Stats 15 - Homework 2

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Academic Integrity Statement

By modifying this statement, I, Haojie Liu, declare that all of the work in this assignment is my own original work. At no time did I look at the code of other students nor did I search for code solutions online. I understand that plagiarism on any single part of this assignment will result in a 0 for the entire assignment and that I will be referred to the dean of students.

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.3      v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

Part 1: Textbook, Section 4.4, Exercise 1

The subset of the `babynames` data has been recreated for you here:

```
year <- c(2003, 1999, 2010, 1989, 1989, 1928, 1981, 1981, 1920, 1941)
sex <- c("M", "F", "F", "F", "F", "M", "F", "F", "F", "M")
name <- c("Bilal","Terria","Naziyah","Shawana","Jessi","Tillman","Leslee",
          "Sherise","Marquerite","Lorraine")
n <- as.integer(c(146, 23, 45, 41, 210, 43, 83, 27, 26, 24))
prop <- c(0.0000695, 0.0000118, 0.0000230, 0.0000206, 0.000105 , 0.0000377,
          0.0000464, 0.0000151, 0.0000209, 0.0000191)
baby_subset <- tibble(year, sex, name, n, prop)
print(baby_subset)
```

```
## # A tibble: 10 x 5
##     year sex   name           n      prop
##    <dbl> <chr> <chr>      <int>     <dbl>
##  1  2003 M     Bilal        146 0.0000695
##  2  1999 F     Terria        23 0.0000118
##  3  2010 F     Naziyah       45 0.000023
##  4  1989 F     Shawana       41 0.0000206
##  5  1989 F     Jessi        210 0.000105
##  6  1928 M     Tillman       43 0.0000377
##  7  1981 F     Leslee        83 0.0000464
##  8  1981 F     Sherise       27 0.0000151
##  9  1920 F     Marquerite    26 0.0000209
## 10  1941 M     Lorraine      24 0.0000191
```

Execute the appropriate `dplyr` commands that will recreate the output you see in the textbook.

a.

```
baby_subset %>%
  select(year,sex,name, n) %>%
  filter(n %in% 41:83)
```

```
## # A tibble: 4 x 4
##    year sex   name        n
##   <dbl> <chr> <chr>   <int>
## 1  2010 F     Naziyah    45
## 2  1989 F     Shawana    41
## 3  1928 M     Tillman    43
## 4  1981 F     Leslee     83
```

b.

```
baby_subset %>%
  filter(nchar(name) == 6)
```

```
## # A tibble: 2 x 5
##    year sex   name       n      prop
##   <dbl> <chr> <chr>  <int>     <dbl>
## 1  1999 F     Terria    23 0.0000118
## 2  1981 F     Leslee    83 0.0000464
```

c.

```
baby_subset %>%
  filter(year == 1989) %>%
  mutate(total=n/prop)
```

```
## # A tibble: 2 x 6
##    year sex   name        n      prop    total
##   <dbl> <chr> <chr>   <int>     <dbl>    <dbl>
## 1  1989 F     Shawana    41 0.0000206 1990291.
## 2  1989 F     Jessi     210 0.000105  2000000
```

d.

```
baby_subset %>%
  group_by(year) %>%
  summarize(
    total = sum(n)
  ) %>%
  select(year, total) %>%
  arrange(year)
```

```
## # A tibble: 8 x 2
##    year total
##   <dbl> <int>
## 1  1920    26
## 2  1928    43
## 3  1941    24
## 4  1981   110
## 5  1989   251
## 6  1999    23
## 7  2003   146
## 8  2010    45
```

Part 2: Textbook, Section 4.4, Exercise 3

The problem with the pipeline is that there will be no column called “am” after summarize the avg_mpg by mean(mpg). Therefore, filter() should placed before summarize() to filter the data.

Part 3: Textbook, Section 4.4, Exercise 4

```
library(Lahman)
Teams %>%
  tail()
```

```
##      yearID lgID teamID franchID divID Rank   G Ghome   W   L DivWin WCWin
## 2980   2021   NL    SFN      SFG     W    1 162    81 107  55      Y     N
## 2981   2021   NL    SLN      STL     C    2 162    81  90  72      N     Y
## 2982   2021   AL    TBA      TBD     E    1 162    81 100  62      Y     N
## 2983   2021   AL    TEX      TEX     W    5 162    81  60 102      N     N
## 2984   2021   AL    TOR      TOR     E    4 162    80  91  71      N     N
## 2985   2021   NL    WAS      WSN     E    5 162    81  65  97      N     N
##      LgWin WSWin   R   AB    H X2B X3B  HR  BB   SO  SB CS HBP SF  RA  ER  ERA
## 2980     N     N 804 5462 1360 271  25 241 602 1461  66 14  64 30 594 524 3.24
## 2981     N     N 706 5351 1303 261  22 198 478 1341  89 22  86 44 672 626 3.98
## 2982     N     N 857 5507 1336 288  36 222 585 1542  88 42  72 41 651 593 3.67
## 2983     N     N 625 5405 1254 225  24 167 433 1381 106 29  58 31 815 758 4.79
## 2984     N     N 846 5476 1455 285  13 262 496 1218  81 20  51 35 663 610 3.91
## 2985     N     N 724 5385 1388 272  20 182 573 1303  56 26  84 31 820 743 4.80
##      CG SHO SV IPouts   HA HRA BBA  SOA  E  DP    FP                 name
## 2980  2  18 56   4365 1254 151 416 1425 80 122 0.986 San Francisco Giants
## 2981  3  15 50   4251 1234 152 608 1225 84 137 0.986  St. Louis Cardinals
## 2982  1  13 42   4367 1264 184 436 1478 80 130 0.986       Tampa Bay Rays
## 2983  0   3 31   4273 1402 232 513 1239 83 146 0.986        Texas Rangers
## 2984  1  14 34   4216 1257 209 473 1468 90 122 0.984    Toronto Blue Jays
## 2985  1   8 36   4183 1364 247 548 1346 96 116 0.983 Washington Nationals
##                   park attendance BPF PPF teamIDBR teamIDlahman45 teamIDretro
## 2980       Oracle Park    1679484  98  97      SFG            SFN         SFN
## 2981 Busch Stadium III    2102530  92  92      STL            SLN         SLN
## 2982   Tropicana Field     761072  92  91      TBR            TBA         TBA
## 2983  Globe Life Field    2110258  99 101      TEX            TEX         TEX
## 2984      Sahlen Field     805901 102 101      TOR            TOR         TOR
## 2985    Nationals Park    1465543  95  96      WSN            MON         WAS
```

```
Teams %>%
  mutate( X1B = H-X2B-X3B-HR) %>%
  summarize(
    BA = H/AB,
    SLG = ( X1B + 2*X2B + 3*X3B + 4*HR)/AB,
    yearID = yearID,
    teamID = teamID
  ) %>%
  ggplot(aes(
    x= yearID,
    y= SLG,
    color = teamID
    ))+geom_point(size=2)+geom_smooth(se =FALSE)
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

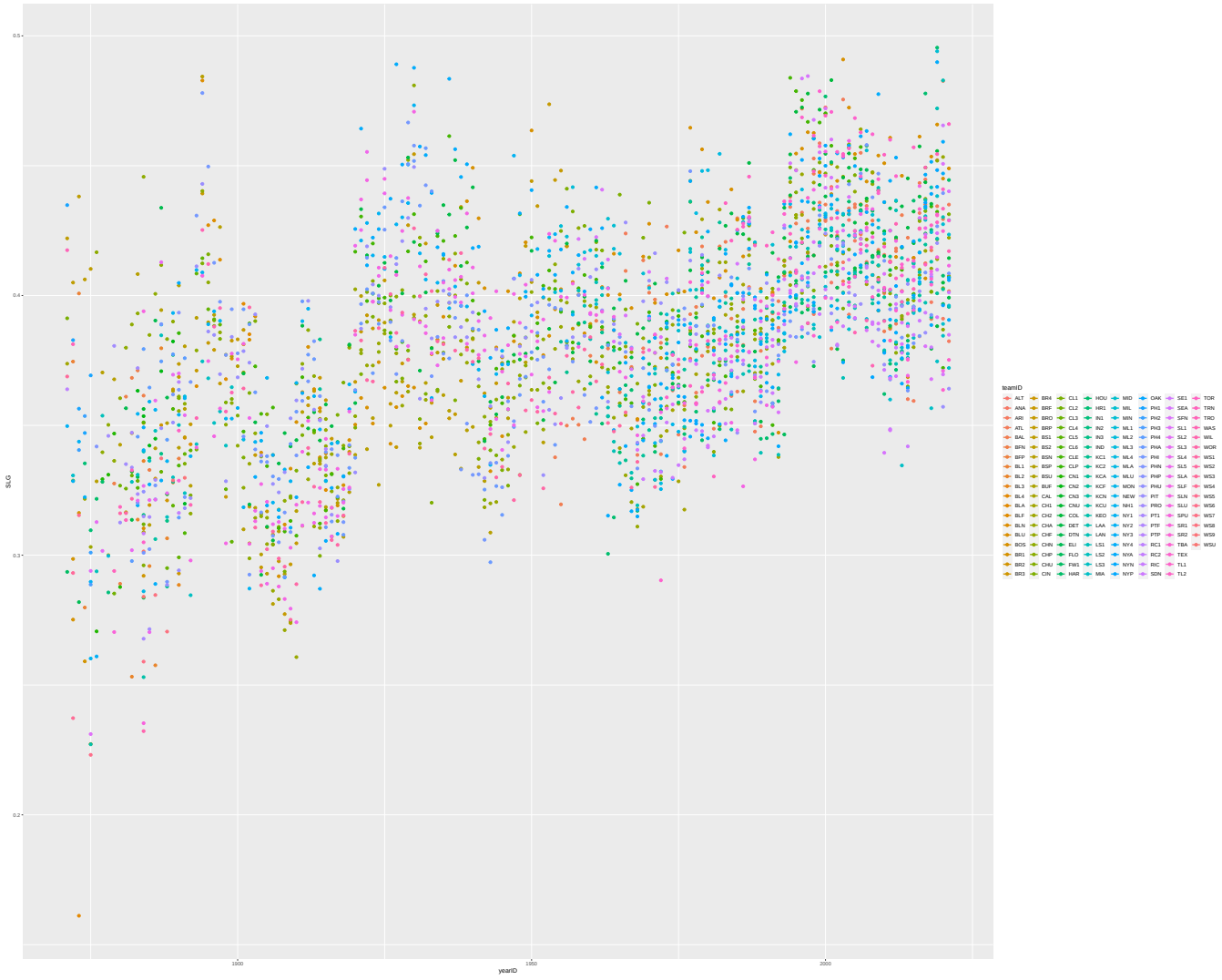
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 1872
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 1.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 0
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 1.0201

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 1890

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 1890

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.005

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 1891

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```




```
Teams %>%
  mutate( X1B = H-X2B-X3B-HR) %>%
  summarize(
    BA = H/AB,
    SLG = ( X1B + 2*X2B + 3*X3B + 4*HR)/AB,
    yearID = yearID,
    teamID = teamID
  ) %>%
  ggplot(aes(
    x= yearID,
    y= BA,
    color = teamID
    ))+geom_point(size =2)+geom_smooth(se =FALSE)
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

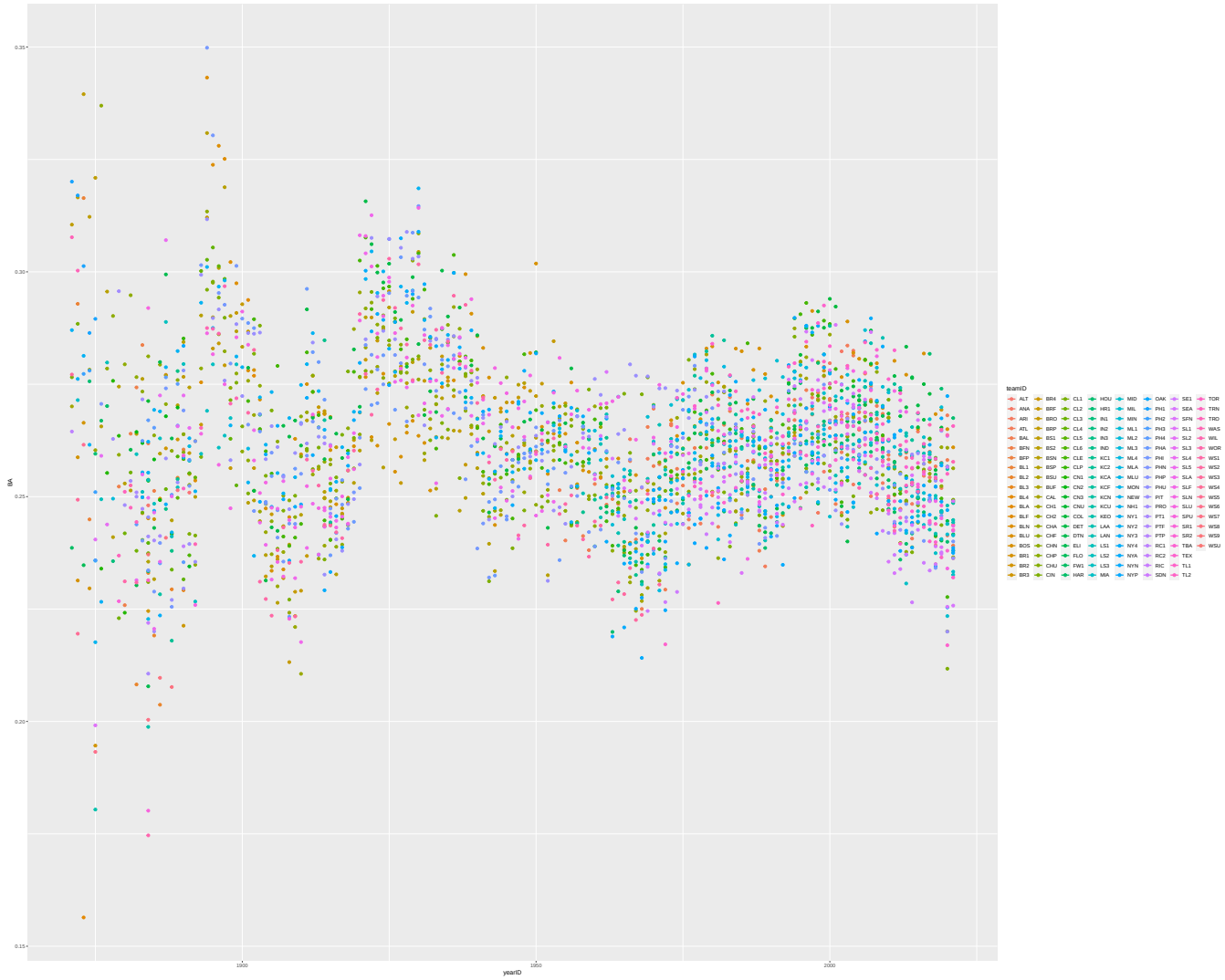
```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 1872
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 1.01
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 0
```

```
## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 1.0201

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : span too small. fewer data values than degrees of freedom.

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 1890

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : pseudoinverse used at 1890

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : neighborhood radius 0.005

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : reciprocal condition number 1

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : at 1891

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : radius 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : all data on boundary of neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : There are other near singularities as well. 2.5e-05

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning in simpleLoess(y, x, w, span, degree = degree, parametric =
## parametric, : zero-width neighborhood. make span bigger

## Warning: Computation failed in `stat_smooth()`:
## NA/NaN/Inf in foreign function call (arg 5)
```



Part 4: Textbook, Section 4.4, Exercise 7

```
Teams %>%
  mutate( X1B = H-X2B-X3B-HR) %>%
  summarize(
    teamID = teamID,
    SLG = ( X1B + 2*X2B + 3*X3B + 4*HR)/AB
  ) %>%
  arrange(desc(SLG)) %>%
  head(5)
```

```
##   teamID       SLG
## 1    HOU 0.4954570
## 2    MIN 0.4940684
## 3    BOS 0.4908996
## 4    NYA 0.4898800
## 5    NYA 0.4890593
```

```
Teams %>%
  filter(yearID >= 1969) %>%
  mutate( X1B = H-X2B-X3B-HR) %>%
  summarize(
    teamID = teamID,
    SLG = ( X1B + 2*X2B + 3*X3B + 4*HR)/AB
```

```
  ) %>%
  arrange(desc(SLG)) %>%
  head(5)
```

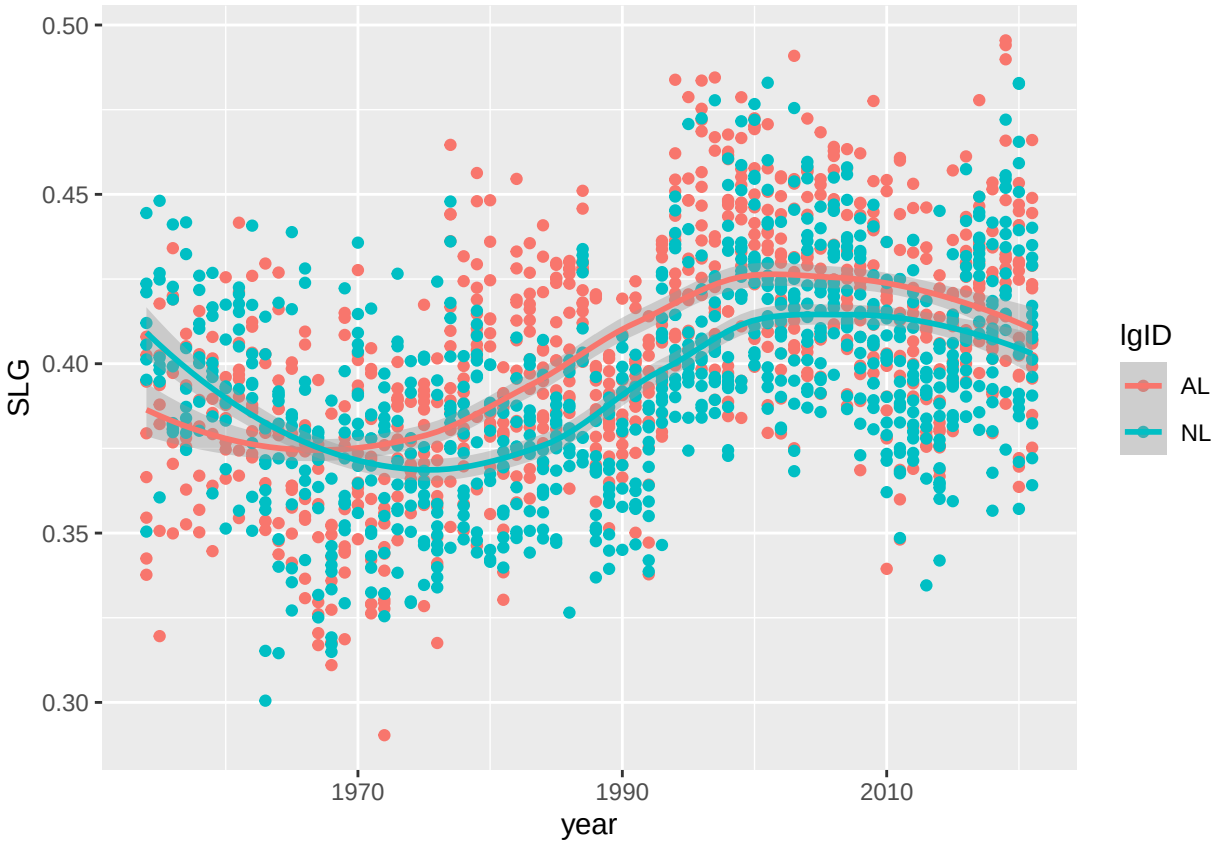
```
##   teamID       SLG
## 1    HOU 0.4954570
## 2    MIN 0.4940684
## 3    BOS 0.4908996
## 4    NYA 0.4898800
## 5    SEA 0.4845030
```

Part 5: Textbook, Section 4.4, Exercise 8

a.

```
Teams %>%
  filter (yearID >= 1954) %>%
  group_by(lgID) %>%
  mutate( X1B = H-X2B-X3B-HR) %>%
  summarise(
    teamID = teamID,
    SLG = ( X1B + 2*X2B + 3*X3B + 4*HR)/AB,
    year = yearID
  ) %>%
  ggplot(aes(
    x = year,
    y = SLG,
    color = lgID
  ))+geom_point()+
  geom_smooth()
```

```
## `summarise()` has grouped output by 'lgID'. You can override using the
## `.groups` argument.
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



AL does have a higher SLG since 1954. According to the graph, most of the time, AL line is above NL line, therefore, it will has a higher mean compare to the others.

Part 6: Textbook, Section 5.5, Exercise 1

```
statenames <- tibble(names = state.name, twoletter = state.abb)
glimpse(statenames)
```

```
## Rows: 50
## Columns: 2
## $ names     <chr> "Alabama", "Alaska", "Arizona", "Arkansas", "California", "C~
## $ twoletter <chr> "AL", "AK", "AZ", "AR", "CA", "CO", "CT", "DE", "FL", "GA", ~
```

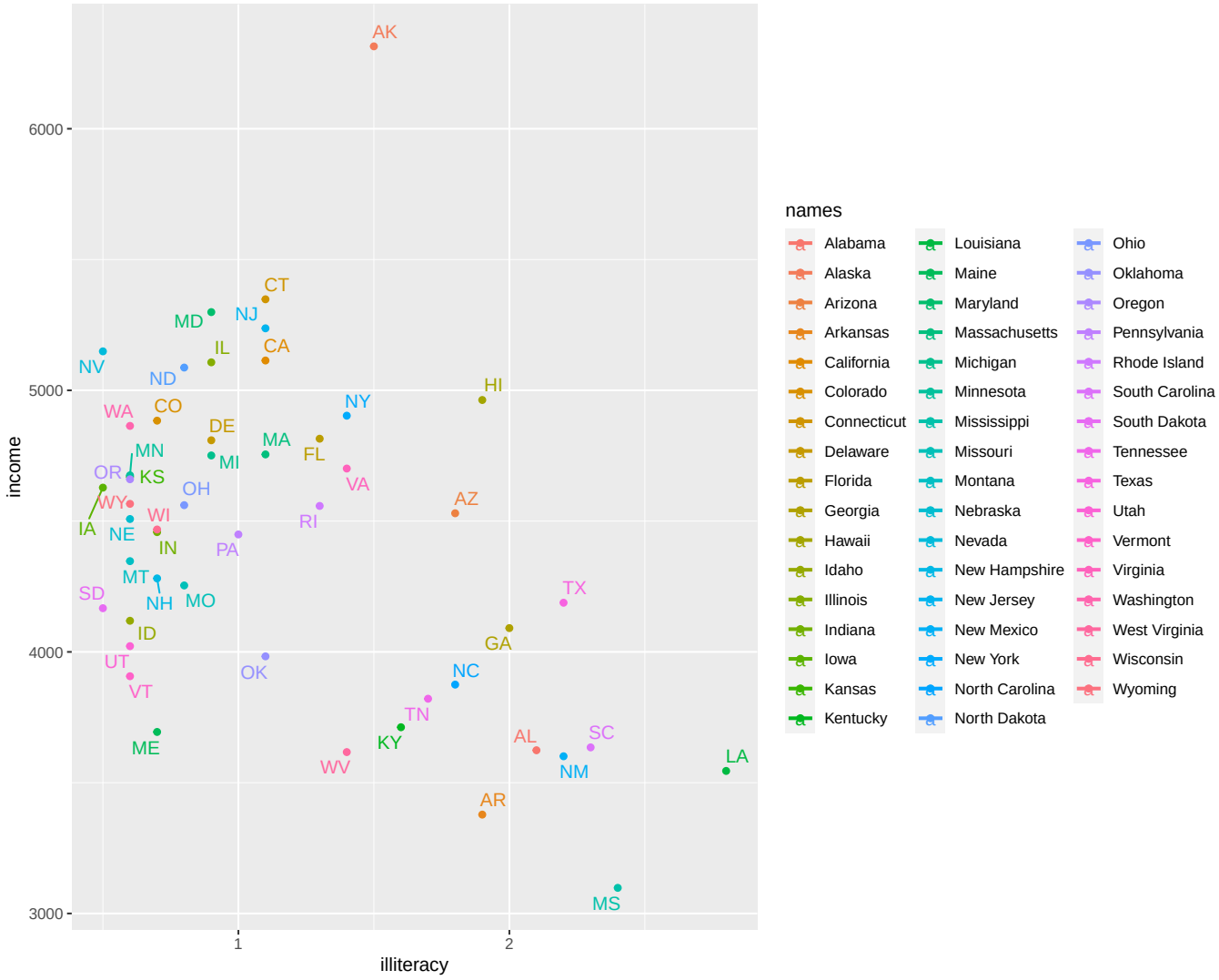
```
statedata <- tibble(
  names = state.name,
  income = state.x77[, 2],
  illiteracy = state.x77[, 3]
  )
glimpse(statedata)
```

```
## Rows: 50
## Columns: 3
## $ names      <chr> "Alabama", "Alaska", "Arizona", "Arkansas", "California", "~
## $ income     <dbl> 3624, 6315, 4530, 3378, 5114, 4884, 5348, 4809, 4815, 4091,~
## $ illiteracy <dbl> 2.1, 1.5, 1.8, 1.9, 1.1, 0.7, 1.1, 0.9, 1.3, 2.0, 1.9, 0.6,~
```

```
library(ggrepel)

statedata <- statedata %>%
  left_join(statenames, by = c("names" = "names"))

statedata %>%
```

```
  ggplot(aes(
    x = illiteracy,
    y = income,
    color = names
  ))+
  geom_point()+
  geom_text_repel(data = statedata, aes(label = twoletter))+
  geom_smooth(se = FALSE)
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



Part 7: Textbook, Section 5.5, Exercise 2

Part a.

```
Batting %>%
  group_by(playerID) %>%
  summarise(
    total_HR = sum(HR),
    total_SB = sum(SB)
  ) %>%
  right_join(People, by = c("playerID" = "playerID")) %>%
  filter(total_HR >= 300 ) %>%
  filter(total_SB >= 300) %>%
```

```
  select(playerID, nameFirst, nameLast, nameGiven, total_HR, total_SB)
```

```
## # A tibble: 8 x 6
##   playerID  nameFirst nameLast  nameGiven          total_HR total_SB
##   <chr>     <chr>     <chr>     <chr>                 <int>    <int>
## 1 beltrca01 Carlos    Beltran   Carlos Ivan             435      312
## 2 bondsba01 Barry     Bonds     Barry Lamar             762      514
## 3 bondsbo01 Bobby     Bonds     Bobby Lee               332      461
## 4 dawsoan01 Andre     Dawson    Andre Nolan             438      314
## 5 finlest01 Steve     Finley    Steven Allen            304      320
## 6 mayswi01  Willie    Mays      Willie Howard           660      338
## 7 rodrial01 Alex      Rodriguez Alexander Enmanuel      696      329
## 8 sandere02 Reggie    Sanders   Reginald Laverne        305      304
```

Part b.

```
Pitching %>%
  group_by(playerID) %>%
  summarise(
    total_W = sum(W),
    total_SO = sum(SO)
  ) %>%
  right_join(People, by = c("playerID" = "playerID")) %>%
  filter(total_W >= 300 ) %>%
  filter(total_SO >= 3000) %>%
  select(playerID, nameFirst, nameLast, nameGiven, total_W, total_SO)
```

```
## # A tibble: 10 x 6
##    playerID  nameFirst nameLast nameGiven       total_W total_SO
##    <chr>     <chr>     <chr>    <chr>             <int>    <int>
##  1 carltst01 Steve     Carlton  Steven Norman       329     4136
##  2 clemero02 Roger     Clemens  William Roger       354     4672
##  3 johnsra05 Randy     Johnson  Randall David       303     4875
##  4 johnswa01 Walter    Johnson  Walter Perry        417     3509
##  5 maddugr01 Greg      Maddux   Gregory Alan        355     3371
##  6 niekrph01 Phil      Niekro   Philip Henry        318     3342
##  7 perryga01 Gaylord   Perry    Gaylord Jackson     314     3534
##  8 ryanno01  Nolan     Ryan     Lynn Nolan          324     5714
##  9 seaveto01 Tom       Seaver   George Thomas       311     3640
## 10 suttodo01 Don       Sutton   Donald Howard       324     3574
```

Part c.

```
Batting %>%
  group_by(playerID, yearID) %>%
  summarize(
    TotalHR = sum(HR),
    BA = sum(H)/sum(AB
    )) %>%
  right_join(People, by = c("playerID" = "playerID")) %>%
  filter(TotalHR >= 50) %>%
  select( yearID, nameFirst, nameLast, nameGiven, TotalHR, BA) %>%
  arrange(BA)
```

```
## `summarise()` has grouped output by 'playerID'. You can override using the
## `.groups` argument.
## Adding missing grouping variables: `playerID`
```

```
## # A tibble: 46 x 7
## # Groups:   playerID [30]
##    playerID  yearID nameFirst nameLast nameGiven              TotalHR    BA
##    <chr>      <int> <chr>     <chr>    <chr>                    <int> <dbl>
```

```
##  1 alonspe01   2019 Pete      Alonso   Peter Morgan               53 0.260
##  2 bautijo02   2010 Jose      Bautista Jose Antonio               54 0.260
##  3 jonesan01   2005 Andruw    Jones    Andruw Rudolf              51 0.263
##  4 marisro01   1961 Roger     Maris    Roger Eugene               61 0.269
##  5 vaughgr01   1998 Greg      Vaughn   Gregory Lamont             50 0.272
##  6 mcgwima01   1997 Mark      McGwire  Mark David                 58 0.274
##  7 fieldce01   1990 Cecil     Fielder  Cecil Grant                51 0.277
##  8 mcgwima01   1999 Mark      McGwire  Mark David                 65 0.278
##  9 stantmi03   2017 Giancarlo Stanton  Giancarlo Cruz-Michael     59 0.281
## 10 judgeaa01   2017 Aaron     Judge    Aaron James                52 0.284
## # ... with 36 more rows
```

Pete Alonso in 2019 has the lowest batting average