>%
mutate('2017_ranking' = min_rank((`correction_2017`)) ) %>%
mutate('2018_ranking' = min_rank((`correction_2018`)) ) %>%
mutate('2019_ranking' = min_rank((`correction_2019`)) ) %>%
mutate('10year_ranking' = min_rank((`10year_mean`)) )

ranked_correction_data
```

```
## # A tibble: 51 x 21
##    State       correction_2011 correction_2012 correction_2013 correction_2014
##    <chr>                 <dbl>           <dbl>           <dbl>           <dbl>
##  1 Louisiana           0.00896         0.00901         0.00877         0.00844
##  2 Oklahoma            0.00709         0.00684         0.00739         0.00737
##  3 Delaware            0.00766         0.00779         0.00780         0.00768
##  4 Alaska              0.00803         0.00798         0.00721         0.00820
##  5 Mississippi         0.00743         0.00774         0.00760         0.00651
##  6 Alabama             0.00690         0.00691         0.00688         0.00674
##  7 Arizona             0.00633         0.00628         0.00637         0.00645
##  8 Texas               0.00689         0.00655         0.00653         0.00632
##  9 Arkansas            0.00565         0.00512         0.00601         0.00621
## 10 Georgia             0.00588         0.00577         0.00557         0.00541
## # ... with 41 more rows, and 16 more variables: correction_2015 <dbl>,
## #   correction_2016 <dbl>, correction_2017 <dbl>, correction_2018 <dbl>,
## #   correction_2019 <dbl>, 10year_mean <dbl>, 2011_ranking <int>,
## #   2012_ranking <int>, 2013_ranking <int>, 2014_ranking <int>,
## #   2015_ranking <int>, 2016_ranking <int>, 2017_ranking <int>,
## #   2018_ranking <int>, 2019_ranking <int>, 10year_ranking <int>
```

ranked correction data

```
final_ranked_correction <- ranked_correction_data %>%
select(State, 12:21)

final_ranked_correction
```

```
## # A tibble: 51 x 11
##    State       `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                <int>          <int>          <int>          <int>
##  1 Louisiana               51             51             51             51
##  2 Oklahoma                47             46             48             48
##  3 Delaware                49             49             50             49
##  4 Alaska                  50             50             47             50
##  5 Mississippi             48             48             49             46
##  6 Alabama                 46             47             46             47
##  7 Arizona                 44             44             44             45
##  8 Texas                   45             45             45             44
##  9 Arkansas                42             39             43             43
## 10 Georgia                 43             43             42             41
## # ... with 41 more rows, and 6 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 10year_ranking <int>
```

# Final ranked correction data # renaming columns

```
final_ranked_correction2 <- final_ranked_correction %>%
rename("2011_corrank" = 2)%>%
rename("2012_corrank" = 3)%>%
rename("2013_corrank" = 4)%>%
rename("2014_corrank" = 5)%>%
rename("2015_corrank" = 6)%>%
rename("2016_corrank" = 7)%>%
rename("2017_corrank" = 8)%>%
rename("2018_corrank" = 9)%>%
rename("2019_corrank" = 10)%>%
rename("10yr_corrank" = 11)
```

EDUCATION DATA: college graduation

#load data

```
college_graduationrate_data <- read_csv("College_Graduation_Rate_perstate.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   `2020` = col_double(),
##   `2019` = col_double(),
##   `2018` = col_double(),
##   `2017` = col_character(),
##   `2016` = col_character(),
##   `2015` = col_character(),
##   `2014` = col_character(),
##   `2013` = col_character(),
##   `2012` = col_character(),
##   `2011` = col_character()
## )
```

```
col_conv <- c(5:11)
college_graduationrate_data[ , col_conv] <- lapply(college_graduationrate_data[ , col_conv],function(x)

college_graduationrate_data
```

```
## # A tibble: 51 x 11
##    States  `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama   27.8   26.3   25.5   27.2   26.5   25.2   24.3   22.3   21.3   18
##  2 Alaska    31.9   30.2   30.2   75.3   70.7   70.7   66.4   67.2   68.2   72.4
##  3 Arizona   33     30.2   29.7   31.7   32.4   32.1   32.6   33.4   32.9   30.8
##  4 Arkans~   24.9   23.3   23.3   33     33.4   29.5   28.7   27.7   25.4   23.9
##  5 Califo~   36.9   35     34.2   39.4   38.5   37.4   38.3   38.7   38.8   39.9
##  6 Colora~   44.2   42.7   41.7   56.4   61.9   54.8   49.7   48.2   44.7   43.5
##  7 Connec~   42.4   39.8   39.6   29.1   24.8   23.9   22     16.8   15.2   15
##  8 Delawa~   34.7   33.2   31.3   44.2   58.4   63.9   59     71.3   16.1   16.4
##  9 Distri~   63.6   59.7   60.4   68.9   73.8   73     59.1   61.6   66.7   82.4
## 10 Florida   33.7   30.7   30.4   56.7   56.8   60.6   60.3   59.4   54.2   54.5
## # ... with 41 more rows
```

Ranking the average graduation rate over the years

using lapply to change character columns to numeric

```
#graduation_rate2[,2:10] <- lapply(graduation_rate2[,2:10],as.numeric)

tenyear_graduation <- college_graduationrate_data %>%
mutate("10year_mean" =rowMeans(select(., `2011`,`2012`,`2013`,`2014`,`2015`,`2016`,`2017`,`2018`,`2019`
)
tenyear_graduation
```

```
## # A tibble: 51 x 12
##    States  `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama   27.8   26.3   25.5   27.2   26.5   25.2   24.3   22.3   21.3   18
##  2 Alaska    31.9   30.2   30.2   75.3   70.7   70.7   66.4   67.2   68.2   72.4
##  3 Arizona   33     30.2   29.7   31.7   32.4   32.1   32.6   33.4   32.9   30.8
##  4 Arkans~   24.9   23.3   23.3   33     33.4   29.5   28.7   27.7   25.4   23.9
##  5 Califo~   36.9   35     34.2   39.4   38.5   37.4   38.3   38.7   38.8   39.9
##  6 Colora~   44.2   42.7   41.7   56.4   61.9   54.8   49.7   48.2   44.7   43.5
##  7 Connec~   42.4   39.8   39.6   29.1   24.8   23.9   22     16.8   15.2   15
##  8 Delawa~   34.7   33.2   31.3   44.2   58.4   63.9   59     71.3   16.1   16.4
##  9 Distri~   63.6   59.7   60.4   68.9   73.8   73     59.1   61.6   66.7   82.4
## 10 Florida   33.7   30.7   30.4   56.7   56.8   60.6   60.3   59.4   54.2   54.5
## # ... with 41 more rows, and 1 more variable: 10year_mean <dbl>
```

ranked_graduation_data

```
ranked_graduation_data <- tenyear_graduation %>%
arrange(desc(`10year_mean`)) %>%
mutate('2011_edurank' =min_rank(desc(`2011`))) %>%
mutate('2012_edurank' = min_rank(desc(`2012`) )) %>%
mutate('2013_edurank' = min_rank(desc(`2013`)) ) %>%
mutate('2014_edurank' = min_rank(desc(`2014`)) ) %>%
mutate('2015_edurank' = min_rank(desc(`2015`)) ) %>%
mutate('2016_edurank' = min_rank(desc(`2016`)) ) %>%
mutate('2017_edurank' = min_rank(desc(`2017`)) ) %>%
mutate('2018_edurank' = min_rank(desc(`2018`)) ) %>%
mutate('2019_edurank' = min_rank(desc(`2019`)) ) %>%
mutate('2020_edurank' = min_rank(desc(`2020`)) ) %>%
mutate('10year_edurank' = min_rank(desc(`10year_mean`)) )

ranked_graduation_data
```

```
## # A tibble: 51 x 23
##    States  `2020` `2019` `2018` `2017` `2016` `2015` `2014` `2013` `2012` `2011`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Distri~   63.6   59.7   60.4   68.9   73.8   73     59.1   61.6   66.7   82.4
##  2 Alaska    31.9   30.2   30.2   75.3   70.7   70.7   66.4   67.2   68.2   72.4
##  3 South ~   28.4   29.7   29.2   60.7   65.4   62.4   60.5   58.3   60.8   56.5
##  4 Florida   33.7   30.7   30.4   56.7   56.8   60.6   60.3   59.4   54.2   54.5
##  5 Nevada    28     25.7   24.9   64.6   60.9   62.4   57.4   56.9   59.8   52.8
##  6 Colora~   44.2   42.7   41.7   56.4   61.9   54.8   49.7   48.2   44.7   43.5
##  7 Washin~   38.4   37     36.7   51.6   50     47.4   55.7   50.9   46.7   45.9
##  8 Delawa~   34.7   33.2   31.3   44.2   58.4   63.9   59     71.3   16.1   16.4
##  9 North ~   31.8   30.4   29.7   44.9   44.6   44.4   46.9   45.5   43.7   41.3
## 10 Wyoming   28.2   29.1   26.9   41.4   43.2   39.7   43.3   48.9   47.7   43.3
## # ... with 41 more rows, and 12 more variables: 10year_mean <dbl>,
## #   2011_edurank <int>, 2012_edurank <int>, 2013_edurank <int>,
## #   2014_edurank <int>, 2015_edurank <int>, 2016_edurank <int>,
## #   2017_edurank <int>, 2018_edurank <int>, 2019_edurank <int>,
## #   2020_edurank <int>, 10year_edurank <int>
```

final_ranked_graduationdata 2011-2020

```
final_ranked_graduation <- ranked_graduation_data %>%
select(States, 13:23)

final_ranked_graduation
```

```
## # A tibble: 51 x 12
##    States            `2011_edurank` `2012_edurank` `2013_edurank` `2014_edurank`
##    <chr>                      <int>          <int>          <int>          <int>
##  1 District of Colu~              1              2              3              4
##  2 Alaska                         2              1              2              1
##  3 South Dakota                   3              3              5              2
##  4 Florida                        4              5              4              3
##  5 Nevada                         5              4              6              6
##  6 Colorado                       7              8              9              8
##  7 Washington                     6              7              7              7
##  8 Delaware                      48             46              1              5
##  9 North Dakota                   9              9             10              9
## 10 Wyoming                        8              6              8             10
## # ... with 41 more rows, and 7 more variables: 2015_edurank <int>,
## #   2016_edurank <int>, 2017_edurank <int>, 2018_edurank <int>,
## #   2019_edurank <int>, 2020_edurank <int>, 10year_edurank <int>
```

Health Data

Used total number of hospitals and total number of insured people per state

Loading and wrangling hospitals data for each year

```
th2011 <- read_csv("totalhospitals2011.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2011 <- th2011 %>%
       slice(-(1:3)) %>%
          rename('2011'= X2,States= `Title: Total Hospitals | KFF`)
th2012 <- read_csv("totalhospitals2012.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2012 <- th2012 %>%
       slice(-(1:3)) %>%
          rename('2012'= X2,States= `Title: Total Hospitals | KFF`)
th2013 <- read_csv("totalhospitals2013.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2013 <- th2013 %>%
       slice(-(1:3)) %>%
          rename('2013'= X2,States= `Title: Total Hospitals | KFF`)
th2014 <- read_csv("totalhospitals2014.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2014 <- th2014 %>%
       slice(-(1:3)) %>%
          rename('2014'= X2,States= `Title: Total Hospitals | KFF`)
th2015 <- read_csv("totalhospitals2015.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2015 <- th2015 %>%
       slice(-(1:3)) %>%
          rename('2015'= X2,States= `Title: Total Hospitals | KFF`)
th2016 <- read_csv("totalhospitals2016.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2016 <- th2016 %>%
       slice(-(1:3)) %>%
          rename('2016'= X2,States= `Title: Total Hospitals | KFF`)
th2017 <- read_csv("totalhospitals2017.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2017 <- th2017 %>%
       slice(-(1:3)) %>%
          rename('2017'= X2,States= `Title: Total Hospitals | KFF`)
th2018 <- read_csv("totalhospitals2018.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2018 <- th2018 %>%
       slice(-(1:3)) %>%
          rename('2018'= X2,States= `Title: Total Hospitals | KFF`)
th2019 <- read_csv("totalhospitals2019.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2019 <- th2019 %>%
       slice(-(1:3)) %>%
          rename('2019'= X2,States= `Title: Total Hospitals | KFF`)
th2020 <- read_csv("totalhospitals2020.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Total Hospitals | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
th_2020 <- th2020 %>%
       slice(-(1:3)) %>%
          rename('2020'= X2,States= `Title: Total Hospitals | KFF`)
```

Joining the data above to get a single tibble for hospitals data

```
statehospitals_from2011 <- th_2011 %>%
  inner_join(th_2012, by='States') %>%
    inner_join(th_2013, by='States') %>%
      inner_join(th_2014, by='States') %>%
        inner_join(th_2015, by='States') %>%
          inner_join(th_2016, by='States') %>%
             inner_join(th_2017, by='States') %>%
               inner_join(th_2018, by='States') %>%
                 inner_join(th_2019, by='States') %>%
                    inner_join(th_2020, by='States') %>%
                      na.omit


statehospitals_from2011
```

```
## # A tibble: 51 x 11
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>   <chr>  <chr>  <chr>  <chr>  <chr>  <chr>  <chr>  <chr>  <chr>  <chr>
##  1 Alabama 102    97     97     96     95     95     102    101    101    101
##  2 Alaska  23     23     22     22     21     21     21     21     20     20
##  3 Arizona 70     72     72     72     71     70     83     83     80     81
##  4 Arkans~ 84     83     84     81     80     80     88     88     89     90
##  5 Califo~ 345    349    347    344    342    341    362    359    359    353
##  6 Colora~ 82     82     82     82     81     79     89     89     90     91
##  7 Connec~ 35     34     33     32     32     32     32     32     31     31
##  8 Delawa~ 7      7      7      7      7      7      8      7      7      7
##  9 Distri~ 11     11     11     11     11     11     11     10     10     10
## 10 Florida 213    216    212    211    210    210    220    217    212    214
## # ... with 41 more rows
```

Loading and wrangling health insurance data for each year

Insurance entities considered are employer, non-group,medicare,medicaid, and military

```
hi2011 <- read_csv("insurance_coverage2011.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2011 <- hi2011 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employ
hi2012 <- read_csv("insurance_coverage2012.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2012 <- hi2012 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employ
hi2013 <- read_csv("insurance_coverage2013.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]

##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2013 <- hi2013 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employ
hi2014 <- read_csv("insurance_coverage2014.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2014 <- hi2014 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employe
hi2015 <- read_csv("insurance_coverage2015.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2015 <- hi2015 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employe
hi2016 <- read_csv("insurance_coverage2016.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population (CPS) | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character()
## )
```

```
hinsurance_2016 <- hi2016 %>%
slice(-(1:3)) %>%
rename(States= `Title: Health Insurance Coverage of the Total Population (CPS) | KFF`) %>%    rename(Em
hi2017 <- read_csv("insurance_coverage2017.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2017 <- hi2017 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employ
hi2018 <- read_csv("insurance_coverage2018.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population (CPS) | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character()
## )
```

```
hinsurance_2018 <- hi2018 %>%
slice(-(1:3)) %>%
rename(States= `Title: Health Insurance Coverage of the Total Population (CPS) | KFF`) %>%    rename(Em
hi2019 <- read_csv("insurance_coverage2019.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character(),
##   X9 = col_character()
## )
```

```
hinsurance_2019 <- hi2019 %>%
 slice(-(1:3)) %>%
  rename(States= `Title: Health Insurance Coverage of the Total Population | KFF`) %>%    rename(Employe
hi2020 <- read_csv("insurance_coverage2020.csv")
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Health Insurance Coverage of the Total Population (CPS) | KFF` = col_character(),
##   X2 = col_character(),
##   X3 = col_character(),
##   X4 = col_character(),
##   X5 = col_character(),
##   X6 = col_character(),
##   X7 = col_character(),
##   X8 = col_character()
## )
```

```
hinsurance_2020 <- hi2020 %>%
slice(-(1:3)) %>%
rename(States= `Title: Health Insurance Coverage of the Total Population (CPS) | KFF`) %>%    rename(Emp

hi2020
```

```
## # A tibble: 85 x 8
##    `Title: Health Insurance Cov~ X2     X3     X4     X5     X6     X7     X8
##    <chr>                         <chr>  <chr>  <chr>  <chr>  <chr>  <chr>  <chr>
##  1 Timeframe: 2020               <NA>   <NA>   <NA>   <NA>   <NA>   <NA>   <NA>
##  2 Location                      Emplo~ Non-G~ Medic~ Medic~ Milit~ Unins~ Total
##  3 United States                 16373~ 17785~ 57920~ 50819~ 74212~ 27957~ 3256~
##  4 Alabama                       23852~ 138600 903500 852500 N/A    436200 4885~
##  5 Alaska                        281900 21700  155600 90200  67900  88800  7061~
##  6 Arizona                       33560~ 306100 15302~ 12567~ 215300 803600 7467~
##  7 Arkansas                      12159~ 231200 687300 536000 52700  254300 2977~
##  8 California                    18985~ 25339~ 91704~ 48851~ 708700 28451~ 3912~
##  9 Colorado                      28785~ 330700 951700 742700 238200 595500 5737~
## 10 Connecticut                   17280~ 181200 818800 563100 N/A    165300 3476~
## # ... with 75 more rows
```

Renaming and subsetting only the required columns for each year

```
hi_2011 <- hinsurance_2011 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2011'=Insured) %>%
      select(States, '2011') %>%
        na.omit
hi_2012 <- hinsurance_2012 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2012'=Insured) %>%
      select(States, '2012') %>%
        na.omit
hi_2013 <- hinsurance_2013 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2013'=Insured) %>%
      select(States, '2013') %>%
         na.omit
hi_2014 <- hinsurance_2014 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2014'=Insured) %>%
      select(States, '2014') %>%
        na.omit
hi_2015 <- hinsurance_2015 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2015'=Insured) %>%
      select(States, '2015') %>%
        na.omit
hi_2016 <- hinsurance_2016 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2016'=Insured) %>%
      select(States, '2016') %>%
        na.omit
hi_2017 <- hinsurance_2017 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2017'=Insured) %>%
      select(States, '2017') %>%
         na.omit
hi_2018 <- hinsurance_2018 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2018'=Insured) %>%
      select(States, '2018') %>%
         na.omit
hi_2019 <- hinsurance_2019 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2019'=Insured) %>%
      select(States, '2019') %>%
        na.omit
hi_2020 <- hinsurance_2020 %>%
  select(States,Total_Population,Uninsured) %>%
    mutate(Insured = as.numeric(Total_Population) - as.numeric(Uninsured)) %>%
     rename('2020'=Insured) %>%
      select(States, '2020') %>%
        na.omit
```

Joining yearly health insurance data to get one tibble for all

```
state_hinsurance_from2011 <- hi_2011 %>%
  inner_join(hi_2012, by='States') %>%
    inner_join(hi_2013, by='States') %>%
      inner_join(hi_2014, by='States') %>%
        inner_join(hi_2015, by='States') %>%
          inner_join(hi_2016, by='States') %>%
             inner_join(hi_2017, by='States') %>%
               inner_join(hi_2018, by='States') %>%
                 inner_join(hi_2019, by='States') %>%
                    inner_join(hi_2020, by='States')


state_hinsurance_from2011
```

```
## # A tibble: 51 x 11
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama 4.01e6 4.07e6 4.06e6 4.15e6 4.25e6 4.41e6 4.29e6 4.40e6 4.31e6 4.45e6
##  2 Alaska  5.58e5 5.63e5 5.74e5 5.83e5 6.05e5 6.20e5 6.11e5 6.36e5 6.21e5 6.17e5
##  3 Arizona 5.24e6 5.27e6 5.34e6 5.66e6 5.92e6 6.15e6 6.15e6 6.66e6 6.31e6 6.66e6
##  4 Arkans~ 2.37e6 2.39e6 2.41e6 2.54e6 2.61e6 2.76e6 2.68e6 2.67e6 2.66e6 2.72e6
##  5 Califo~ 3.02e7 3.06e7 3.11e7 3.32e7 3.50e7 3.65e7 3.59e7 3.62e7 3.56e7 3.63e7
##  6 Colora~ 4.22e6 4.31e6 4.42e6 4.67e6 4.89e6 5.06e6 5.05e6 5.23e6 5.18e6 5.14e6
##  7 Connec~ 3.17e6 3.16e6 3.15e6 3.24e6 3.27e6 3.43e6 3.28e6 3.25e6 3.25e6 3.31e6
##  8 Delawa~ 8.02e5 8.13e5 8.08e5 8.38e5 8.67e5 8.92e5 8.80e5 9.12e5 8.78e5 9   e5
##  9 Distri~ 5.39e5 5.63e5 5.72e5 5.89e5 6.11e5 6.58e5 6.34e5 6.59e5 6.47e5 6.94e5
## 10 Florida 1.47e7 1.51e7 1.53e7 1.62e7 1.72e7 1.81e7 1.79e7 1.81e7 1.82e7 1.90e7
## # ... with 41 more rows
```

Economics Data

Used unemployment rates and median income for each state

Loading uemployment rates data

```
unemploymentrates_2011to2018 <- read_csv(here::here("stateunemploymentdata", "stateunemploymentrates_to
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9], 'X10' [10], 'X11' [11], 'X12' [12],
## 'X13' [13], 'X14' [14], 'X15' [15], 'X16' [16], 'X17' [17], 'X18' [18],
## 'X19' [19], 'X20' [20], 'X21' [21], 'X22' [22], 'X23' [23], 'X24' [24],
## 'X25' [25], 'X26' [26], 'X27' [27], 'X28' [28], 'X29' [29], 'X30' [30],
## 'X31' [31], 'X32' [32], 'X33' [33], 'X34' [34], 'X35' [35], 'X36' [36],
## 'X37' [37], 'X38' [38], 'X39' [39], 'X40' [40], 'X41' [41]

##
```

```
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_double(),
##   `Average Annual Unemployment Rates by State (see previous tab for Iowa's counties)` = col_characte
##   X2 = col_character()
## )
## i Use `spec()` for the full column specifications.
```

```
#names(unemploymentrates_2011to2018) <- NULL
unemploymentrates_2011to2018
```

```
## # A tibble: 66 x 41
##    `Average Annual Unemp~ X2        X3     X4     X5     X6     X7     X8     X9
##    <chr>                  <chr>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 U.S. Bureau of Labor ~ <NA>     NA     NA     NA     NA     NA     NA     NA
##  2 Local Area Unemployme~ <NA>     NA     NA     NA     NA     NA     NA     NA
##  3 April 2019 release     <NA>     NA     NA     NA     NA     NA     NA     NA
##  4 <NA>                   <NA>     NA     NA     NA     NA     NA     NA     NA
##  5 Fips                   Area   1980   1981   1982   1983   1984   1985   1986
##  6 00000                  Unit~    7.1    7.6    9.7    9.6    7.5    7.2    7
##  7 01000                  Alab~    8.9   10.6   14.1   13.8   11      9.2    9.7
##  8 02000                  Alas~    9.6    9.4    9.9    9.9    9.8    9.7   10.9
##  9 04000                  Ariz~    6.6    6.2   10.1    8.8    5.2    6.3    6.9
## 10 05000                  Arka~    7.6    8.7    9.9    9.9    8.7    8.7    8.6
## # ... with 56 more rows, and 32 more variables: X10 <dbl>, X11 <dbl>,
## #   X12 <dbl>, X13 <dbl>, X14 <dbl>, X15 <dbl>, X16 <dbl>, X17 <dbl>,
## #   X18 <dbl>, X19 <dbl>, X20 <dbl>, X21 <dbl>, X22 <dbl>, X23 <dbl>,
## #   X24 <dbl>, X25 <dbl>, X26 <dbl>, X27 <dbl>, X28 <dbl>, X29 <dbl>,
## #   X30 <dbl>, X31 <dbl>, X32 <dbl>, X33 <dbl>, X34 <dbl>, X35 <dbl>,
## #   X36 <dbl>, X37 <dbl>, X38 <dbl>, X39 <dbl>, X40 <dbl>, X41 <dbl>
```

Removing unwanted rows

```
States_ur_2011to2018 <- unemploymentrates_2011to2018 %>%
slice(-(1:4))
```

removing headers and using first row as headers

```
names(States_ur_2011to2018) <- NULL
#States_ur_2011to2018
names(States_ur_2011to2018) <- States_ur_2011to2018[1,]
```

```
## Warning: The `value` argument of `names<-` must be a character vector as of
## tibble 3.0.0.
```

Final unemployment rates data for 2011 to 2018

```
statesunemploymentrates_2011to2018 <- States_ur_2011to2018 %>%
  slice(-c(1:2)) %>%
   rename(States=Area) %>%
    select(-c("1980":"2010"),-1) %>%
     na.omit
statesunemploymentrates_2011to2018
```

```
## # A tibble: 51 x 9
##    States               `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018`
##    <chr>                 <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama                 9.6    8      7.2    6.8    6.1    5.8    4.4    3.9
##  2 Alaska                  7.6    7.1    7      6.9    6.5    6.9    7      6.6
##  3 Arizona                 9.5    8.3    7.7    6.8    6.1    5.4    4.9    4.8
##  4 Arkansas                8.3    7.6    7.2    6      5      4      3.7    3.7
##  5 California             11.7   10.4    8.9    7.5    6.2    5.5    4.8    4.2
##  6 Colorado                8.4    7.9    6.9    5      3.9    3.2    2.7    3.3
##  7 Connecticut             8.8    8.3    7.8    6.6    5.7    5.1    4.7    4.1
##  8 Delaware                7.5    7.2    6.7    5.7    4.9    4.5    4.5    3.8
##  9 District of Columbia   10.2    9      8.5    7.8    6.9    6.1    6.1    5.6
## 10 Florida                10      8.5    7.2    6.3    5.5    4.8    4.2    3.6
## # ... with 41 more rows
```

#Loading unemployment data using here package for 2019 and 2020 and joining with the rest

```
statesur_2019 <- read_csv(here::here("stateunemploymentdata", "statesunemploymentrate_2019.csv"))
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   `2019` = col_double()
## )
```

```
statesur_2020 <- read_csv(here::here("stateunemploymentdata", "statesunemploymentrate_2020.csv"))
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   `2020` = col_double()
## )
```

```
statesunemploymentrates_2011to2020 <- statesunemploymentrates_2011to2018 %>%
      inner_join(statesur_2019, by = "States") %>%
       inner_join(statesur_2020, by = "States")
statesunemploymentrates_2011to2020
```

```
## # A tibble: 51 x 11
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama    9.6    8      7.2    6.8    6.1    5.8    4.4    3.9    3.1    5.9
##  2 Alaska     7.6    7.1    7      6.9    6.5    6.9    7      6.6    5.4    7.8
##  3 Arizona    9.5    8.3    7.7    6.8    6.1    5.4    4.9    4.8    4.6    7.9
##  4 Arkans~    8.3    7.6    7.2    6      5      4      3.7    3.7    3.4    6.1
##  5 Califo~   11.7   10.4    8.9    7.5    6.2    5.5    4.8    4.2    4     10.1
##  6 Colora~    8.4    7.9    6.9    5      3.9    3.2    2.7    3.3    2.5    7.3
##  7 Connec~    8.8    8.3    7.8    6.6    5.7    5.1    4.7    4.1    3.5    7.9
##  8 Delawa~    7.5    7.2    6.7    5.7    4.9    4.5    4.5    3.8    3.6    7.8
##  9 Distri~   10.2    9      8.5    7.8    6.9    6.1    6.1    5.6    4.9    8
## 10 Florida   10      8.5    7.2    6.3    5.5    4.8    4.2    3.6    3.2    7.7
## # ... with 41 more rows
```

Median Income Data

Loading and wrangling Median Income Data for 2011 to 2018

```
statesmedianincome_to2018 <- read_csv(here::here("Statesmedianincome", "medianstateincome_to2018.csv"))
```

```
## Warning: Missing column names filled in: 'X2' [2], 'X3' [3], 'X4' [4], 'X5' [5],
## 'X6' [6], 'X7' [7], 'X8' [8], 'X9' [9], 'X10' [10], 'X11' [11], 'X12' [12],
## 'X13' [13], 'X14' [14], 'X15' [15], 'X16' [16], 'X17' [17], 'X18' [18],
## 'X19' [19], 'X20' [20], 'X21' [21], 'X22' [22], 'X23' [23], 'X24' [24],
## 'X25' [25], 'X26' [26], 'X27' [27], 'X28' [28], 'X29' [29], 'X30' [30],
## 'X31' [31], 'X32' [32], 'X33' [33], 'X34' [34], 'X35' [35], 'X36' [36],
## 'X37' [37], 'X38' [38], 'X39' [39], 'X40' [40], 'X41' [41], 'X42' [42],
## 'X43' [43], 'X44' [44], 'X45' [45], 'X46' [46], 'X47' [47], 'X48' [48],
## 'X49' [49], 'X50' [50], 'X51' [51], 'X52' [52], 'X53' [53], 'X54' [54],
## 'X55' [55], 'X56' [56], 'X57' [57], 'X58' [58], 'X59' [59], 'X60' [60],
## 'X61' [61], 'X62' [62], 'X63' [63], 'X64' [64], 'X65' [65], 'X66' [66],
## 'X67' [67], 'X68' [68], 'X69' [69], 'X70' [70], 'X71' [71], 'X72' [72],
## 'X73' [73], 'X74' [74], 'X75' [75]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   .default = col_character()
## )
## i Use `spec()` for the full column specifications.
```

```
statesmedianincome_to2018
```

```
## # A tibble: 115 x 75
##    `Table with row ~ X2    X3    X4    X5    X6    X7    X8    X9    X10   X11  
##    <chr>             <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
##  1 Table H-8.  Medi~  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  2 (Households as o~  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  3 CURRENT DOLLARS    <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>  <NA>
##  4 State             "201~  <NA> "201~  <NA> "201~  <NA> "201~  <NA> "201~  <NA>
##  5 <NA>              "Med~ "Sta~ "Med~ "Sta~ "Med~ "Sta~ "Med~ "Sta~ "Med~ "Sta~
##  6 United States     "63,~ "420" "61,~ "322" "61,~ "335" "59,~ "436" "56,~ "321"
##  7 Alabama           "49,~ "2,4~ "50,~ "1,0~ "51,~ "845" "47,~ "2,3~ "44,~ "3,4~
##  8 Alaska            "68,~ "3,3~ "77,~ "3,7~ "72,~ "2,7~ "75,~ "4,0~ "75,~ "3,4~
##  9 Arizona           "62,~ "2,2~ "59,~ "2,6~ "61,~ "2,6~ "57,~ "1,9~ "52,~ "2,0~
## 10 Arkansas          "49,~ "2,1~ "49,~ "2,4~ "48,~ "2,6~ "45,~ "2,1~ "42,~ "1,5~
## # ... with 105 more rows, and 64 more variables: X12 <chr>, X13 <chr>,
## #   X14 <chr>, X15 <chr>, X16 <chr>, X17 <chr>, X18 <chr>, X19 <chr>,
## #   X20 <chr>, X21 <chr>, X22 <chr>, X23 <chr>, X24 <chr>, X25 <chr>,
## #   X26 <chr>, X27 <chr>, X28 <chr>, X29 <chr>, X30 <chr>, X31 <chr>,
## #   X32 <chr>, X33 <chr>, X34 <chr>, X35 <chr>, X36 <chr>, X37 <chr>,
## #   X38 <chr>, X39 <chr>, X40 <chr>, X41 <chr>, X42 <chr>, X43 <chr>,
## #   X44 <chr>, X45 <chr>, X46 <chr>, X47 <chr>, X48 <chr>, X49 <chr>,
## #   X50 <chr>, X51 <chr>, X52 <chr>, X53 <chr>, X54 <chr>, X55 <chr>,
## #   X56 <chr>, X57 <chr>, X58 <chr>, X59 <chr>, X60 <chr>, X61 <chr>,
## #   X62 <chr>, X63 <chr>, X64 <chr>, X65 <chr>, X66 <chr>, X67 <chr>,
## #   X68 <chr>, X69 <chr>, X70 <chr>, X71 <chr>, X72 <chr>, X73 <chr>,
## #   X74 <chr>, X75 <chr>
```

Cleaning the above median income data

```
states_medianincome_to2018 <- statesmedianincome_to2018 %>%
slice(-(1:3))
```

```
names(states_medianincome_to2018) <- NULL
names(states_medianincome_to2018) <- states_medianincome_to2018[1,]
```

```
## Warning: The `value` argument of `names<-` can't be empty as of tibble 3.0.0.
## Columns 3, 5, 7, 9, 11, and 32 more must be named.
```

```
## Warning: The `value` argument of `names<-` must be a character vector as of
## tibble 3.0.0.
```

Using select, rename, slice and na.omit to clean and subset the data further

```
states_medianincome_2011to2018 <- states_medianincome_to2018 %>%
     select(State,starts_with(c("2"))) %>%
        select(-c("2010 (37)":"2000 (30)")) %>%
         rename(twentysvtn="2017",twentysvtnt="2017 (40)") %>%
          slice(-c(1:3)) %>%
             na.omit %>%
             slice(-c(52:104))
```

Removing a thousand coma seperator

Then using lapply together with a function to convert charater columns to numeric columns

```
col_conv <- c(2:11)
states_medianincome_2011to2018[ , col_conv] <- lapply(states_medianincome_2011to2018[ , col_conv],funct
```

Create new columns to replace the other ambiguous columns by taking their averages

And removing the ambiguous columns

```
smi <- states_medianincome_2011to2018 %>%
    mutate("2013" = ((as.numeric(`2013 (38)`) + as.numeric(`2013 (39)`))/2)) %>%
    mutate("2017" = ((as.numeric(twentysvtn) + as.numeric(twentysvtnt))/2)) %>%
     select(-c(twentysvtnt,twentysvtn,`2013 (38)`,`2013 (39)`))
```

Loading and wrangling median income data for 2019 and 2020

```
statesmedianincome_2019 <- read_csv(here::here("Statesmedianincome", "medianstateincome2019.csv"))
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Title: Median Annual Household Income | KFF` = col_character(),
##   X2 = col_character()
## )
```

```
statesmedianincome_2020 <- read_csv(here::here("Statesmedianincome", "medianstateincome_2020.csv"))
```

```
## Warning: Missing column names filled in: 'X2' [2]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Median household income in the United States by state 2020` = col_character(),
##   X2 = col_double()
## )
```

```
statesmedianincome_2020
```

```
## # A tibble: 54 x 2
##    `Median household income in the United States by state 2020`               X2
##    <chr>                                                                   <dbl>
##  1 Median household income in the United States in 2020, by state (in cur~    NA
##  2 <NA>                                                                       NA
##  3 Maryland                                                                94384
##  4 District of Columbia                                                    88311
##  5 New Hampshire                                                           88235
##  6 Massachusetts                                                           86725
##  7 New Jersey                                                              85239
##  8 Utah                                                                    83670
##  9 Colorado                                                                82611
## 10 Virginia                                                                81947
## # ... with 44 more rows
```

```
smi_2019<- statesmedianincome_2019 %>%
  rename(State = `Title: Median Annual Household Income | KFF`,"2019"=X2)
smi_2020 <- statesmedianincome_2020 %>%
  rename(State = `Median household income in the United States by state 2020`,"2020" = X2)

smi2019_2020 <- smi_2019 %>%
    inner_join(smi_2020, by = "State")
```

Removing dollar sign and a comma from 2019 column using gsub

```
smi2019_2020$`2019` = as.numeric(gsub("[\\$,]", "", smi2019_2020$`2019`))
```

Changing District of Colombia to D.C. in 2019/2020 data to enable smooth join

```
smi2019_2020[10,1] <- "D.C."
```

Joining 2019 and 2020 with the rest of the data

```
statesmedianincome_2011to2020 <- smi %>%
      inner_join(smi2019_2020, by = "State")
statesmedianincome_2011to2020
```

```
## # A tibble: 51 x 11
##    State   `2018` `2016` `2015` `2014` `2012` `2011` `2013` `2017` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama  49936  47221  44509  42278  43464  42590 44350.  50989   51734  54393
##  2 Alaska   68734  75723  75112  67629  63648  57431 66804. 75109   75463  74476
##  3 Arizona  62283  57100  52248  49254  47044  48621 51606. 60412.  62055  66628
##  4 Arkans~  49781  45907  42798  44922  39018  41302 39648. 49290   48952  50540
##  5 Califo~  70489  66637  63636  60487  57020  53367 59161  69898.  80440  77358
##  6 Colora~  73034  70566  66596  60940  57255  58629 65642. 74578   77127  82611
##  7 Connec~  72812  75923  72889  70161  64247  65415 68536  73542   78833  79043
##  8 Delawa~  65012  58046  57756  57522  48972  54660 53155  63640.  70176  69132
##  9 D.C.     85750  70982  70071  68277  65246  55251 60366  82332   92266  88311
## 10 Florida  54644  51176  48825  46140  46071  45105 48209  53384.  59227  57435
## # ... with 41 more rows
```

###ANALYSIS ## Unemployment rates ## Values are ranked from smallest to largest

Calculating and mutating new column for 10 yr average for unemployment rates

```
averagestateunemploymentrates_2011to2020 <- statesunemploymentrates_2011to2020 %>%
mutate("10year_mean" = (`2011`+`2012`+`2013`+`2014`+`2015`+`2016`+`2017`+`2018`+`2019`+`2020` )/10)

averagestateunemploymentrates_2011to2020
```

```
## # A tibble: 51 x 12
##    States `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama    9.6    8      7.2    6.8    6.1    5.8    4.4    3.9    3.1    5.9
##  2 Alaska     7.6    7.1    7      6.9    6.5    6.9    7      6.6    5.4    7.8
##  3 Arizona    9.5    8.3    7.7    6.8    6.1    5.4    4.9    4.8    4.6    7.9
##  4 Arkans~    8.3    7.6    7.2    6      5      4      3.7    3.7    3.4    6.1
##  5 Califo~   11.7   10.4    8.9    7.5    6.2    5.5    4.8    4.2    4     10.1
##  6 Colora~    8.4    7.9    6.9    5      3.9    3.2    2.7    3.3    2.5    7.3
##  7 Connec~    8.8    8.3    7.8    6.6    5.7    5.1    4.7    4.1    3.5    7.9
##  8 Delawa~    7.5    7.2    6.7    5.7    4.9    4.5    4.5    3.8    3.6    7.8
##  9 Distri~   10.2    9      8.5    7.8    6.9    6.1    6.1    5.6    4.9    8
## 10 Florida   10      8.5    7.2    6.3    5.5    4.8    4.2    3.6    3.2    7.7
## # ... with 41 more rows, and 1 more variable: 10year_mean <dbl>
```

Ranking states based on employment rates

```
rankedstateunemploymentrates_2011to2020 <-averagestateunemploymentrates_2011to2020 %>%
  arrange(`10year_mean`) %>%
    mutate('2011_ranking' = min_rank(`2011`) ) %>%
    mutate('2012_ranking' = min_rank(`2012`) ) %>%
    mutate('2013_ranking' = min_rank(`2013`) ) %>%
    mutate('2014_ranking' = min_rank(`2014`) ) %>%
    mutate('2015_ranking' = min_rank(`2015`) ) %>%
    mutate('2016_ranking' = min_rank(`2016`) ) %>%
    mutate('2017_ranking' = min_rank(`2017`) ) %>%
    mutate('2018_ranking' = min_rank(`2018`) ) %>%
    mutate('2019_ranking' = min_rank(`2019`) ) %>%
    mutate('2020_ranking' = min_rank(`2020`) ) %>%
    mutate('10year_ranking' = min_rank(`10year_mean`) )
```

Displaying the rankings only

```
unemploymentrates_ranks <- rankedstateunemploymentrates_2011to2020 %>%
     select(States, c(`2011_ranking`:`10year_ranking`))
unemploymentrates_ranks
```

```
## # A tibble: 51 x 12
##    States        `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                  <int>          <int>          <int>          <int>
##  1 North Dakota               1              1              1              1
##  2 Nebraska                   2              2              2              2
##  3 South Dakota               3              3              2              3
##  4 Vermont                    5              4              4              5
##  5 Iowa                       5              4              6              7
##  6 New Hampshire              4              9             10              9
##  7 Utah                      12              8              5              4
##  8 Minnesota                  9             10              9              7
##  9 Kansas                     9             11             11             11
## 10 Oklahoma                   8              6             11             11
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

Median income Analysis

Values are ranked from largest to smallest

```
statesmedianincome_2011to2020[,order(colnames(statesmedianincome_2011to2020))]
```

```
## # A tibble: 51 x 11
##    `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020` State
##     <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl> <chr>
##  1  42590  43464 44350.  42278  44509  47221 50989   49936  51734  54393 Alabama
##  2  57431  63648 66804.  67629  75112  75723 75109   68734  75463  74476 Alaska
##  3  48621  47044 51606.  49254  52248  57100 60412.  62283  62055  66628 Arizona
##  4  41302  39018 39648.  44922  42798  45907 49290   49781  48952  50540 Arkans~
##  5  53367  57020 59161   60487  63636  66637 69898.  70489  80440  77358 Califo~
##  6  58629  57255 65642.  60940  66596  70566 74578   73034  77127  82611 Colora~
##  7  65415  64247 68536   70161  72889  75923 73542   72812  78833  79043 Connec~
##  8  54660  48972 53155   57522  57756  58046 63640.  65012  70176  69132 Delawa~
##  9  55251  65246 60366   68277  70071  70982 82332   85750  92266  88311 D.C.
## 10  45105  46071 48209   46140  48825  51176 53384.  54644  59227  57435 Florida
## # ... with 41 more rows
```

Using rowmeans to find 10yr average

```
averagestatesmedianincome_2011to2020 <- statesmedianincome_2011to2020 %>%
mutate("10year_mean" =rowMeans(select(.,`2011`,`2012`,`2013`,`2014`,`2015`,`2016`,`2017`,`2018`,`2019`,

rankedstatesmedianincome_2011to2020 <-averagestatesmedianincome_2011to2020 %>%
  arrange(desc(`10year_mean`)) %>%
    mutate('2011_ranking' = min_rank(desc(`2011`)) ) %>%
    mutate('2012_ranking' = min_rank(desc(`2012`) )) %>%
    mutate('2013_ranking' = min_rank(desc(`2013`)) ) %>%
    mutate('2014_ranking' = min_rank(desc(`2014`)) ) %>%
    mutate('2015_ranking' = min_rank(desc(`2015`)) ) %>%
    mutate('2016_ranking' = min_rank(desc(`2016`)) ) %>%
    mutate('2017_ranking' = min_rank(desc(`2017`)) ) %>%
    mutate('2018_ranking' = min_rank(desc(`2018`)) ) %>%
    mutate('2019_ranking' = min_rank(desc(`2019`)) ) %>%
    mutate('2020_ranking' = min_rank(desc(`2020`)) ) %>%
    mutate('10year_ranking' = min_rank(desc(`10year_mean`)) )

medianincome_ranks <- rankedstatesmedianincome_2011to2020%>%
     select(State, c(`2011_ranking`:`10year_ranking`))
medianincome_ranks
```

```
## # A tibble: 51 x 12
##    State         `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                  <int>          <int>          <int>          <int>
##  1 Maryland                   1              1              3              1
##  2 New Hampshire              2              2              1              2
##  3 D.C.                      15              4             14              5
##  4 Massachusetts              4              7              9             11
##  5 Connecticut                3              6              2              4
##  6 New Jersey                 6              3              8              9
##  7 Hawaii                     7             15              7              3
##  8 Alaska                    10              8              4              6
##  9 Virginia                   5              5              5              8
## 10 Washington                11              9             11             16
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

Loading population data for each state from 2011 to 2020 for analysis

```
statespopulation_2011to2020 <- read_csv("Statespopulation_2011to2020.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   `2011` = col_double(),
##   `2012` = col_double(),
##   `2013` = col_double(),
##   `2014` = col_double(),
##   `2015` = col_double(),
##   `2016` = col_double(),
##   `2017` = col_double(),
##   `2018` = col_double(),
##   `2019` = col_double(),
##   `2020` = col_double()
## )
```

```
## Warning: 3 parsing failures.
## row col   expected    actual                              file
##  83  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
##  96  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
## 109  -- 11 columns 1 columns 'Statespopulation_2011to2020.csv'
```

```
statespopulation_2011to2020
```

```
## # A tibble: 114 x 11
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
##  1 Alabama 4.68e6 4.70e6 4.71e6 4.71e6 4.73e6 4.83e6 4.74e6 4.86e6 4.77e6 4.89e6
##  2 Alaska  6.97e5 7.06e5 7.05e5 7.07e5 7.08e5 7.08e5 7.10e5 7.21e5 7.02e5 7.06e5
##  3 Arizona 6.32e6 6.39e6 6.47e6 6.56e6 6.66e6 6.88e6 6.84e6 7.23e6 7.10e6 7.47e6
##  4 Arkans~ 2.85e6 2.86e6 2.87e6 2.88e6 2.88e6 2.94e6 2.91e6 2.91e6 2.92e6 2.98e6
##  5 Califo~ 3.69e7 3.72e7 3.75e7 3.80e7 3.83e7 3.91e7 3.87e7 3.91e7 3.86e7 3.91e7
##  6 Colora~ 4.98e6 5.05e6 5.13e6 5.22e6 5.32e6 5.50e6 5.46e6 5.73e6 5.61e6 5.74e6
##  7 Connec~ 3.47e6 3.48e6 3.48e6 3.48e6 3.48e6 3.57e6 3.48e6 3.42e6 3.45e6 3.48e6
##  8 Delawa~ 8.80e5 8.88e5 8.98e5 9.05e5 9.18e5 9.44e5 9.32e5 9.74e5 9.40e5 9.82e5
##  9 Distri~ 5.84e5 5.96e5 6.10e5 6.24e5 6.35e5 6.84e5 6.58e5 6.91e5 6.71e5 7.17e5
## 10 Florida 1.86e7 1.89e7 1.91e7 1.94e7 1.98e7 2.05e7 2.05e7 2.11e7 2.10e7 2.17e7
## # ... with 104 more rows
```

```
hospitals_population <- statehospitals_from2011 %>%
    inner_join(statespopulation_2011to2020, by = "States")

#Converting columns to numeric
hospitals_population[,2:21] <- lapply(hospitals_population[,2:21],as.numeric)
```

Finding hospitals per population data for each state

```
hospitalsperpopulation <- hospitals_population %>%
    mutate("2011_h/p" =`2011.x`/`2011.y`) %>%
   mutate("2012_h/p" =`2012.x`/`2012.y`) %>%
   mutate("2013_h/p" =`2013.x`/`2013.y`) %>%
   mutate("2014_h/p" =`2014.x`/`2014.y`) %>%
   mutate("2015_h/p" =`2015.x`/`2015.y`) %>%
   mutate("2016_h/p" =`2016.x`/`2016.y`) %>%
   mutate("2017_h/p" =`2017.x`/`2017.y`) %>%
   mutate("2018_h/p" =`2018.x`/`2018.y`) %>%
   mutate("2019_h/p" =`2019.x`/`2019.y`) %>%
   mutate("2020_h/p" =`2020.x`/`2020.y`)
#Selecting only the 'h/p' columns

h_p_data <- hospitalsperpopulation %>%
    select(States,c(`2011_h/p`:`2020_h/p`))
```

Rank from the highest value

```
averagestatehp_2011to2020 <- h_p_data%>%
mutate("10year_mean" =rowMeans(select(.,`2011_h/p`,`2012_h/p`,`2013_h/p`,`2014_h/p`,`2015_h/p`,`2016_h/

rankedstateshp_2011to2020 <-averagestatehp_2011to2020%>%
  arrange(desc(`10year_mean`)) %>%
    mutate('2011_ranking' =min_rank(desc(`2011_h/p`))) %>%
     mutate('2012_ranking' = min_rank(desc(`2012_h/p`) )) %>%
    mutate('2013_ranking' = min_rank(desc(`2013_h/p`)) ) %>%
    mutate('2014_ranking' = min_rank(desc(`2014_h/p`)) ) %>%
    mutate('2015_ranking' = min_rank(desc(`2015_h/p`)) ) %>%
    mutate('2016_ranking' = min_rank(desc(`2016_h/p`)) ) %>%
    mutate('2017_ranking' = min_rank(desc(`2017_h/p`)) ) %>%
    mutate('2018_ranking' = min_rank(desc(`2018_h/p`)) ) %>%
    mutate('2019_ranking' = min_rank(desc(`2019_h/p`)) ) %>%
    mutate('2020_ranking' = min_rank(desc(`2020_h/p`)) ) %>%
    mutate('10year_ranking' = min_rank(desc(`10year_mean`)) )

States_hospitalsperpopulation_ranks <- rankedstateshp_2011to2020%>%
     select(States, c(`2011_ranking`:`10year_ranking`))
States_hospitalsperpopulation_ranks
```

```
## # A tibble: 51 x 12
##    States        `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                  <int>          <int>          <int>          <int>
##  1 South Dakota               1              1              1              1
##  2 North Dakota               2              2              2              2
##  3 Montana                    3              4              3              3
##  4 Nebraska                   4              3              4              4
##  5 Kansas                     5              5              5              5
##  6 Wyoming                    6              6              6              6
##  7 Iowa                       7              7              7              7
##  8 Mississippi                8              8              8              8
##  9 Oklahoma                  10             10             10             10
## 10 West Virginia             11             11             11             11
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

Health Insurance Analysis

```
insurance_population <- state_hinsurance_from2011 %>%
    inner_join(statespopulation_2011to2020, by = "States")

#Converting columns to numeric
insurance_population[,2:21] <- lapply(insurance_population[,2:21],as.numeric)
```

```
insuredperpopulation <- insurance_population %>%
    mutate("2011_i/p" =`2011.x`/`2011.y`) %>%
   mutate("2012_i/p" =`2012.x`/`2012.y`) %>%
   mutate("2013_i/p" =`2013.x`/`2013.y`) %>%
   mutate("2014_i/p" =`2014.x`/`2014.y`) %>%
   mutate("2015_i/p" =`2015.x`/`2015.y`) %>%
   mutate("2016_i/p" =`2016.x`/`2016.y`) %>%
   mutate("2017_i/p" =`2017.x`/`2017.y`) %>%
   mutate("2018_i/p" =`2018.x`/`2018.y`) %>%
   mutate("2019_i/p" =`2019.x`/`2019.y`) %>%
   mutate("2020_i/p" =`2020.x`/`2020.y`)
#Selecting only the 'h/p' columns

h_i_data <- insuredperpopulation %>%
    select(States,c(`2011_i/p`:`2020_i/p`))
```

Ranking from the highest value

```
averagestateip_2011to2020 <- h_i_data%>%
mutate("10year_mean" =rowMeans(select(.,`2011_i/p`,`2012_i/p`,`2013_i/p`,`2014_i/p`,`2015_i/p`,`2016_i/

rankedstatesip_2011to2020 <-averagestateip_2011to2020%>%
  arrange(desc(`10year_mean`)) %>%
    mutate('2011_ranking' =min_rank(desc(`2011_i/p`))) %>%
     mutate('2012_ranking' = min_rank(desc(`2012_i/p`) )) %>%
    mutate('2013_ranking' = min_rank(desc(`2013_i/p`)) ) %>%
    mutate('2014_ranking' = min_rank(desc(`2014_i/p`)) ) %>%
    mutate('2015_ranking' = min_rank(desc(`2015_i/p`)) ) %>%
    mutate('2016_ranking' = min_rank(desc(`2016_i/p`)) ) %>%
    mutate('2017_ranking' = min_rank(desc(`2017_i/p`)) ) %>%
    mutate('2018_ranking' = min_rank(desc(`2018_i/p`)) ) %>%
    mutate('2019_ranking' = min_rank(desc(`2019_i/p`)) ) %>%
    mutate('2020_ranking' = min_rank(desc(`2020_i/p`)) ) %>%
    mutate('10year_ranking' = min_rank(desc(`10year_mean`)) )

States_insuredperpopulation_ranks <- rankedstatesip_2011to2020%>%
     select(States, c(`2011_ranking`:`10year_ranking`))
States_insuredperpopulation_ranks
```

```
## # A tibble: 51 x 12
##    States            `2011_ranking` `2012_ranking` `2013_ranking` `2014_ranking`
##    <chr>                      <int>          <int>          <int>          <int>
##  1 Massachusetts                  1              1              1              1
##  2 District of Colu~              4              2              2              4
##  3 Hawaii                         2              3              4              3
##  4 Vermont                        3              4              3              2
##  5 Minnesota                      6              5              5              6
##  6 Iowa                           8              6              6              5
##  7 Connecticut                    5              9              8              7
##  8 Rhode Island                  14             18             19              8
##  9 Wisconsin                      9              8              7             10
## 10 Pennsylvania                  12             10              9             15
## # ... with 41 more rows, and 7 more variables: 2015_ranking <int>,
## #   2016_ranking <int>, 2017_ranking <int>, 2018_ranking <int>,
## #   2019_ranking <int>, 2020_ranking <int>, 10year_ranking <int>
```

Using average of hospitals and insurance rankings to get overall health ranks

```
overall_health_ranking_data <- States_hospitalsperpopulation_ranks %>%
           inner_join(States_insuredperpopulation_ranks, by = "States")
overall_health_ranking_data
```

```
## # A tibble: 51 x 23
##    States    `2011_ranking.x` `2012_ranking.x` `2013_ranking.x` `2014_ranking.x`
##    <chr>                <int>            <int>            <int>            <int>
##  1 South Da~                1                1                1                1
##  2 North Da~                2                2                2                2
##  3 Montana                  3                4                3                3
##  4 Nebraska                 4                3                4                4
##  5 Kansas                   5                5                5                5
##  6 Wyoming                  6                6                6                6
##  7 Iowa                     7                7                7                7
##  8 Mississi~                8                8                8                8
##  9 Oklahoma                10               10               10               10
## 10 West Vir~               11               11               11               11
## # ... with 41 more rows, and 18 more variables: 2015_ranking.x <int>,
## #   2016_ranking.x <int>, 2017_ranking.x <int>, 2018_ranking.x <int>,
## #   2019_ranking.x <int>, 2020_ranking.x <int>, 10year_ranking.x <int>,
## #   2011_ranking.y <int>, 2012_ranking.y <int>, 2013_ranking.y <int>,
## #   2014_ranking.y <int>, 2015_ranking.y <int>, 2016_ranking.y <int>,
## #   2017_ranking.y <int>, 2018_ranking.y <int>, 2019_ranking.y <int>,
## #   2020_ranking.y <int>, 10year_ranking.y <int>
```

```
health_weighted_ranks <- overall_health_ranking_data %>%
     mutate("2011_weighted_rank"=((0.2 * (`2011_ranking.x`))+(0.8*(`2011_ranking.y`)))/2) %>%
     mutate("2012_weighted_rank"=((0.2 * (`2012_ranking.x`))+(0.8*(`2012_ranking.y`)))/2) %>%
     mutate("2013_weighted_rank"=((0.2 * (`2013_ranking.x`))+(0.8*(`2013_ranking.y`)))/2) %>%
     mutate("2014_weighted_rank"=((0.2 * (`2014_ranking.x`))+(0.8*(`2014_ranking.y`)))/2) %>%
     mutate("2015_weighted_rank"=((0.2 * (`2015_ranking.x`))+(0.8*(`2015_ranking.y`)))/2) %>%
     mutate("2016_weighted_rank"=((0.2 * (`2016_ranking.x`))+(0.8*(`2016_ranking.y`)))/2) %>%
     mutate("2017_weighted_rank"=((0.2 * (`2017_ranking.x`))+(0.8*(`2017_ranking.y`)))/2) %>%
     mutate("2018_weighted_rank"=((0.2 * (`2018_ranking.x`))+(0.8*(`2018_ranking.y`)))/2) %>%
     mutate("2019_weighted_rank"=((0.2 * (`2019_ranking.x`))+(0.8*(`2019_ranking.y`)))/2) %>%
     mutate("2020_weighted_rank"=((0.2 * (`2020_ranking.x`))+(0.8*(`2020_ranking.y`)))/2) %>%
     mutate("10yr_weighted_rank"=((0.2 * (`10year_ranking.x`))+(0.8*(`10year_ranking.y`)))/2)


health_ranks_2011to2020 <- health_weighted_ranks %>%
  mutate("2011_overall_hrank" = min_rank(`2011_weighted_rank`)) %>%
  mutate("2012_overall_hrank" = min_rank(`2012_weighted_rank`)) %>%
   mutate("2013_overall_hrank" = min_rank(`2013_weighted_rank`)) %>%
   mutate("2014_overall_hrank" = min_rank(`2014_weighted_rank`)) %>%
   mutate("2015_overall_hrank" = min_rank(`2015_weighted_rank`)) %>%
    mutate("2016_overall_hrank" = min_rank(`2016_weighted_rank`)) %>%
   mutate("2017_overall_hrank" = min_rank(`2017_weighted_rank`)) %>%
   mutate("2018_overall_hrank" = min_rank(`2018_weighted_rank`)) %>%
   mutate("2019_overall_hrank" = min_rank(`2019_weighted_rank`)) %>%
   mutate("2020_overall_hrank" = min_rank(`2020_weighted_rank`)) %>%
   mutate("10yr_overall_hrank" = min_rank(`10yr_weighted_rank`))


health_ranks2011to2020 <- health_ranks_2011to2020 %>%
  arrange(`10yr_overall_hrank`) %>%
      select(States, c(`2011_overall_hrank`:`10yr_overall_hrank`))
 health_ranks2011to2020
```

```
## # A tibble: 51 x 12
##    States   `2011_overall_hr~ `2012_overall_h~ `2013_overall_h~ `2014_overall_h~
##    <chr>                <int>            <int>            <int>            <int>
##  1 Iowa                     3                1                2                2
##  2 Vermont                  1                3                1                1
##  3 Distric~                 5                2                3                5
##  4 Minneso~                 4                4                4                4
##  5 Hawaii                   2                5                5                3
##  6 Massach~                 7                6                6                6
##  7 Wiscons~                 8                7                7                8
##  8 North D~                 6                8                8                7
##  9 Pennsyl~                15               12               10               18
## 10 Connect~                10               14               11                9
## # ... with 41 more rows, and 7 more variables: 2015_overall_hrank <int>,
## #   2016_overall_hrank <int>, 2017_overall_hrank <int>,
## #   2018_overall_hrank <int>, 2019_overall_hrank <int>,
## #   2020_overall_hrank <int>, 10yr_overall_hrank <int>
```

Economics Analysis

```
medianincome_ranks <-  medianincome_ranks %>%
     rename(States = State)


medianincome_ranks[3,1] <- "District of Columbia"
```

Using average of unemployment ranks and median income rankings to get overall economic ranks

```
overall_economics_ranking_data <- unemploymentrates_ranks %>%
          inner_join(medianincome_ranks, by = "States")
overall_economics_ranking_data
```

```
## # A tibble: 51 x 23
##    States    `2011_ranking.x` `2012_ranking.x` `2013_ranking.x` `2014_ranking.x`
##    <chr>                <int>            <int>            <int>            <int>
##  1 North Da~                1                1                1                1
##  2 Nebraska                 2                2                2                2
##  3 South Da~                3                3                2                3
##  4 Vermont                  5                4                4                5
##  5 Iowa                     5                4                6                7
##  6 New Hamp~                4                9               10                9
##  7 Utah                    12                8                5                4
##  8 Minnesota                9               10                9                7
##  9 Kansas                   9               11               11               11
## 10 Oklahoma                 8                6               11               11
## # ... with 41 more rows, and 18 more variables: 2015_ranking.x <int>,
## #   2016_ranking.x <int>, 2017_ranking.x <int>, 2018_ranking.x <int>,
## #   2019_ranking.x <int>, 2020_ranking.x <int>, 10year_ranking.x <int>,
## #   2011_ranking.y <int>, 2012_ranking.y <int>, 2013_ranking.y <int>,
## #   2014_ranking.y <int>, 2015_ranking.y <int>, 2016_ranking.y <int>,
## #   2017_ranking.y <int>, 2018_ranking.y <int>, 2019_ranking.y <int>,
## #   2020_ranking.y <int>, 10year_ranking.y <int>
```

```
economics_weighted_ranks <- overall_economics_ranking_data %>%
     mutate("2011_weighted_rank"=((0.5 * (`2011_ranking.x`))+(0.5*(`2011_ranking.y`)))/2) %>%
     mutate("2012_weighted_rank"=((0.5 * (`2012_ranking.x`))+(0.5*(`2012_ranking.y`)))/2) %>%
     mutate("2013_weighted_rank"=((0.5 * (`2013_ranking.x`))+(0.5*(`2013_ranking.y`)))/2) %>%
     mutate("2014_weighted_rank"=((0.5* (`2014_ranking.x`))+(0.5*(`2014_ranking.y`)))/2) %>%
     mutate("2015_weighted_rank"=((0.5 * (`2015_ranking.x`))+(0.5*(`2015_ranking.y`)))/2) %>%
     mutate("2016_weighted_rank"=((0.5 * (`2016_ranking.x`))+(0.5*(`2016_ranking.y`)))/2) %>%
     mutate("2017_weighted_rank"=((0.5 * (`2017_ranking.x`))+(0.5*(`2017_ranking.y`)))/2) %>%
     mutate("2018_weighted_rank"=((0.5 * (`2018_ranking.x`))+(0.5*(`2018_ranking.y`)))/2) %>%
     mutate("2019_weighted_rank"=((0.5 * (`2019_ranking.x`))+(0.5*(`2019_ranking.y`)))/2) %>%
     mutate("2020_weighted_rank"=((0.5 * (`2020_ranking.x`))+(0.5*(`2020_ranking.y`)))/2) %>%
    mutate("10yr_weighted_rank"=((0.5 * (`10year_ranking.x`))+(0.5*(`10year_ranking.y`)))/2)


economics_ranks_2011to2020 <- economics_weighted_ranks %>%
  mutate("2011_overall_erank" = min_rank(`2011_weighted_rank`)) %>%
  mutate("2012_overall_erank" = min_rank(`2012_weighted_rank`)) %>%
   mutate("2013_overall_erank" = min_rank(`2013_weighted_rank`)) %>%
   mutate("2014_overall_erank" = min_rank(`2014_weighted_rank`)) %>%
   mutate("2015_overall_erank" = min_rank(`2015_weighted_rank`)) %>%
    mutate("2016_overall_erank" = min_rank(`2016_weighted_rank`)) %>%
   mutate("2017_overall_erank" = min_rank(`2017_weighted_rank`)) %>%
   mutate("2018_overall_erank" = min_rank(`2018_weighted_rank`)) %>%
   mutate("2019_overall_erank" = min_rank(`2019_weighted_rank`)) %>%
   mutate("2020_overall_erank" = min_rank(`2020_weighted_rank`)) %>%
   mutate("10yr_overall_erank" = min_rank(`10yr_weighted_rank`))


economics_ranks2011to2020 <- economics_ranks_2011to2020 %>%
  arrange(`10yr_overall_erank`) %>%
      select(States, c(`2011_overall_erank`:`10yr_overall_erank`))




economics_ranks2011to2020
```

```
## # A tibble: 51 x 12
##    States  `2011_overall_er~ `2012_overall_er~ `2013_overall_e~ `2014_overall_e~
##    <chr>               <int>             <int>            <int>            <int>
##  1 New Ha~                 1                 1                1                1
##  2 Hawaii                  7                12                2                2
##  3 Utah                   11                 3                3                3
##  4 Minnes~                 6                 7                4                3
##  5 Nebras~                 3                10               10                8
##  6 Vermont                10                 8                4                6
##  7 North ~                 2                 2                8                3
##  8 Virgin~                 4                 3                4                9
##  9 Maryla~                 4                 3                8                7
## 10 Massac~                 7                 8               13               13
## # ... with 41 more rows, and 7 more variables: 2015_overall_erank <int>,
## #   2016_overall_erank <int>, 2017_overall_erank <int>,
## #   2018_overall_erank <int>, 2019_overall_erank <int>,
## #   2020_overall_erank <int>, 10yr_overall_erank <int>
```

Wrangling our previous data for use in finding overall rankings

Using average of road_quality ranks and electricity price rankings to get overall infrastructure ranks

```
roadrank_summary1 <- roadrank_summary %>%
  rename(States = State)
elecprice_rank_summary1 <- elecprice_rank%>%
  rename(States = state)
elecprice_rank_summary1[35,1] <- "District of Columbia"

overall_infrastructure_ranking_data <- roadrank_summary1 %>%
          inner_join(elecprice_rank_summary1, by = "States")
```

```
infrastructure_weighted_ranks <- overall_infrastructure_ranking_data %>%
     mutate("2011_weighted_rank"=((0.5 * (`2011_ranking.x`))+(0.5*(`2011_ranking.y`)))/2) %>%
     mutate("2012_weighted_rank"=((0.5 * (`2012_ranking.x`))+(0.5*(`2012_ranking.y`)))/2) %>%
     mutate("2013_weighted_rank"=((0.5 * (`2013_ranking.x`))+(0.5*(`2013_ranking.y`)))/2) %>%
     mutate("2014_weighted_rank"=((0.5 * (`2014_ranking.x`))+(0.5*(`2014_ranking.y`)))/2) %>%
     mutate("2015_weighted_rank"=((0.5 * (`2015_ranking.x`))+(0.5*(`2015_ranking.y`)))/2) %>%
     mutate("2016_weighted_rank"=((0.5 * (`2016_ranking.x`))+(0.5*(`2016_ranking.y`)))/2) %>%
     mutate("2017_weighted_rank"=((0.5 * (`2017_ranking.x`))+(0.5*(`2017_ranking.y`)))/2) %>%
     mutate("2018_weighted_rank"=((0.5 * (`2018_ranking.x`))+(0.5*(`2018_ranking.y`)))/2) %>%
     mutate("2019_weighted_rank"=((0.5 * (`2019_ranking.x`))+(0.5*(`2019_ranking.y`)))/2) %>%
     mutate("2020_weighted_rank"=((0.5 * (`2020_ranking.x`))+(0.5*(`2020_ranking.y`)))/2) %>%


infrastructure_ranks_2011to2020 <- infrastructure_weighted_ranks %>%
  mutate("2011_overall_irank" = min_rank(`2011_weighted_rank`)) %>%
  mutate("2012_overall_irank" = min_rank(`2012_weighted_rank`)) %>%
   mutate("2013_overall_irank" = min_rank(`2013_weighted_rank`)) %>%
   mutate("2014_overall_irank" = min_rank(`2014_weighted_rank`)) %>%
   mutate("2015_overall_irank" = min_rank(`2015_weighted_rank`)) %>%
    mutate("2016_overall_irank" = min_rank(`2016_weighted_rank`)) %>%
   mutate("2017_overall_irank" = min_rank(`2017_weighted_rank`)) %>%
   mutate("2018_overall_irank" = min_rank(`2018_weighted_rank`)) %>%
   mutate("2019_overall_irank" = min_rank(`2019_weighted_rank`)) %>%
   mutate("2020_overall_irank" = min_rank(`2020_weighted_rank`)) %>%
   mutate("10yr_overall_irank" = min_rank(`10yr_weighted_rank`))


infrastruture_ranks2011to2020 <- infrastructure_ranks_2011to2020 %>%
  arrange(`10yr_overall_irank`) %>%
      select(States, c(`2011_overall_irank`:`10yr_overall_irank`))




infrastruture_ranks2011to2020
```

```
## # A tibble: 51 x 12
##    States  `2011_overall_ir~ `2012_overall_ir~ `2013_overall_i~ `2014_overall_i~
##    <chr>               <int>             <int>            <int>            <int>
##  1 Idaho                   1                 6                1                2
##  2 North ~                 2                 1                2                1
##  3 Tennes~                 4                 3                5                4
##  4 Kentuc~                 4                 5                6                3
##  5 Nebras~                 4                 2                4                4
##  6 Wyoming                 3                 3                7                8
##  7 Oregon                  7                 8                8                9
##  8 Montana                 9                 6                9                6
##  9 Georgia                11                 8               22               14
## 10 Arkans~                16                14                12                10
## # ... with 41 more rows, and 7 more variables: 2015_overall_irank <int>,
## #   2016_overall_irank <int>, 2017_overall_irank <int>,
## #   2018_overall_irank <int>, 2019_overall_irank <int>,
## #   2020_overall_irank <int>, 10yr_overall_irank <int>
```

Health, Economics, Education, Infrastructure, and Crime_rate ranking combined

```
final_ranks_graduation <- final_ranked_graduation %>%
  rename( States = States)


final_ranked_correction3 <-final_ranked_correction2 %>%
  rename(States = State)


Factor_rankings_combined <- economics_ranks2011to2020 %>%
  inner_join(health_ranks2011to2020, by ="States") %>%
inner_join(final_ranks_graduation, by = "States") %>%
 inner_join(infrastruture_ranks2011to2020, by = "States") %>%
  inner_join(final_ranked_correction3, by = "States" )
```

Calculating overall ranks for each factors combined by using weighted averages of the individual factor rankings

```
Final_rankings <- Factor_rankings_combined %>%
mutate("2011" = (0.3*(`2011_overall_erank`)+0.1*(`2011_overall_hrank`)+0.3*(`2011_edurank`)+0.2*(`2011_
mutate("2012" = (0.3*(`2012_overall_erank`)+0.1*(`2012_overall_hrank`)+0.3*(`2012_edurank`)+0.2*(`2012_
mutate("2013" = (0.3*(`2013_overall_erank`)+0.1*(`2013_overall_hrank`)+0.3*(`2013_edurank`)+0.2*(`2013_
mutate("2014" = (0.3*(`2014_overall_erank`)+0.1*(`2014_overall_hrank`)+0.3*(`2014_edurank`)+0.2*(`2014_
mutate("2015" = (0.3*(`2015_overall_erank`)+0.1*(`2015_overall_hrank`)+0.3*(`2015_edurank`)+0.2*(`2015_
mutate("2016" = (0.3*(`2016_overall_erank`)+0.1*(`2016_overall_hrank`)+0.3*(`2016_edurank`)+0.2*(`2016_
mutate("2017" = (0.3*(`2017_overall_erank`)+0.1*(`2017_overall_hrank`)+0.3*(`2017_edurank`)+0.2*(`2017_
mutate("2018" = (0.3*(`2018_overall_erank`)+0.1*(`2018_overall_hrank`)+0.3*(`2018_edurank`)+0.2*(`2018_
mutate("2019" = (0.3*(`2019_overall_erank`)+0.1*(`2019_overall_hrank`)+0.3*(`2019_edurank`)+0.2*(`2019_
mutate("2020" = (0.3*(`2020_overall_erank`)+0.2*(`2020_overall_hrank`)+0.2*(`2020_overall_irank`) +0.3*
mutate("10_yr" = (0.3*(`10yr_overall_erank`)+0.1*(`10yr_overall_hrank`)+0.3*(`10year_edurank`)+0.2*(`10


Final_rankings
```

```
## # A tibble: 51 x 66
##    States  `2011_overall_er~ `2012_overall_er~ `2013_overall_e~ `2014_overall_e~
##    <chr>               <int>             <int>            <int>            <int>
##  1 New Ha~                 1                 1                1                1
##  2 Hawaii                  7                12                2                2
##  3 Utah                   11                 3                3                3
##  4 Minnes~                 6                 7                4                3
##  5 Nebras~                 3                10               10                8
##  6 Vermont                10                 8                4                6
##  7 North ~                 2                 2                8                3
##  8 Virgin~                 4                 3                4                9
##  9 Maryla~                 4                 3                8                7
## 10 Massac~                 7                 8               13               13
## # ... with 41 more rows, and 61 more variables: 2015_overall_erank <int>,
## #   2016_overall_erank <int>, 2017_overall_erank <int>,
## #   2018_overall_erank <int>, 2019_overall_erank <int>,
## #   2020_overall_erank <int>, 10yr_overall_erank <int>,
## #   2011_overall_hrank <int>, 2012_overall_hrank <int>,
## #   2013_overall_hrank <int>, 2014_overall_hrank <int>,
## #   2015_overall_hrank <int>, 2016_overall_hrank <int>,
## #   2017_overall_hrank <int>, 2018_overall_hrank <int>,
## #   2019_overall_hrank <int>, 2020_overall_hrank <int>,
## #   10yr_overall_hrank <int>, 2011_edurank <int>, 2012_edurank <int>,
## #   2013_edurank <int>, 2014_edurank <int>, 2015_edurank <int>,
## #   2016_edurank <int>, 2017_edurank <int>, 2018_edurank <int>,
## #   2019_edurank <int>, 2020_edurank <int>, 10year_edurank <int>,
## #   2011_overall_irank <int>, 2012_overall_irank <int>,
## #   2013_overall_irank <int>, 2014_overall_irank <int>,
## #   2015_overall_irank <int>, 2016_overall_irank <int>,
## #   2017_overall_irank <int>, 2018_overall_irank <int>,
## #   2019_overall_irank <int>, 2020_overall_irank <int>,
## #   10yr_overall_irank <int>, 2011_corrank <int>, 2012_corrank <int>,
## #   2013_corrank <int>, 2014_corrank <int>, 2015_corrank <int>,
## #   2016_corrank <int>, 2017_corrank <int>, 2018_corrank <int>,
## #   2019_corrank <int>, 10yr_corrank <int>, 2011 <dbl>, 2012 <dbl>, 2013 <dbl>,
## #   2014 <dbl>, 2015 <dbl>, 2016 <dbl>, 2017 <dbl>, 2018 <dbl>, 2019 <dbl>,
## #   2020 <dbl>, 10_yr <dbl>
```

Final ranks for each year as well as the 10 year average

```
Final_ranks <- Final_rankings %>%
  arrange(`10_yr`) %>%
    mutate("2011" = min_rank(`2011`)) %>%
  mutate("2012" = min_rank(`2012`)) %>%
   mutate("2013" = min_rank(`2013`)) %>%
   mutate("2014" = min_rank(`2014`)) %>%
   mutate("2015" = min_rank(`2015`)) %>%
    mutate("2016" = min_rank(`2016`)) %>%
   mutate("2017" = min_rank(`2017`)) %>%
   mutate("2018" = min_rank(`2018`)) %>%
   mutate("2019" = min_rank(`2019`)) %>%
   mutate("2020" = min_rank(`2020`)) %>%
   mutate("10yr" = min_rank(`10_yr`))
```

```
Final <- Final_ranks %>%
  select(States, c(`2011`:`10yr`)) %>%
  select(-c("10_yr"))


 Final
```

```
## # A tibble: 51 x 12
##    States  `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
##    <chr>    <int>  <int>  <int>  <int>  <int>  <int>  <int>  <int>  <int>  <int>
##  1 North ~      1      1      1      1      1      1      1      7     19     11
##  2 Nebras~      2      3      4      2      2      2      4      4      8      7
##  3 South ~      4      5      3      3      8      5      7     28     27     19
##  4 Utah         5      4      5      8      4     11     13      7      4      9
##  5 Minnes~      6      7      6      7      5      6      8      1      5      6
##  6 Wyoming      3      2      2      4      3     13     12     40     30     23
##  7 Washin~      7      8      8      6      6      7      5     13     12     16
##  8 Iowa         9      6      7      5      9      4      3     11     13     14
##  9 Distri~     11      9     10     11     11      8      6     14     10      5
## 10 Kansas       8      9      9     10     10     12     15     16     15     13
## # ... with 41 more rows, and 1 more variable: 10yr <int>
```

Showing 10 yr rankings for each of the factors

```
States_factor_rankings <- Final_ranks %>%
  arrange(`10yr`) %>%
select(States, `10yr_overall_erank`,`10yr_overall_hrank`,
       `10yr_overall_irank`,`10year_edurank`,`10yr_corrank`,`10yr`)



States_factor_rankings
```

```
## # A tibble: 51 x 7
##    States   `10yr_overall_er~ `10yr_overall_h~ `10yr_overall_i~ `10year_edurank`
##    <chr>                <int>            <int>            <int>            <int>
##  1 North D~                 7                8                2                9
##  2 Nebraska                 5               15                5               17
##  3 South D~                13               22               11                3
##  4 Utah                     3               38               15               16
##  5 Minneso~                 3                4               25               23
##  6 Wyoming                 14               35                6               10
##  7 Washing~                18               25               22                7
##  8 Iowa                    11                1               19               24
##  9 Distric~                23                3               44                1
## 10 Kansas                  15               23               20               15
## # ... with 41 more rows, and 2 more variables: 10yr_corrank <int>, 10yr <int>
```

Finding the most Improved States

```
Rank_change <- Final %>%
  mutate(change = `2011`- `2019`)

most_improved_states <- Rank_change %>%
  arrange(desc(change))%>%
  select(States,change,c(`2011`:`2020`))
```

Loading US map library for our map chart

```
library(usmap)
```

Loading state rankings from the web (US News) to compare with our rankings

```
us_news_ranks <- read_csv("us news states ranks.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   Ranks = col_double(),
##   States = col_character()
## )
```

```
us_news_ranks
```

```
## # A tibble: 51 x 2
##    Ranks States
##    <dbl> <chr>
##  1     1 District of Columbia
##  2     2 Washington
##  3     3 Minnesota
##  4     4 Utah
##  5     5 New Hampshire
##  6     6 Idaho
##  7     7 Nebraska
##  8     8 Virginia
##  9     9 Wisconsin
## 10    10 Massachusetts
## # ... with 41 more rows
```

Adding latitude and longitude variables for each state

```
states_mapinfo <- read_csv("states_mapinfo.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   States = col_character(),
##   Latitude = col_double(),
##   Longitude = col_double()
## )
```

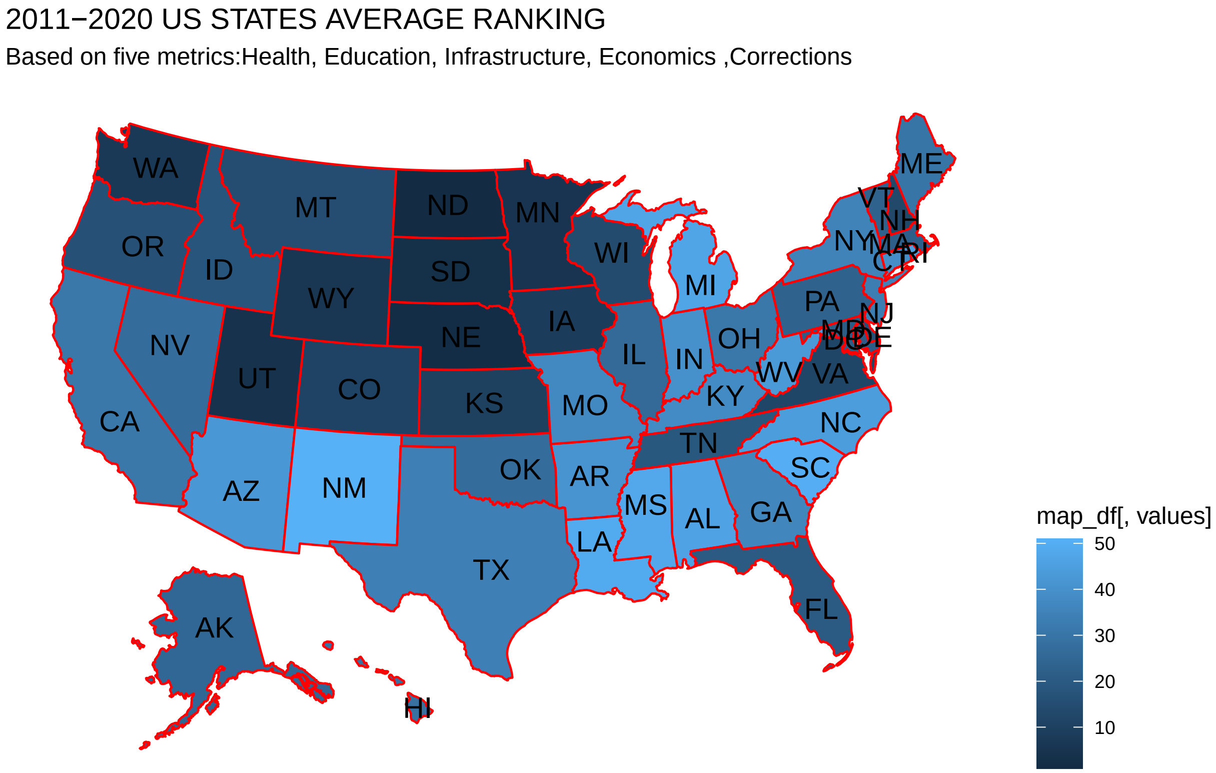
```
Final <- Final %>%
  inner_join(states_mapinfo, by = "States")
```

preparing data to pass into map plotting function

```
states_ranks<- Final%>%
#select(States, '10yr' )
rename(state = States)

us_states_ranks <- states_ranks %>%
  select(state, '10yr')





usnews_ranks<- us_news_ranks%>%
#select(States, '10yr' )
rename(state = States)
```

Plotting US Map showing our overall rankings

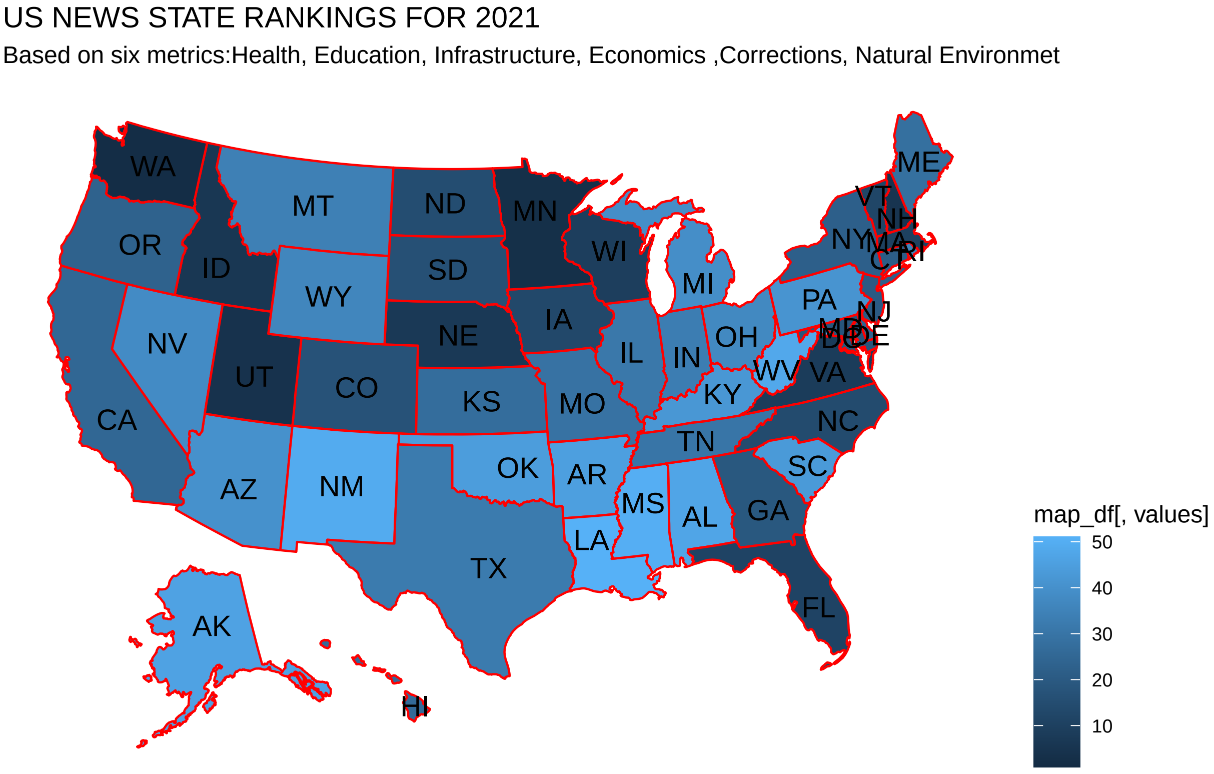
```
plot_usmap(data = us_states_ranks, values = '10yr', color = "red", labels = TRUE) +
  labs(title = "2011-2020 US STATES AVERAGE RANKING",
       subtitle ="Based on five metrics:Health, Education, Infrastructure, Economics ,Corrections",
       values ="State Rank")+
  theme(legend.position = "right")
```


2011−2020 US STATES AVERAGE RANKING

Based on five metrics:Health, Education, Infrastructure, Economics ,Corrections

Plotting map for US NEWS rankings to compare to our own

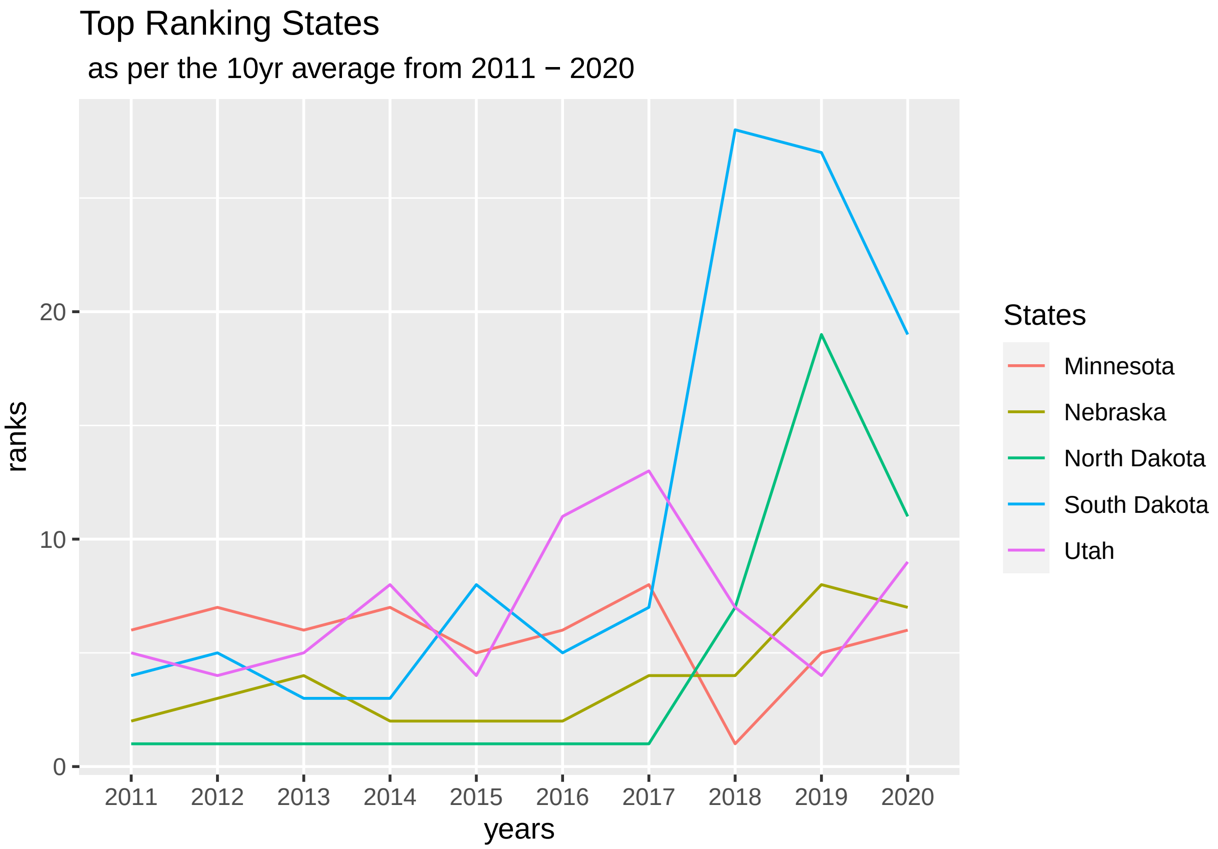
```
plot_usmap(data = usnews_ranks, values = "Ranks", color = "red", labels = TRUE) +
  labs(title = "US NEWS STATE RANKINGS FOR 2021",
       subtitle ="Based on six metrics:Health, Education, Infrastructure, Economics ,Corrections, Natur
  theme(legend.position = "right")
```


US NEWS STATE RANKINGS FOR 2021

Based on six metrics:Health, Education, Infrastructure, Economics ,Corrections, Natural Environmet

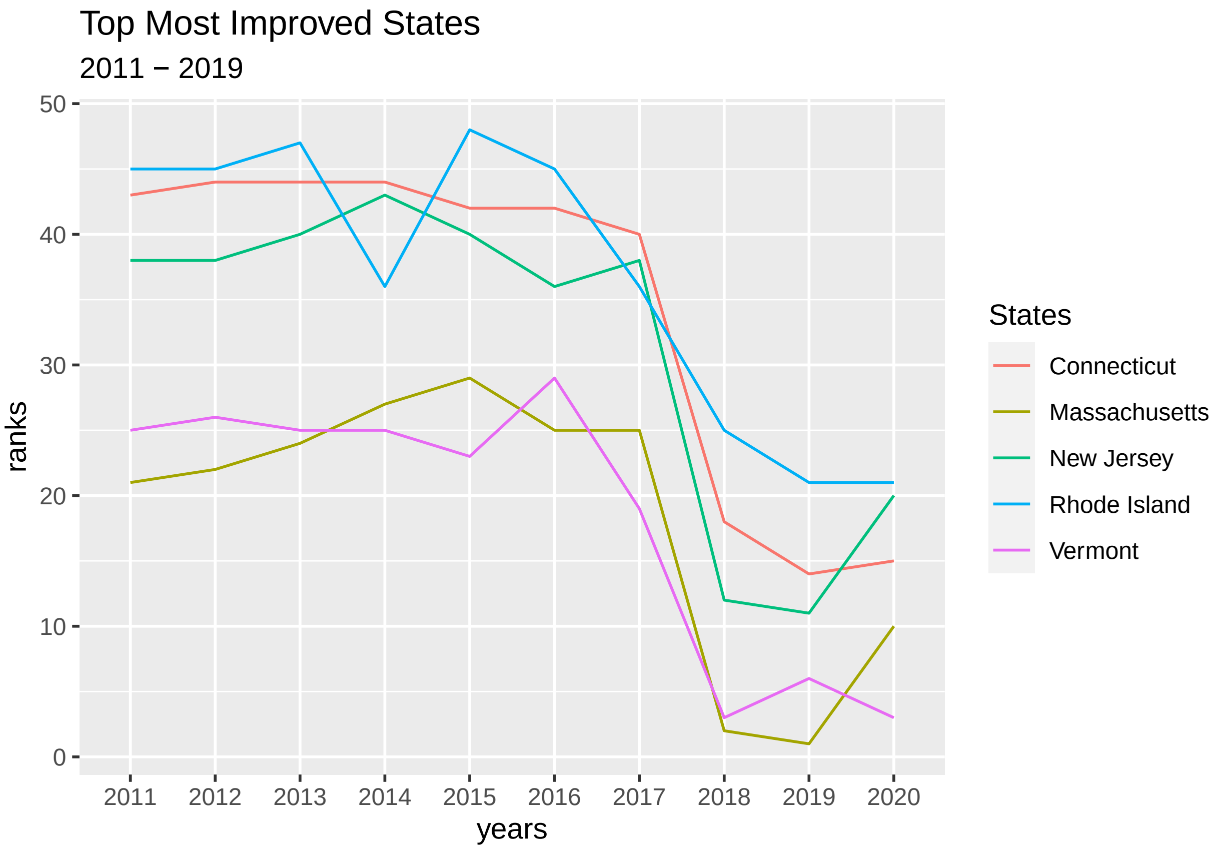
subsetting data for top states based on 10 yr average and plotting their ranks

```
top_n_states <- Final[1:5,]

top_n_states <- top_n_states %>%
 select(States, c(`2011`:`2020`))

top_states <- top_n_states %>%
  pivot_longer(!States, names_to = "years", values_to = "ranks") %>%
  ggplot() +
  geom_line(aes(x = years , y = ranks , colour = States, group = States)) +

  labs(title = "Top Ranking States",
       subtitle = " as per the 10yr average from 2011 - 2020")

top_states
```



subsetting data for most improved states and plotting their ranks

```
top5_mi_states <- most_improved_states[1:5,]

top5_mistates <- top5_mi_states%>%
 select(States, c(`2011`:`2020`))

top5_improved_states <- top5_mistates%>%
  pivot_longer(!States, names_to = "years", values_to = "ranks") %>%
  ggplot()+
  geom_line(aes(x = years , y = ranks , colour = States, group = States)) +
    labs(title = "Top Most Improved States",
       subtitle = "2011 - 2019")


top5_improved_states
```

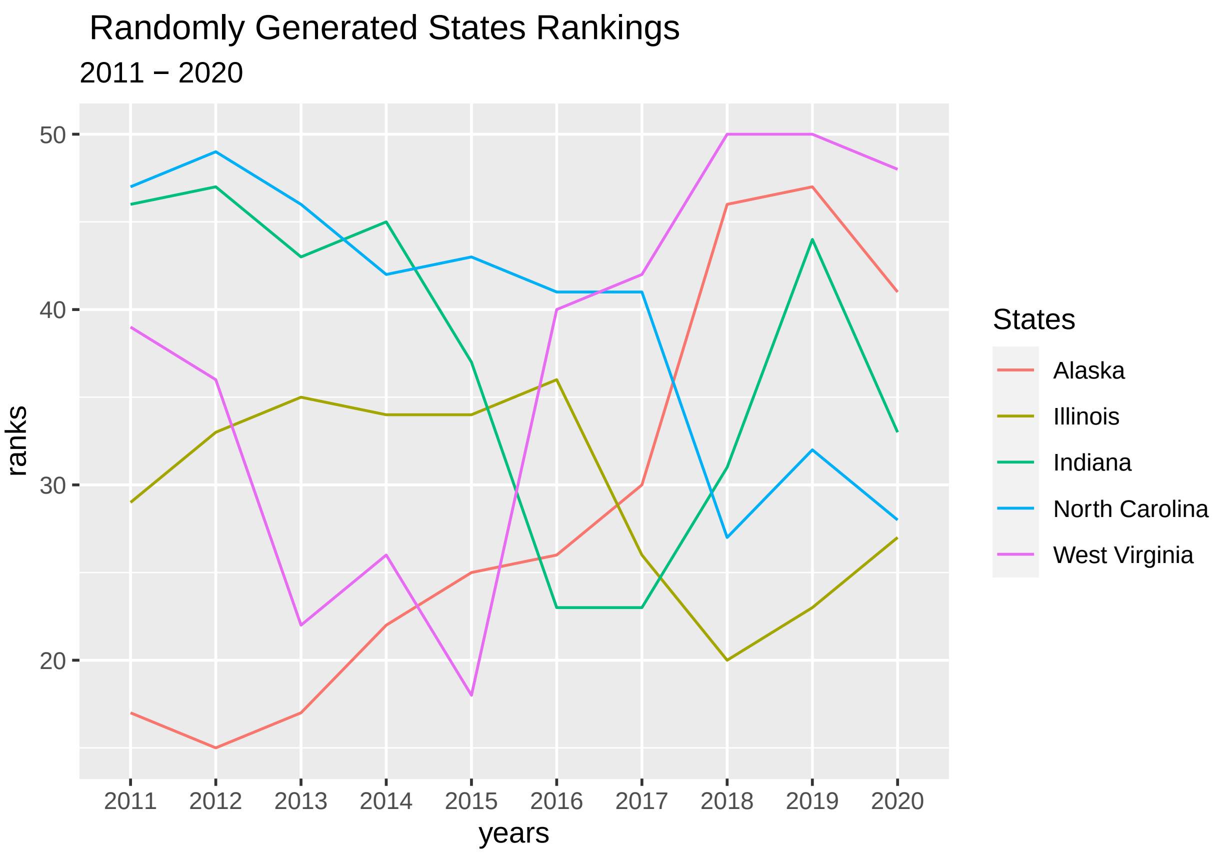


Generating random states and plotting their graphs over time

```
index = sample(1:nrow(Final), 6,replace = TRUE)
index
```

```
## [1] 40 25 43 25 26 44
```

```
Random_states <- Final[index,]

random_states <- Random_states%>%
 select(States, c(`2011`:`2020`))

random_states_ranks <- random_states%>%
  pivot_longer(!States, names_to = "years", values_to = "ranks") %>%
  ggplot()+
  geom_line(aes(x = years , y = ranks , colour = States, group = States)) +
    labs(title = " Randomly Generated States Rankings",
       subtitle = "2011 - 2020")


random_states_ranks
```



loading us news rankings

joining state factor rankings with us news best states rank for modelling and simulation

```
us_news_ranks <- read_csv("us news states ranks.csv")
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   Ranks = col_double(),
##   States = col_character()
## )
```

```
state_factor_rankings2 <- States_factor_rankings %>%
  select(-c(7))

regression_rank_data <- state_factor_rankings2 %>%
  inner_join(us_news_ranks, by ='States') %>%
select(-c(1))

regression_rank_data
```

```
## # A tibble: 51 x 6
##    `10yr_overall_erank` `10yr_overall_hran~ `10yr_overall_iran~ `10year_edurank`
##                   <int>               <int>               <int>            <int>
##  1                    7                   8                   2                9
##  2                    5                  15                   5               17
##  3                   13                  22                  11                3
##  4                    3                  38                  15               16
##  5                    3                   4                  25               23
##  6                   14                  35                   6               10
##  7                   18                  25                  22                7
##  8                   11                   1                  19               24
##  9                   23                   3                  44                1
## 10                   15                  23                  20               15
## # ... with 41 more rows, and 2 more variables: 10yr_corrank <int>, Ranks <dbl>
```

First Multiple Regression model for economics, corrections, education, health, and infrastructure

```
multiple_regression <- lm(Ranks ~. , data = regression_rank_data)
summary(multiple_regression)
```

```
##
## Call:
## lm(formula = Ranks ~ ., data = regression_rank_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -20.183  -3.570   1.122   3.680  21.228
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -3.74061    5.01104  -0.746  0.45926
## `10yr_overall_erank`  0.54438    0.11075   4.915 1.22e-05 ***
## `10yr_overall_hrank` -0.06922    0.12218  -0.567  0.57382
## `10yr_overall_irank`  0.11276    0.09936   1.135  0.26245
## `10year_edurank`      0.17650    0.09503   1.857  0.06981 .
## `10yr_corrank`        0.38831    0.11141   3.485  0.00111 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.299 on 45 degrees of freedom
## Multiple R-squared:  0.6479, Adjusted R-squared:  0.6088
## F-statistic: 16.56 on 5 and 45 DF,  p-value: 2.967e-09
```

Accordind to the multiple regression model the 5 metrics used have an adjusted R value of 0.6088 implying that the metrics used in the project account for 60% of the weight in determination of a states rank and the remaining factors only account for 40%

At a p__value of 0.1, factors that have the most influence in determining the overall rank of a state from US best news ranks are economics,corrections, and education.

Below is our multiple regression model for these three important factors: economics, corrections, and education

```
regression_rank_data2 <- regression_rank_data %>%
  select(Ranks,`10yr_overall_erank`,`10yr_corrank`,`10year_edurank`)

multiple_regression2 <- lm(Ranks ~. , data = regression_rank_data2)
summary(multiple_regression2)
```

```
##
## Call:
## lm(formula = Ranks ~ ., data = regression_rank_data2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -23.6316  -2.6826   0.1326   3.8408  18.8274
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -1.37807    3.56170  -0.387  0.70057
## `10yr_overall_erank`   0.51831    0.10187   5.088 6.24e-06 ***
## `10yr_corrank`         0.32619    0.10011   3.258  0.00209 **
## `10year_edurank`       0.21609    0.09064   2.384  0.02121 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.313 on 47 degrees of freedom
## Multiple R-squared:  0.6311, Adjusted R-squared:  0.6076
## F-statistic:  26.8 on 3 and 47 DF,  p-value: 2.967e-10
```

After our second multiple regression model, we arrived at the following multiple regression equation

We are going to simulate a model using this equation and plot the resulting model simulations below for each factor

e stands for econmics, cor for corrections, and edu for education

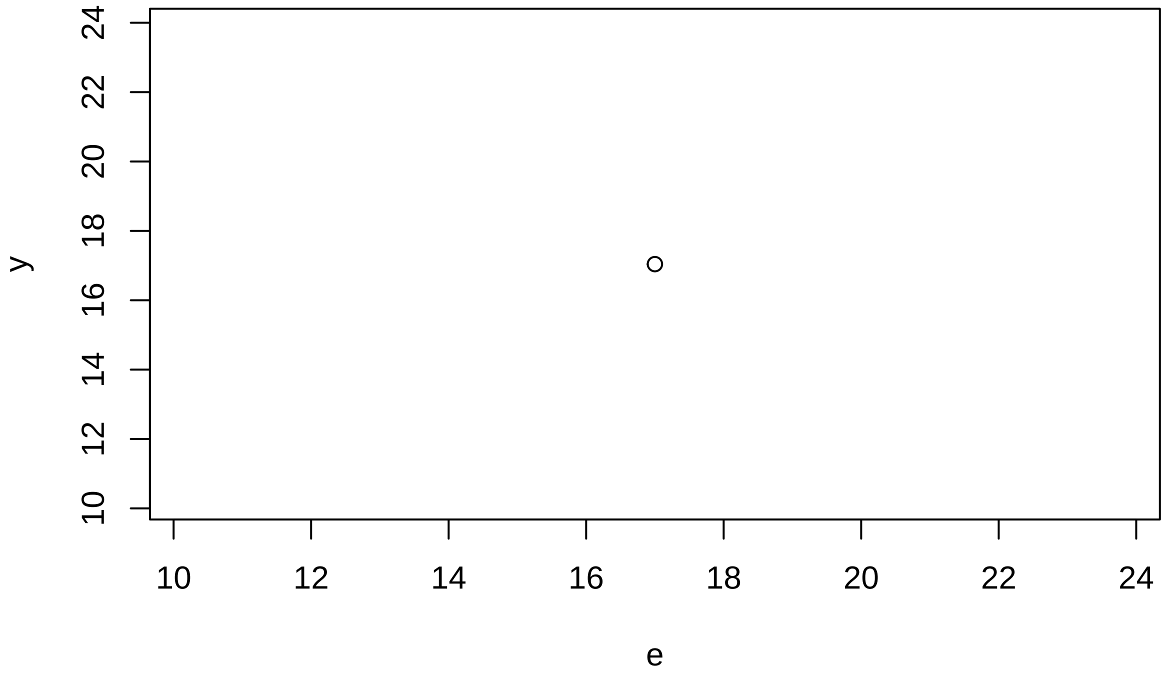
y stand for overall ranking

```
e <- sample(1:51, 1)  #Based on the 51 rankings for each state
cor <-  sample(1:51, 1)

edu <- sample(1:51, 1)
```

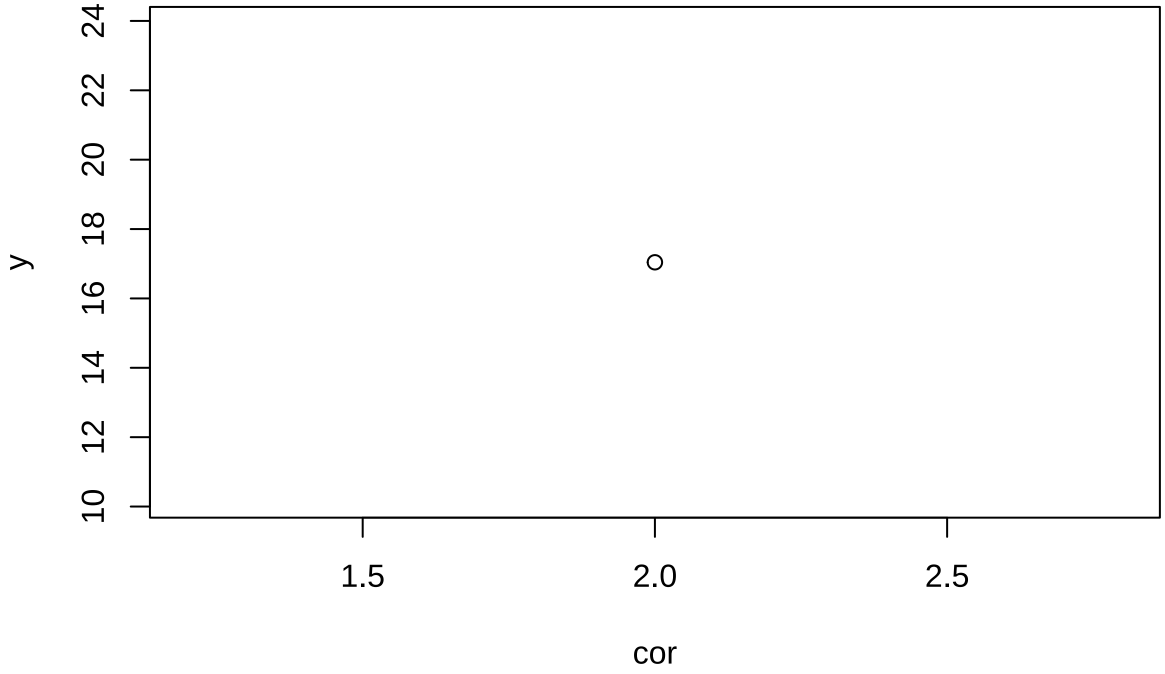
```
y <- -1.378 + 0.518*e + 0.326*cor+ 0.216*edu +3.56170
summary(y)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   17.04   17.04   17.04   17.04   17.04   17.04
```

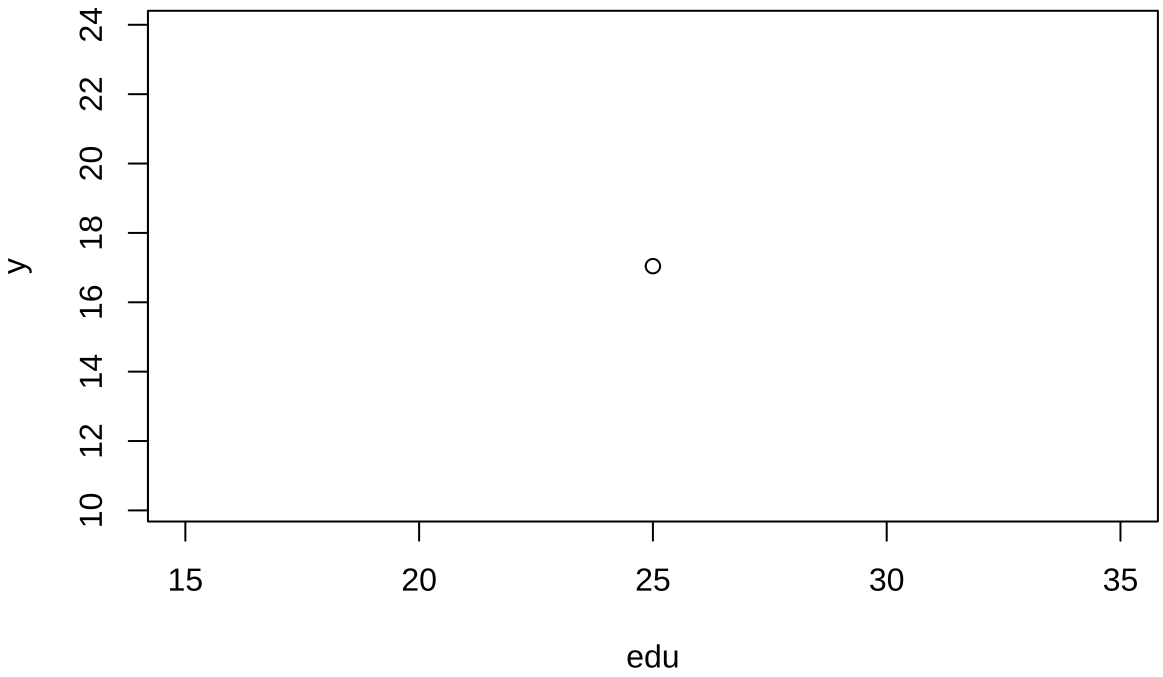
```
#plotting economics versus overall rank as per the simulated model
plot(e, y)
```



```
plot(cor, y)
```



```
plot(edu, y)
```


y
edu