MDAIR Presentation-Data Manipulation and Visualization in R

Laura Walker, Institutional Research Data Analyst, University System of Maryland—April 27, 2018

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Download R Studio

Opening Packages & Setting the Working Directory

```
# Opening Packages
library(ggplot2) # visualizations
library(knitr) # R Markdown files
library(scales) # Stacked Percent Chart
library(readxl) # Uploading Data
library(stringr) # Legend title wrapping
library(tidyr) # rearranging data for Stacked 100% Chart
# Setting the Working Directory
# 1 Open Windows Explorer
# 2 Navigate to C Drive
# 3 Select "Users"
# 4 Select Desktop
# 5 Copy the Address **BE SURE TO REPLACE THE "\" WITH "/"
setwd("C:/Users/alwalker/Desktop")
## REPLACE "alwalker" WITH YOUR MACHINE'S USERNAME
```

Uploading A Dataframe and a list

```
IPEDS <- read_excel("Hands-on Workshop 1-Laura Walker-Data Manipulation and Visualization
 in R-IPEDS Source Document.xlsx")
manual_colors <- c("#101820","#EAAA00","#AF272F")
```

Head of a Data Frame

```
head(IPEDS)
```

```
## # A tibble: 6 x 21
##    UnitID Inst_Name       Inst_Sector    Count_Doctor_Deg Count_Masters_D~
##     <dbl> <chr>           <chr>                     <dbl>            <dbl>
## 1 161688. Allegany Colle~ Public, 2-year              NA               NA
## 2 161767. Anne Arundel C~ Public, 2-year              NA               NA
## 3 161864. Baltimore City~ Public, 2-year              NA               NA
## 4 162007. Bowie State Un~ Public, 4-yea~              10.             337.
## 5 405872. Carroll Commun~ Public, 2-year              NA               NA
## 6 162104. Cecil College   Public, 2-year              NA               NA
## # ... with 16 more variables: Count_Bachelors_Deg <dbl>,
## #   Count_Assoc_Deg <dbl>, Count_PostBac_PostMasters_Deg <dbl>,
## #   Count_Cert <dbl>, Count_Cert_Less_Year <dbl>,
## #   Grand_Total_All_Students <dbl>, Grand_Total_Female <dbl>,
## #   Grand_Total_Amer_Ind_AK_Native <dbl>, Grand_Total_Asian <dbl>,
## #   Grand_Total_Black_AA <dbl>, Grand_Total_Hispanic <dbl>,
## #   Grand_Total_Native_Hawaiian_PI <dbl>, Grand_Total_White <dbl>,
## #   Grand_Total_Two_More <dbl>, Grand_Total_Race_Unknown <dbl>,
## #   Grand_Total_Nonresident_Alien <dbl>
```

Viewing the nth Row of Data

```
# Someone asked how one would view a specific row. Below is the code to see the "tenth" r
ow
IPEDS[10,]
```

```
## # A tibble: 1 x 21
##    UnitID Inst_Name         Inst_Sector  Count_Doctor_Deg Count_Masters_D~
##     <dbl> <chr>             <chr>                   <dbl>            <dbl>
## 1 162557. Frederick Commun~ Public, 2-y~               NA               NA
## # ... with 16 more variables: Count_Bachelors_Deg <dbl>,
## #   Count_Assoc_Deg <dbl>, Count_PostBac_PostMasters_Deg <dbl>,
## #   Count_Cert <dbl>, Count_Cert_Less_Year <dbl>,
## #   Grand_Total_All_Students <dbl>, Grand_Total_Female <dbl>,
## #   Grand_Total_Amer_Ind_AK_Native <dbl>, Grand_Total_Asian <dbl>,
## #   Grand_Total_Black_AA <dbl>, Grand_Total_Hispanic <dbl>,
## #   Grand_Total_Native_Hawaiian_PI <dbl>, Grand_Total_White <dbl>,
## #   Grand_Total_Two_More <dbl>, Grand_Total_Race_Unknown <dbl>,
## #   Grand_Total_Nonresident_Alien <dbl>
```

First Three Rows of a Dataframe

```
head(IPEDS, 3)
```

```
## # A tibble: 3 x 21
##    UnitID Inst_Name         Inst_Sector  Count_Doctor_Deg Count_Masters_D~
##     <dbl> <chr>             <chr>                   <dbl>            <dbl>
## 1 161688. Allegany College~ Public, 2-y~               NA               NA
## 2 161767. Anne Arundel Com~ Public, 2-y~               NA               NA
## 3 161864. Baltimore City C~ Public, 2-y~               NA               NA
## # ... with 16 more variables: Count_Bachelors_Deg <dbl>,
## #   Count_Assoc_Deg <dbl>, Count_PostBac_PostMasters_Deg <dbl>,
## #   Count_Cert <dbl>, Count_Cert_Less_Year <dbl>,
## #   Grand_Total_All_Students <dbl>, Grand_Total_Female <dbl>,
## #   Grand_Total_Amer_Ind_AK_Native <dbl>, Grand_Total_Asian <dbl>,
## #   Grand_Total_Black_AA <dbl>, Grand_Total_Hispanic <dbl>,
## #   Grand_Total_Native_Hawaiian_PI <dbl>, Grand_Total_White <dbl>,
## #   Grand_Total_Two_More <dbl>, Grand_Total_Race_Unknown <dbl>,
## #   Grand_Total_Nonresident_Alien <dbl>
```

Last Five Rows of a Dataframe

```
tail(IPEDS, 5)
```

```
## # A tibble: 5 x 21
##    UnitID Inst_Name      Inst_Sector     Count_Doctor_Deg Count_Masters_D~
##     <dbl> <chr>          <chr>                      <dbl>            <dbl>
## 1 163286. University of~ Public, 4-year~             628.            2795.
## 2 163204. University of~ Public, 4-year~              46.            3667.
## 3 162210. Washington Ad~ Private not-fo~               0.              86.
## 4 164216. Washington Co~ Private not-fo~               0.               3.
## 5 164313. Wor-Wic Commu~ Public, 2-year               NA               NA
## # ... with 16 more variables: Count_Bachelors_Deg <dbl>,
## #   Count_Assoc_Deg <dbl>, Count_PostBac_PostMasters_Deg <dbl>,
## #   Count_Cert <dbl>, Count_Cert_Less_Year <dbl>,
## #   Grand_Total_All_Students <dbl>, Grand_Total_Female <dbl>,
## #   Grand_Total_Amer_Ind_AK_Native <dbl>, Grand_Total_Asian <dbl>,
## #   Grand_Total_Black_AA <dbl>, Grand_Total_Hispanic <dbl>,
## #   Grand_Total_Native_Hawaiian_PI <dbl>, Grand_Total_White <dbl>,
## #   Grand_Total_Two_More <dbl>, Grand_Total_Race_Unknown <dbl>,
## #   Grand_Total_Nonresident_Alien <dbl>
```

Summary Function

```
summary(IPEDS)
```

```
##      UnitID        Inst_Name         Inst_Sector        Count_Doctor_Deg
##  Min.   :161688   Length:40          Length:40          Min.   :  0.00
##  1st Qu.:162489   Class :character   Class :character   1st Qu.:  0.00
##  Median :163125   Mode  :character   Mode  :character   Median :  5.50
##  Mean   :175867                                         Mean   :115.88
##  3rd Qu.:163706                                         3rd Qu.: 73.75
##  Max.   :434672                                         Max.   :796.00
##                                                         NA's   :16
##  Count_Masters_Deg Count_Bachelors_Deg Count_Assoc_Deg
##  Min.   :   3.0    Min.   :  86.0      Min.   :   0.0
##  1st Qu.: 122.8    1st Qu.: 365.5      1st Qu.:   0.0
##  Median : 267.0    Median : 647.0      Median :   0.0
##  Mean   : 746.8    Mean   :1343.0      Mean   : 402.6
##  3rd Qu.: 665.2    3rd Qu.:1141.5      3rd Qu.: 611.5
##  Max.   :4953.0    Max.   :6748.0      Max.   :2519.0
##  NA's   :16        NA's   :16
##  Count_PostBac_PostMasters_Deg   Count_Cert     Count_Cert_Less_Year
##  Min.   :  0                   Min.   :  0.00   Min.   :  0.00
##  1st Qu.:  0                   1st Qu.:  0.00   1st Qu.:  0.00
##  Median : 18                   Median :  0.00   Median :  0.00
##  Mean   : 95                   Mean   : 58.95   Mean   : 49.38
##  3rd Qu.: 78                   3rd Qu.: 64.75   3rd Qu.: 54.75
##  Max.   :743                   Max.   :684.00   Max.   :479.00
##  NA's   :16
##  Grand_Total_All_Students Grand_Total_Female
##  Min.   :  451            Min.   :  197
##  1st Qu.: 2607            1st Qu.: 1838
##  Median : 5078            Median : 3112
##  Mean   : 8800            Mean   : 4914
##  3rd Qu.: 8911            3rd Qu.: 5173
##  Max.   :50248            Max.   :24177
##
##  Grand_Total_Amer_Ind_AK_Native Grand_Total_Asian Grand_Total_Black_AA
##  Min.   :  1.00                 Min.   :   2.0    Min.   :   11
##  1st Qu.:  7.75                 1st Qu.:  57.0    1st Qu.:  377
##  Median : 12.50                 Median : 107.0    Median : 1088
##  Mean   : 28.65                 Mean   : 604.5    Mean   : 2337
```

```
##  3rd Qu.: 26.50                3rd Qu.: 538.5    3rd Qu.: 2816
##  Max.   :234.00                Max.   :5156.0    Max.   :14924
##
##  Grand_Total_Hispanic Grand_Total_Native_Hawaiian_PI Grand_Total_White
##  Min.   :  12.0       Min.   :  0.00                 Min.   :   46
##  1st Qu.: 128.2       1st Qu.:  2.00                 1st Qu.: 1092
##  Median : 219.0       Median :  5.50                 Median : 2414
##  Mean   : 701.5       Mean   : 20.75                 Mean   : 3992
##  3rd Qu.: 691.5       3rd Qu.: 16.75                 3rd Qu.: 4658
##  Max.   :5732.0       Max.   :356.00                 Max.   :19921
##
##  Grand_Total_Two_More Grand_Total_Race_Unknown
##  Min.   :   0.00      Min.   :   1.0
##  1st Qu.:  63.25      1st Qu.:  54.0
##  Median : 172.00      Median :  94.0
##  Mean   : 296.75      Mean   : 347.7
##  3rd Qu.: 441.25      3rd Qu.: 244.5
##  Max.   :1873.00      Max.   :4617.0
##
##  Grand_Total_Nonresident_Alien
##  Min.   :   7.0
##  1st Qu.:  34.0
##  Median : 151.0
##  Mean   : 470.9
##  3rd Qu.: 331.0
##  Max.   :4531.0
##
```

The Structure of our Dataframe

```
str(IPEDS)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':    40 obs. of  21 variables:
##  $ UnitID                        : num  161688 161767 161864 162007 405872 ...
##  $ Inst_Name                     : chr  "Allegany College of Maryland" "Anne Arundel C
ommunity College" "Baltimore City Community College" "Bowie State University" ...
##  $ Inst_Sector                   : chr  "Public, 2-year" "Public, 2-year" "Public, 2-y
ear" "Public, 4-year or above" ...
##  $ Count_Doctor_Deg              : num  NA NA NA 10 NA NA NA NA 0 NA ...
##  $ Count_Masters_Deg             : num  NA NA NA 337 NA NA NA NA 77 NA ...
##  $ Count_Bachelors_Deg           : num  NA NA NA 832 NA NA NA NA 464 NA ...
##  $ Count_Assoc_Deg               : num  438 1717 423 0 611 ...
##  $ Count_PostBac_PostMasters_Deg : num  NA NA NA 62 NA NA NA NA 0 NA ...
##  $ Count_Cert                    : num  91 218 37 0 20 5 14 684 0 70 ...
##  $ Count_Cert_Less_Year          : num  74 408 69 0 9 60 53 100 0 116 ...
##  $ Grand_Total_All_Students      : num  3091 14689 4726 5430 3542 ...
##  $ Grand_Total_Female            : num  2010 8721 3222 3414 2159 ...
##  $ Grand_Total_Amer_Ind_AK_Native: num  6 60 7 5 9 11 26 35 1 23 ...
##  $ Grand_Total_Asian             : num  8 558 123 75 57 35 27 243 12 286 ...
##  $ Grand_Total_Black_AA          : num  353 2472 3634 4432 145 ...
##  $ Grand_Total_Hispanic          : num  45 972 134 155 139 129 92 489 62 662 ...
##  $ Grand_Total_Native_Hawaiian_PI: num  3 42 6 8 1 0 3 32 2 7 ...
##  $ Grand_Total_White             : num  2557 8821 353 199 3039 ...
##  $ Grand_Total_Two_More          : num  58 541 86 184 79 94 45 448 52 244 ...
##  $ Grand_Total_Race_Unknown      : num  27 1072 92 110 66 ...
##  $ Grand_Total_Nonresident_Alien : num  34 151 291 262 7 14 20 34 370 36 ...
```

What Do We Do With NAs?

```
# Structure of calling specific columns in R: Data_frame_Name$Variable_Name

# Changing NAs to 0s for a specific column

IPEDS$Count_Doctor_Deg[is.na(IPEDS$Count_Doctor_Deg)] <- 0

# Changing NAs to 0s for the entire dataframe

IPEDS[is.na(IPEDS)] <- 0
```

Adding Fields

```
IPEDS$Grand_Total_Male <- IPEDS$Grand_Total_All_Students - IPEDS$Grand_Total_Female

colnames(IPEDS)
```

```
##  [1] "UnitID"                          "Inst_Name"
##  [3] "Inst_Sector"                     "Count_Doctor_Deg"
##  [5] "Count_Masters_Deg"               "Count_Bachelors_Deg"
##  [7] "Count_Assoc_Deg"                 "Count_PostBac_PostMasters_Deg"
##  [9] "Count_Cert"                      "Count_Cert_Less_Year"
## [11] "Grand_Total_All_Students"        "Grand_Total_Female"
## [13] "Grand_Total_Amer_Ind_AK_Native" "Grand_Total_Asian"
## [15] "Grand_Total_Black_AA"            "Grand_Total_Hispanic"
## [17] "Grand_Total_Native_Hawaiian_PI" "Grand_Total_White"
## [19] "Grand_Total_Two_More"            "Grand_Total_Race_Unknown"
## [21] "Grand_Total_Nonresident_Alien"   "Grand_Total_Male"
```

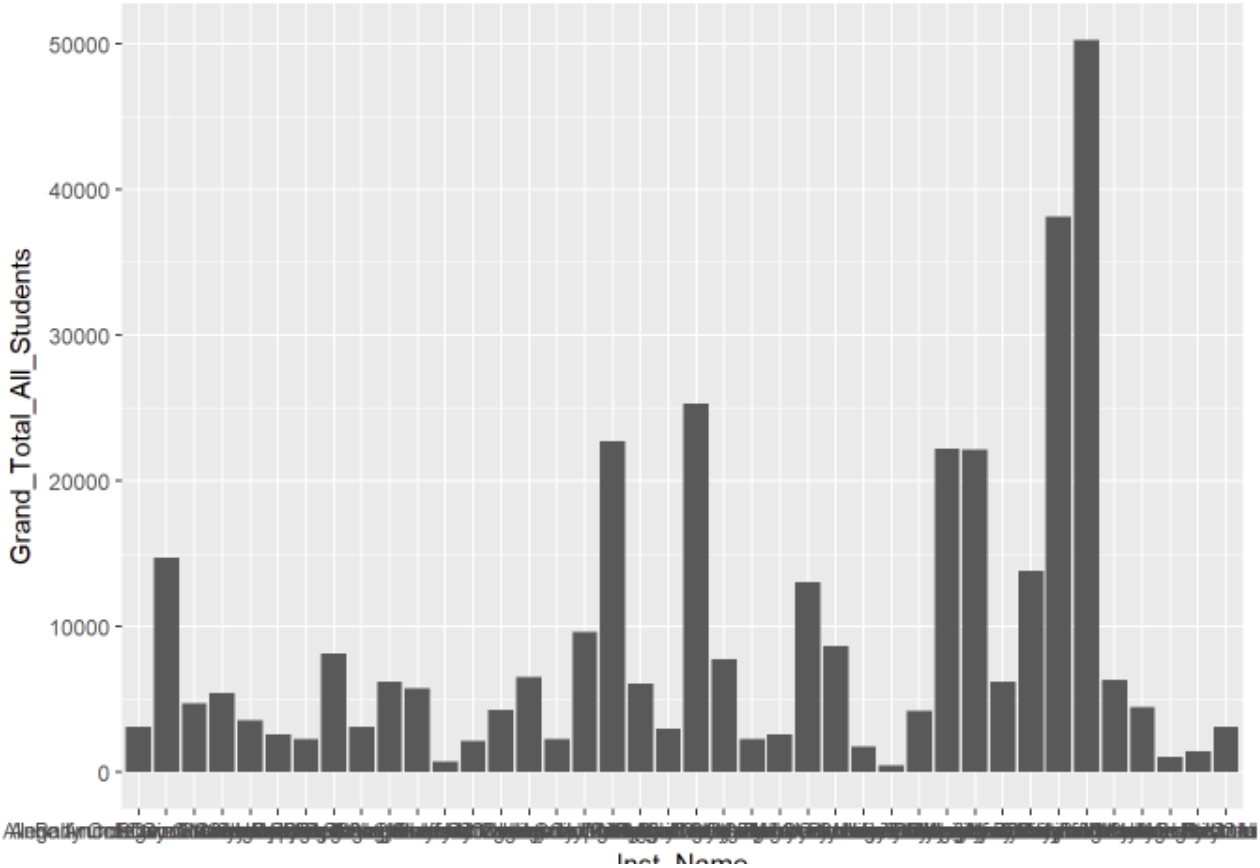
Rearranging Fields By Field Names

```
#Moving the new variable created, Grand_Total_Male in between "Grand_Total_All_Students"
& "Grand_Total_Female"

IPEDS <- IPEDS[c("UnitID", "Inst_Name", "Inst_Sector", "Count_Doctor_Deg", "Count_Masters
_Deg", "Count_Bachelors_Deg", "Count_Assoc_Deg", "Count_PostBac_PostMasters_Deg", "Count_
Cert", "Count_Cert_Less_Year", "Grand_Total_All_Students", "Grand_Total_Male", "Grand_Tot
al_Female", "Grand_Total_Amer_Ind_AK_Native", "Grand_Total_Asian", "Grand_Total_Black_AA"
, "Grand_Total_Hispanic", "Grand_Total_Native_Hawaiian_PI", "Grand_Total_White", "Grand_T
otal_Two_More", "Grand_Total_Race_Unknown", "Grand_Total_Nonresident_Alien")]
```

Visualizations

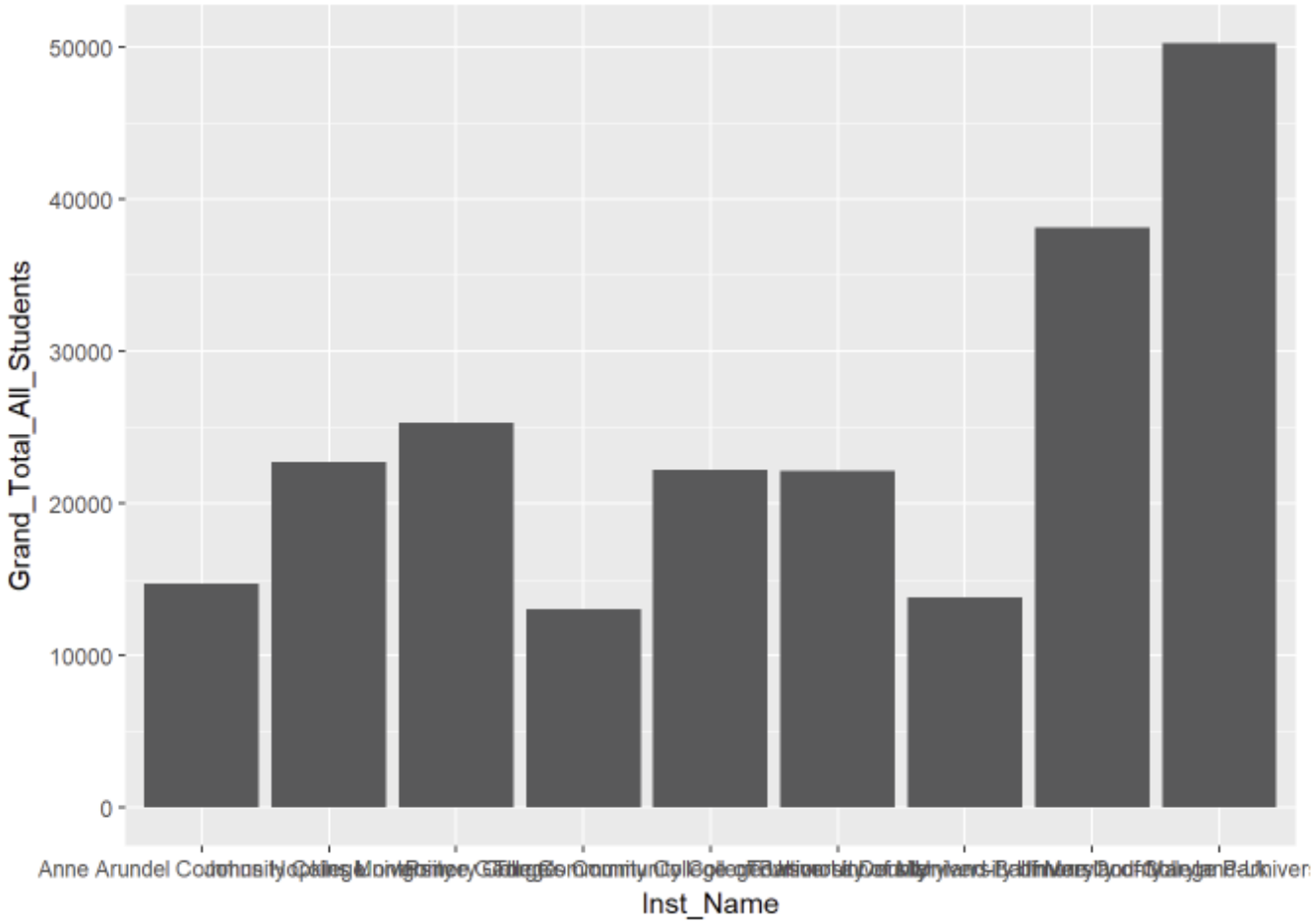
Comparison–Column Chart

```
vis_column_chart <-ggplot(IPEDS, aes(Inst_Name, Grand_Total_All_Students)) + geom_bar(sta
t = "identity")

vis_column_chart
```



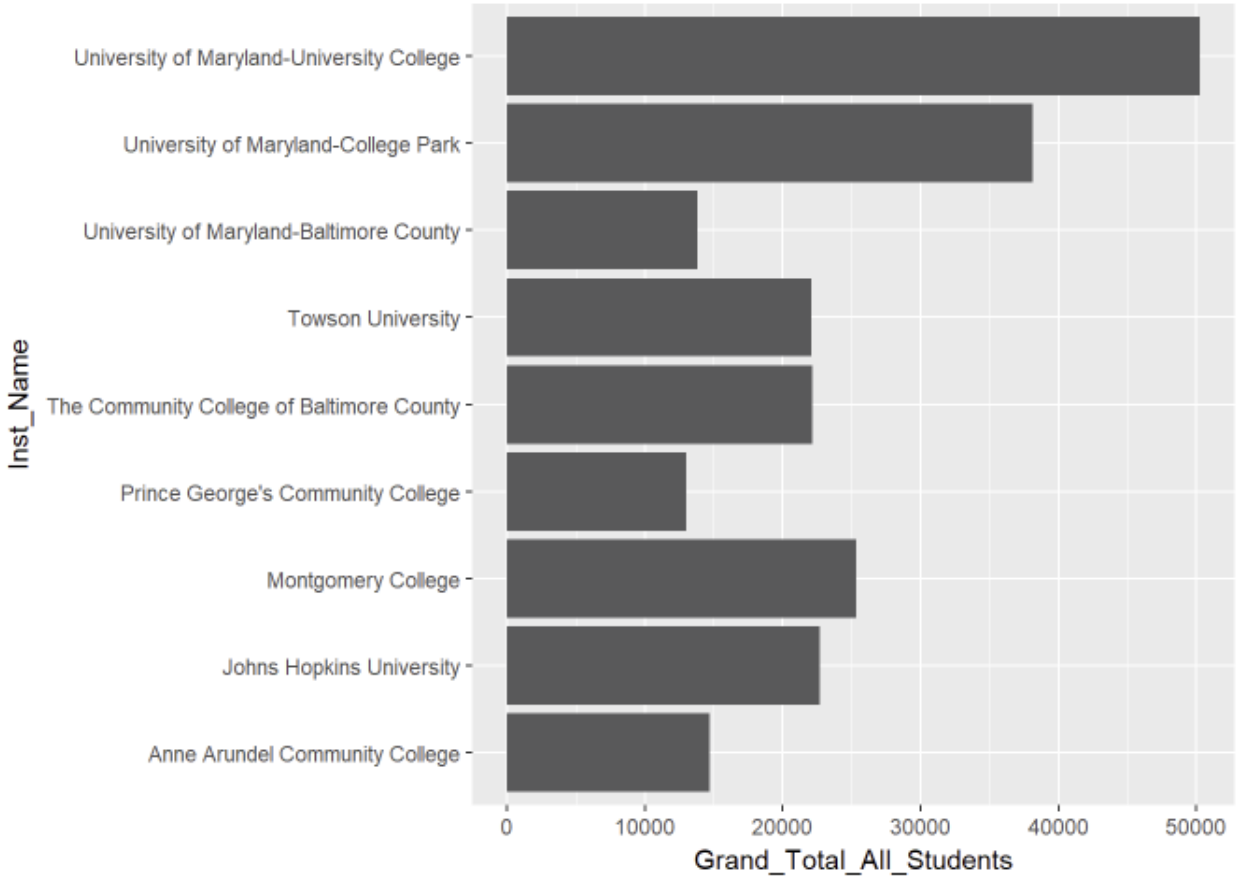
Tweaking the Column Chart Part 1

```
IPEDS_large_pops <- subset(IPEDS, Grand_Total_All_Students > 10000)


vis_column_chart_v2 <-ggplot(IPEDS_large_pops, aes(Inst_Name, Grand_Total_All_Students))
+ geom_bar(stat = "identity")

vis_column_chart_v2
```



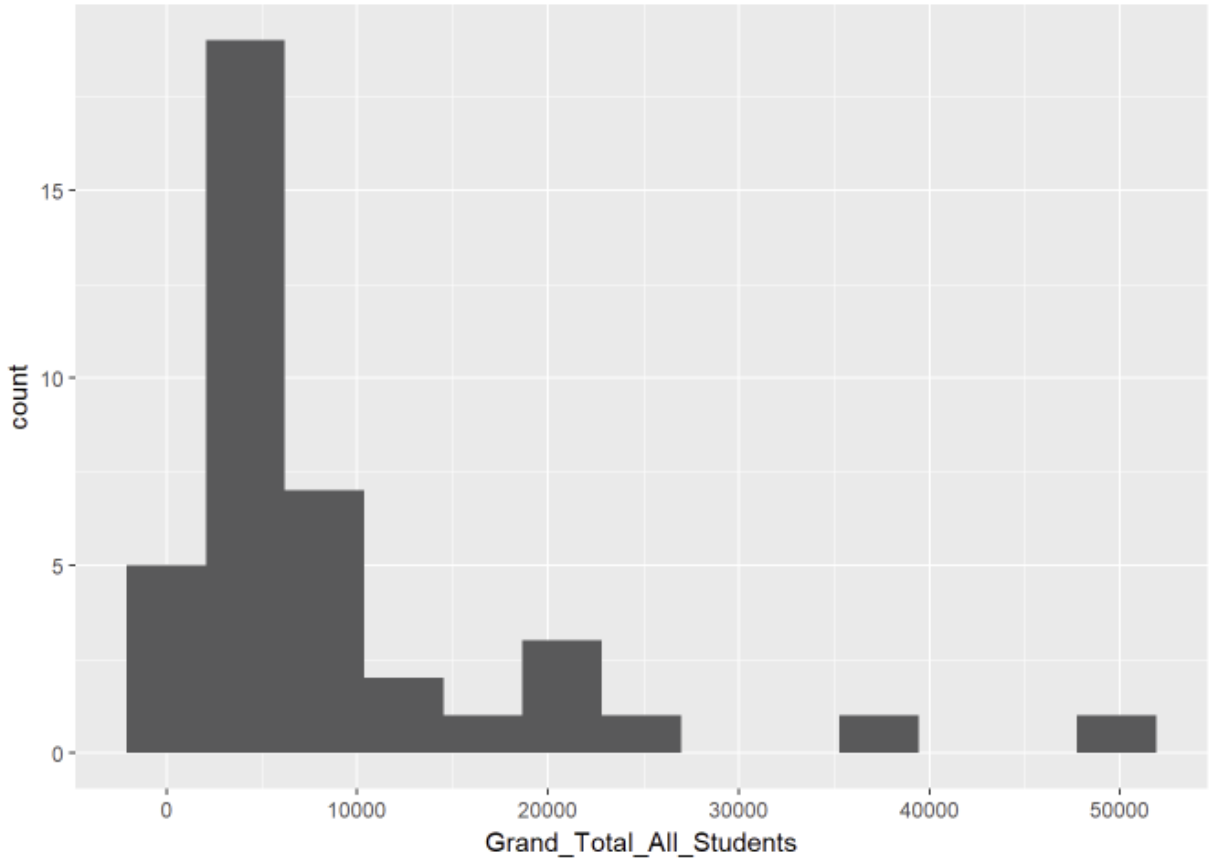
Tweaking the Column Chart Part 2

```
vis_column_chart_horiz <- vis_column_chart_v2 + coord_flip()
vis_column_chart_horiz
```



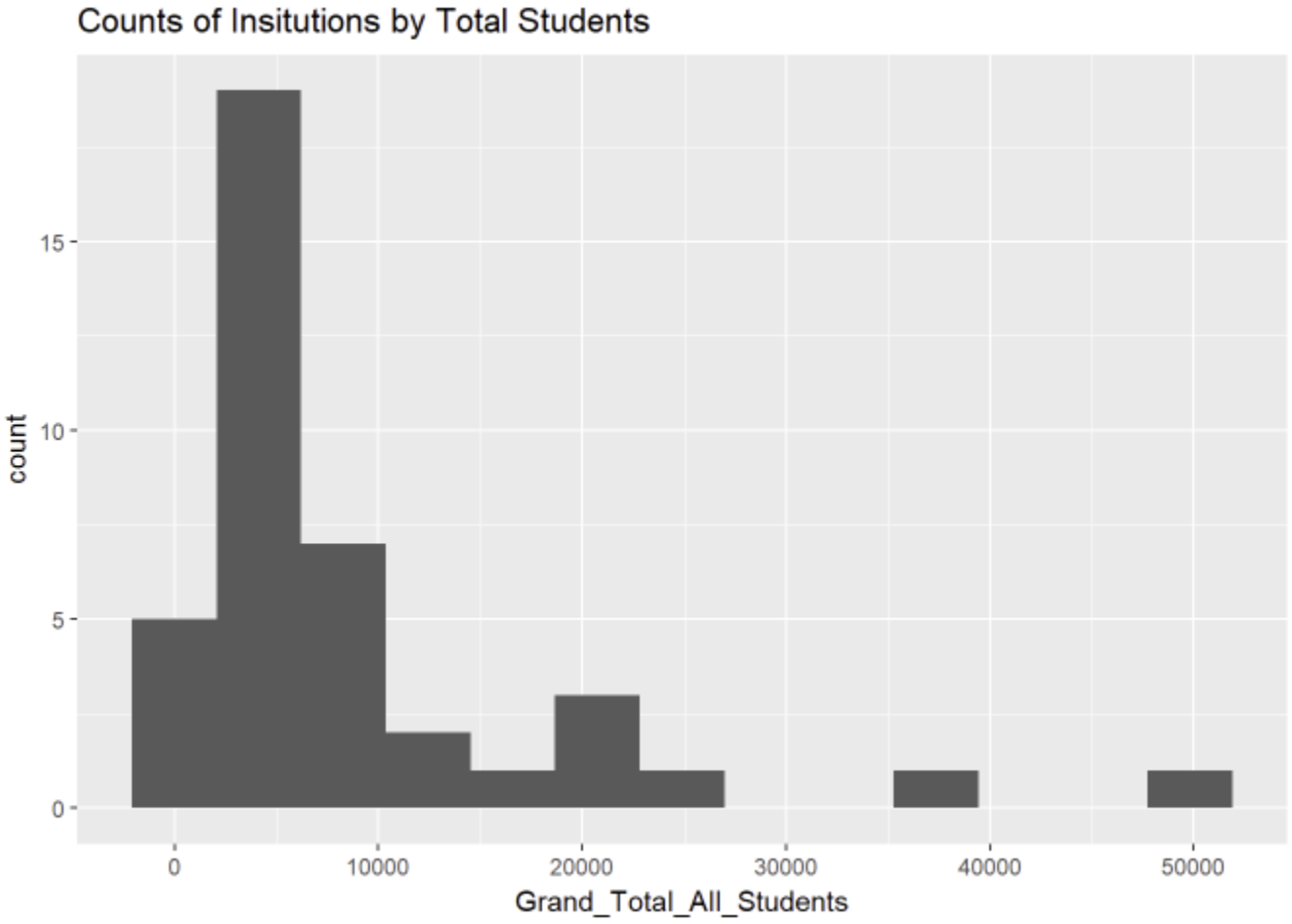
Distribution–Histogram

```
vis_histogram <- ggplot(IPEDS, aes(Grand_Total_All_Students)) + geom_histogram(bins = 13)
vis_histogram
```



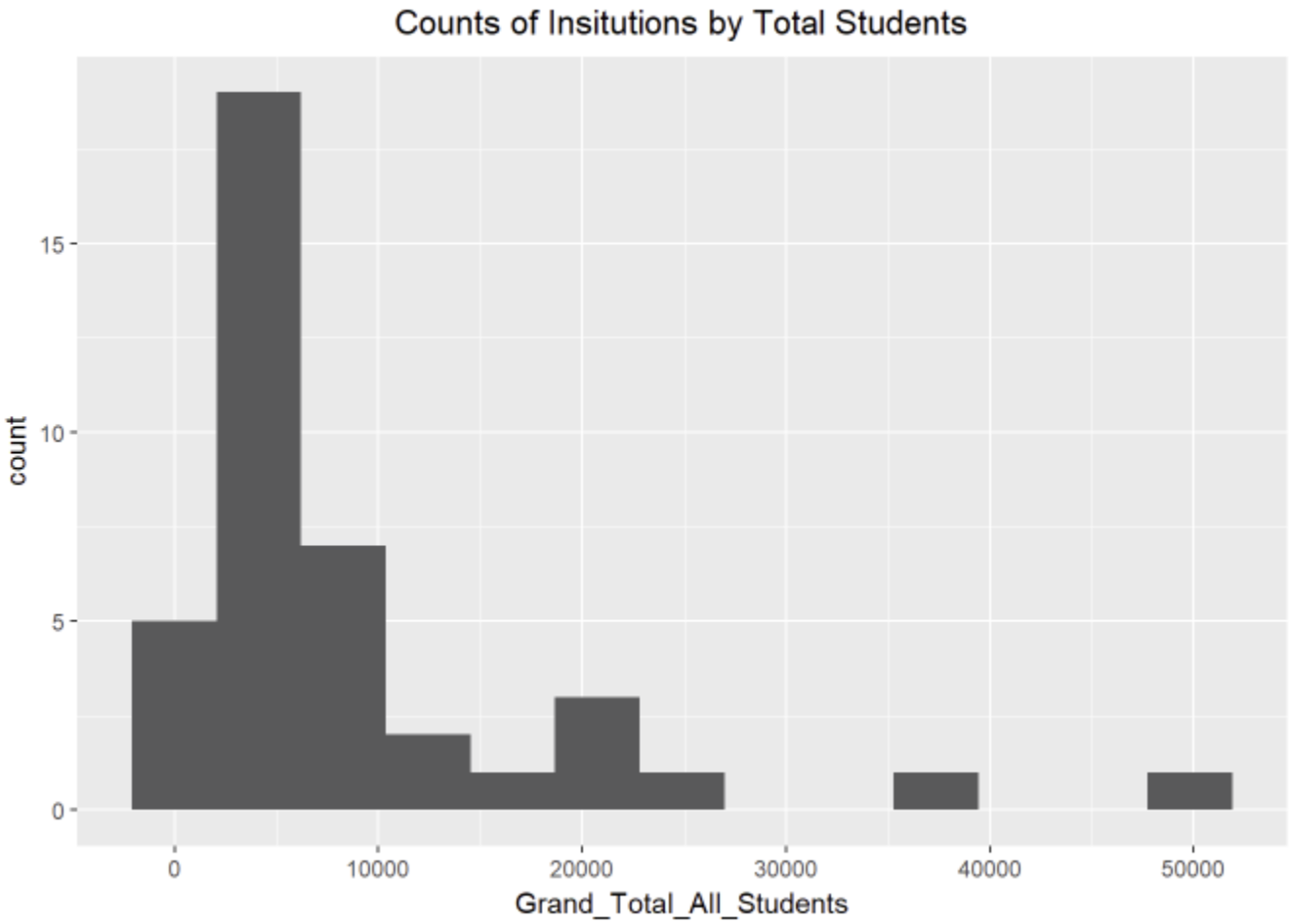
Tweaking the Histogram Part 1-Adding a Title

```
vis_histogram_w_title <- vis_histogram + labs(title="Counts of Insitutions by Total Students")    # Adds a Title to the graphic

vis_histogram_w_title
```



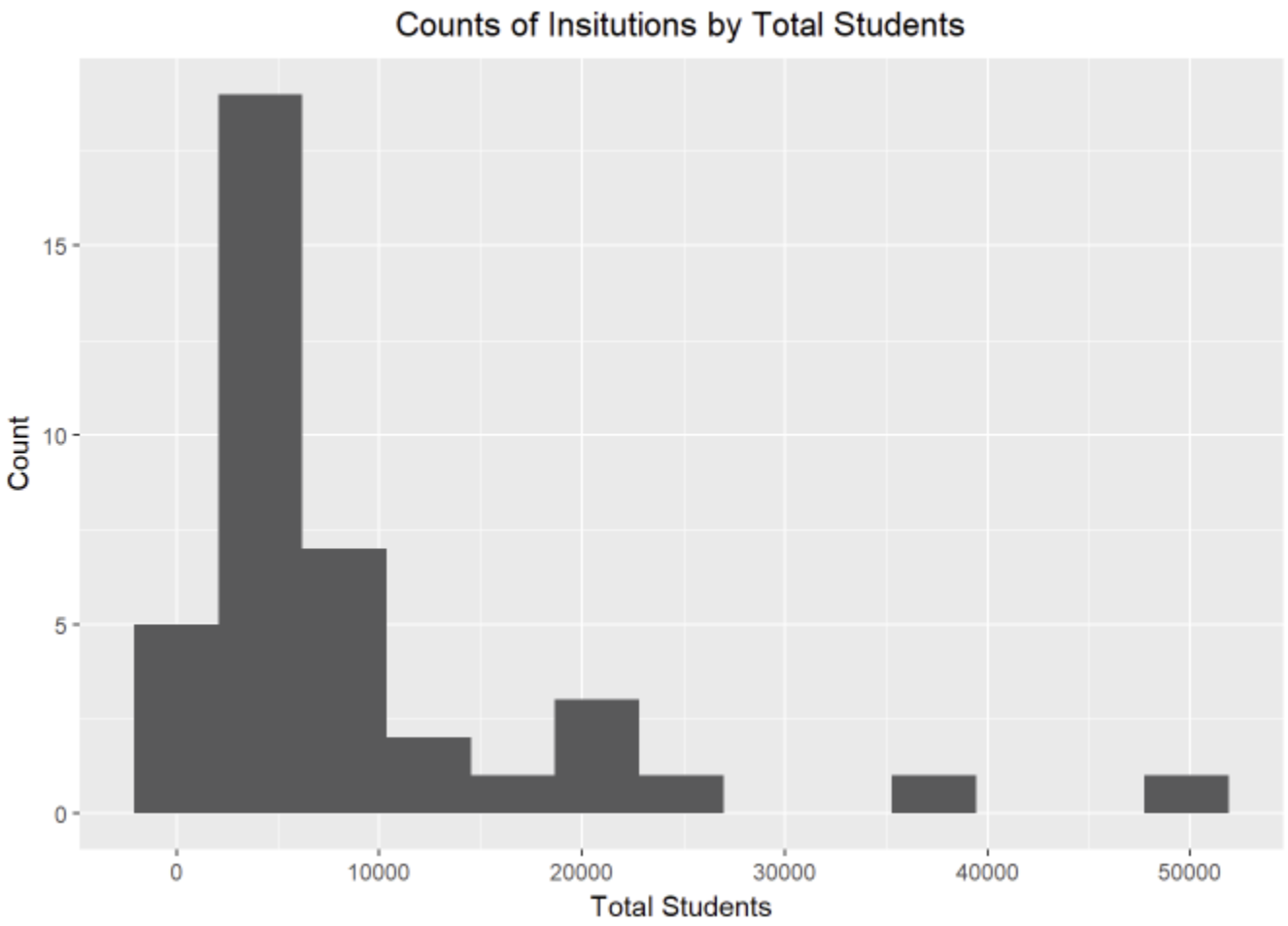
Tweaking the Histogram Part 2-Centering the Title

```
vis_histogram_w_centered_title <- vis_histogram_w_title + theme(plot.title = element_text
(hjust = 0.5)) # Centers the Title

vis_histogram_w_centered_title
```



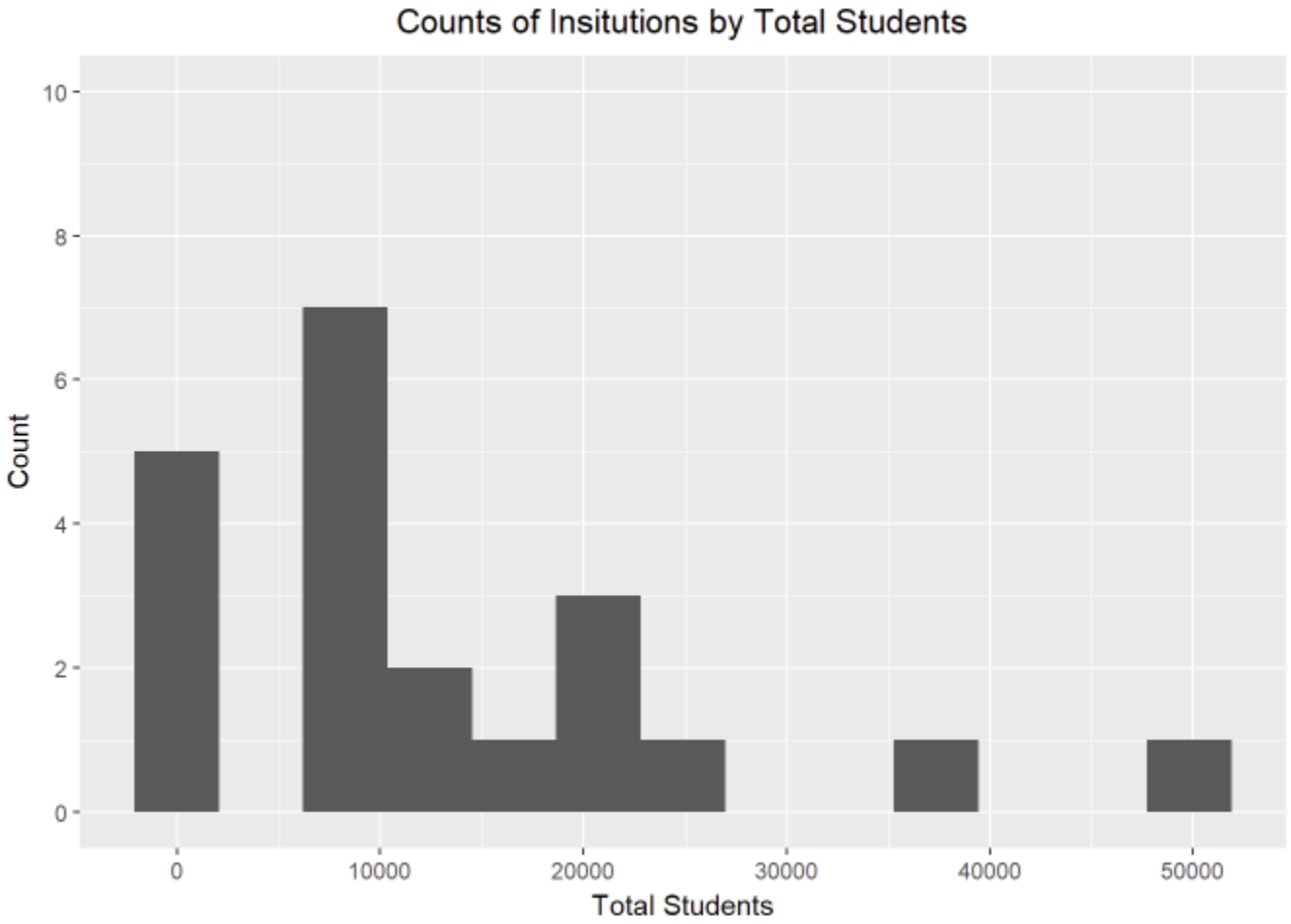
Tweaking the Histogram Part 3-Editing the Axis Names

```
vis_histogram_w_centered_title_edited_axes <- vis_histogram_w_centered_title + labs(x="Total Students",y="Count") # Changes axis names

vis_histogram_w_centered_title_edited_axes
```



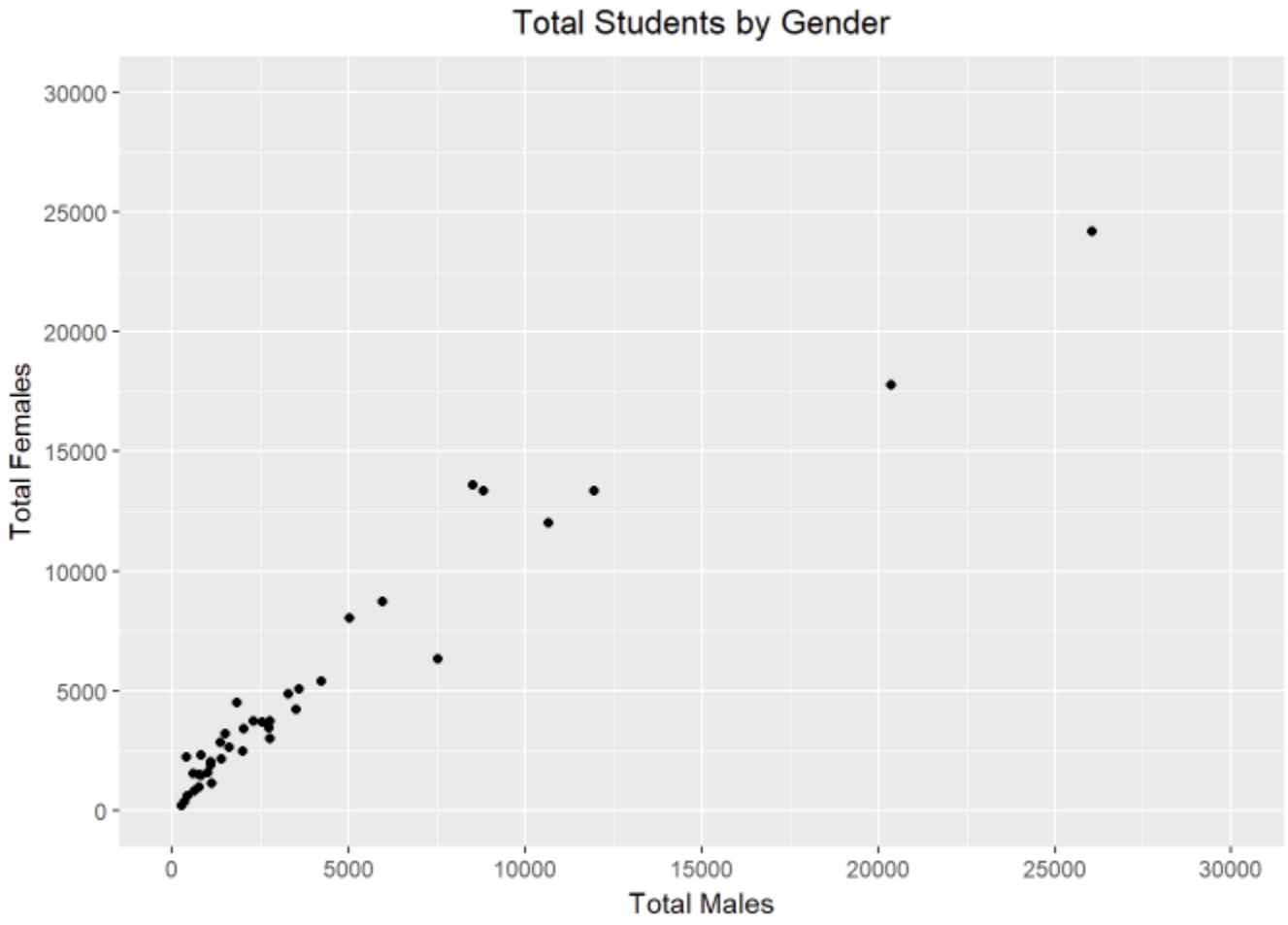
Tweaking the Histogram Part 4-Editing the Y-Axis Limits

```
vis_histogram_w_edited_y_axis <- vis_histogram_w_centered_title_edited_axes + scale_y_continuous(breaks = seq(0, 10, by=2), limits=c(0,10)) # sets the y-axis from 0 to 10 in 2 increments

vis_histogram_w_edited_y_axis
```



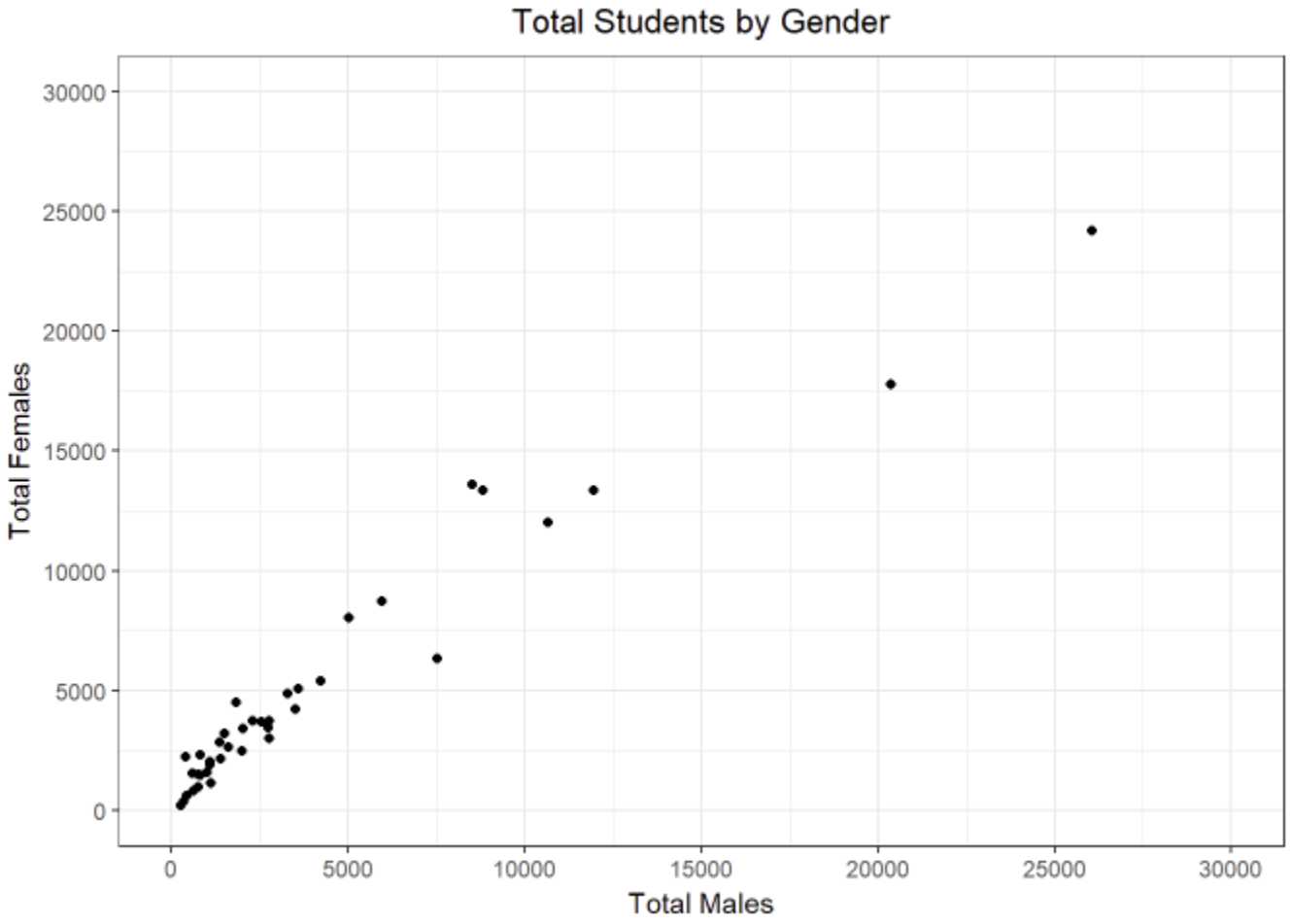
Association–Two-Variable Scatter Plot

```
vis_scatter <- ggplot(IPEDS, aes(x=Grand_Total_Male, y=Grand_Total_Female)) + geom_point(
) + labs(title="Total Students by Gender") + theme(plot.title = element_text(hjust = 0.5)
) + labs(x="Total Males",y="Total Females") + scale_y_continuous(breaks = seq(0, 30000, b
y=5000), limits=c(0,30000)) + scale_x_continuous(breaks = seq(0, 30000, by=5000), limits=
c(0,30000))

vis_scatter
```



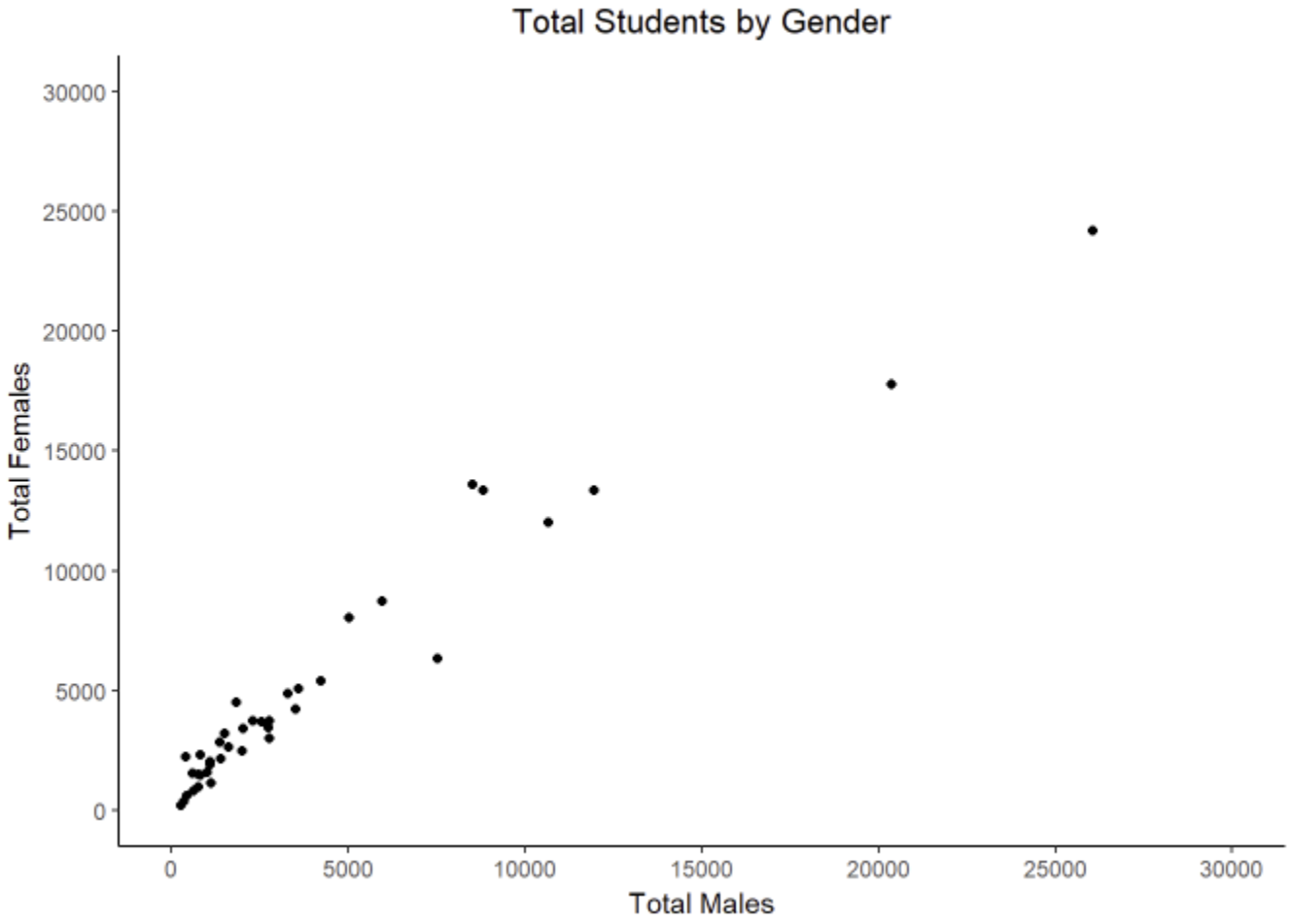
Tweaking the Scatter Plot-Part 1-That Grey Background Though!

```
# "theme_bw()" gets rid of the grey background

vis_scatter_background_edited <- vis_scatter + theme_bw() + theme(plot.title = element_te
xt(hjust = 0.5))

vis_scatter_background_edited
```



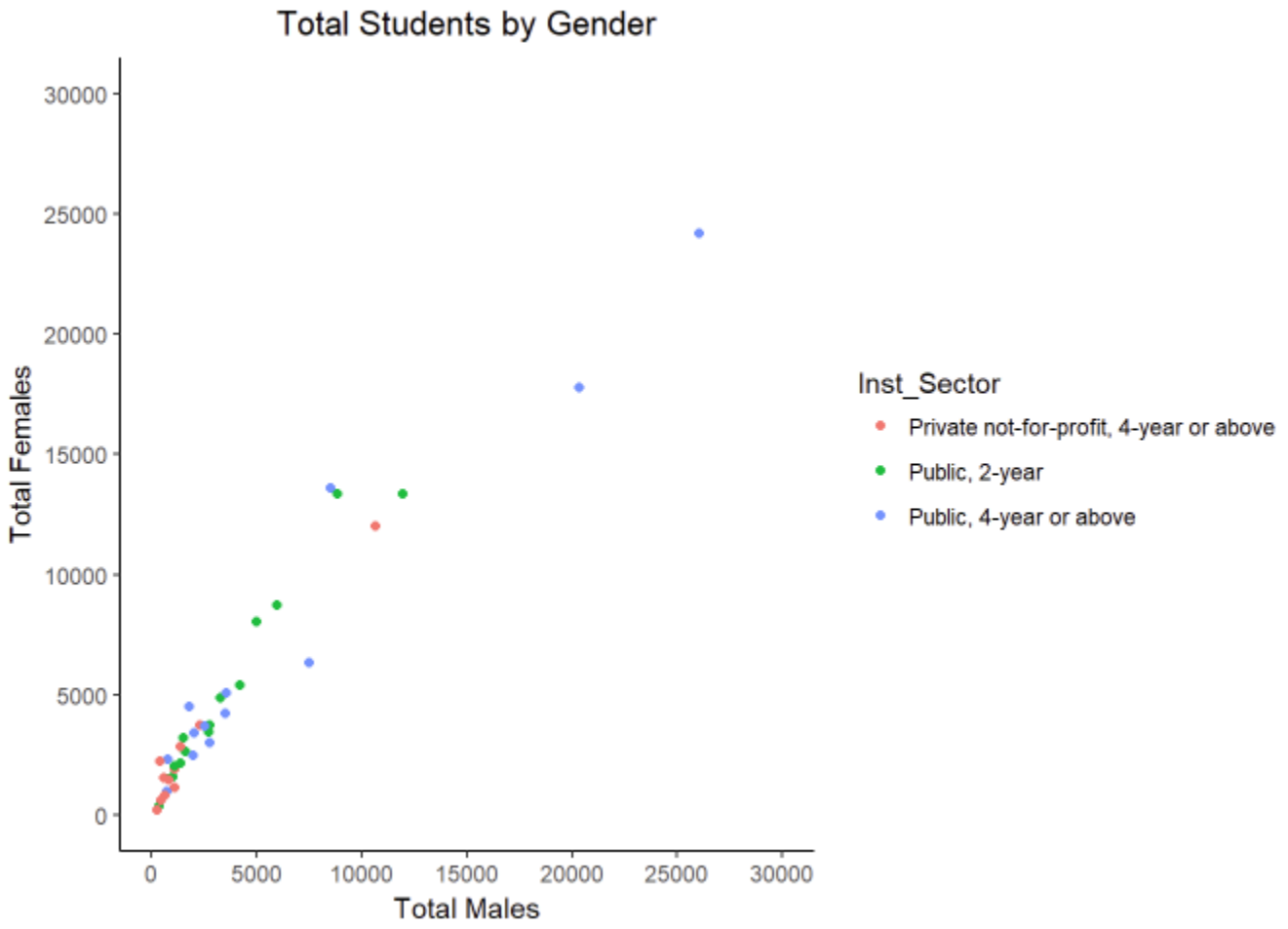
Tweaking the Scatter Plot-Part 2-Axis Lines

```
vis_scatter_axis_lines <- vis_scatter_background_edited + theme_bw() + theme(panel.border
 = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(
), axis.line = element_line(colour = "black")) + theme(plot.title = element_text(hjust =
0.5))

vis_scatter_axis_lines
```



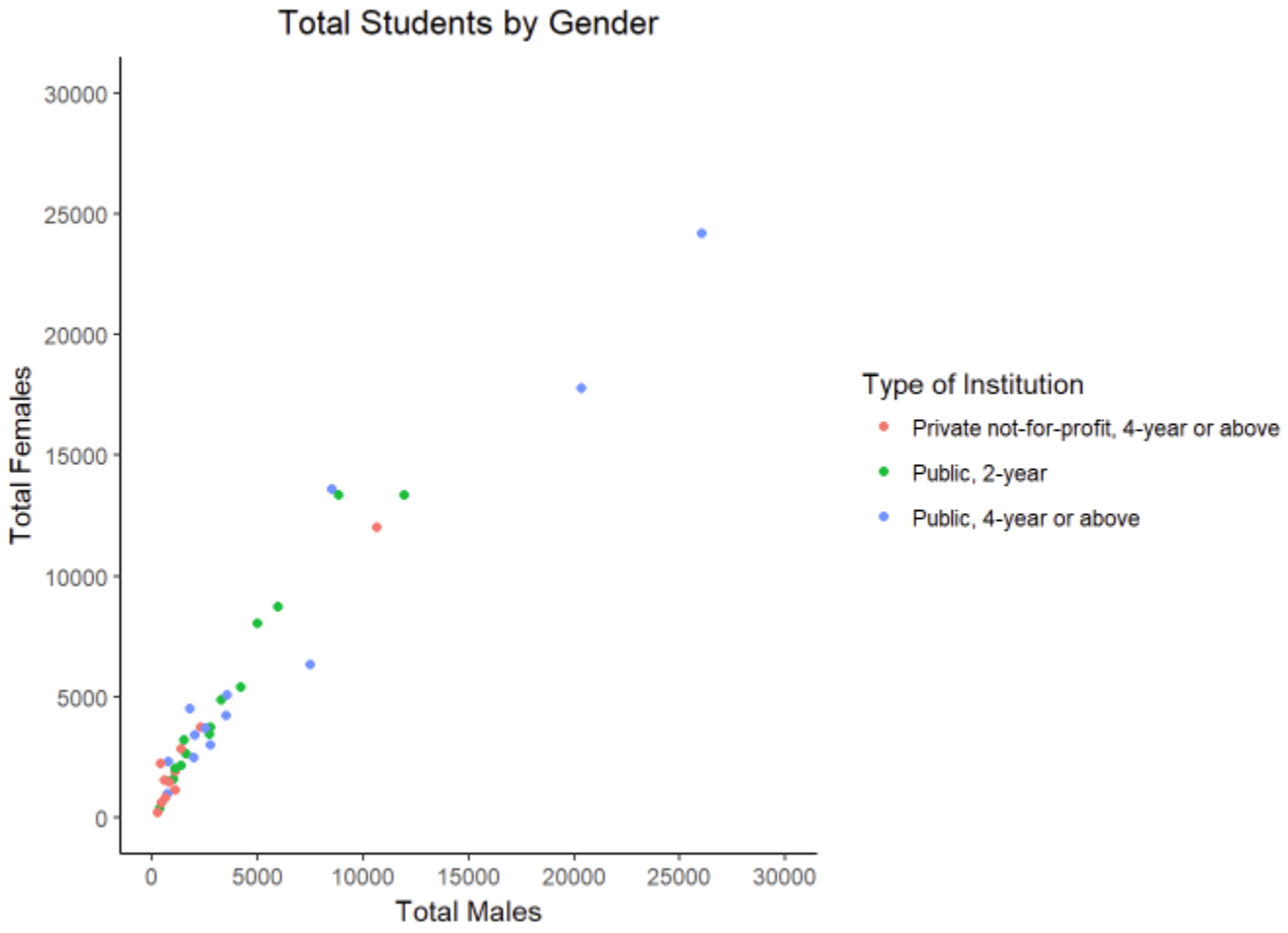
Tweaking the Scatter Plot-Part 3-Color– added ", color=Inst_Sector" to first layer

```
vis_scatter_point_colors <- ggplot(IPEDS, aes(x=Grand_Total_Male, y=Grand_Total_Female, color=Inst_Sector)) + geom_point() + labs(title="Total Students by Gender") + labs(x="Total Males",y="Total Females") + scale_y_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000)) + scale_x_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000)) + theme_bw() + theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black")) + theme(plot.title = element_text(hjust = 0.5))

vis_scatter_point_colors
```



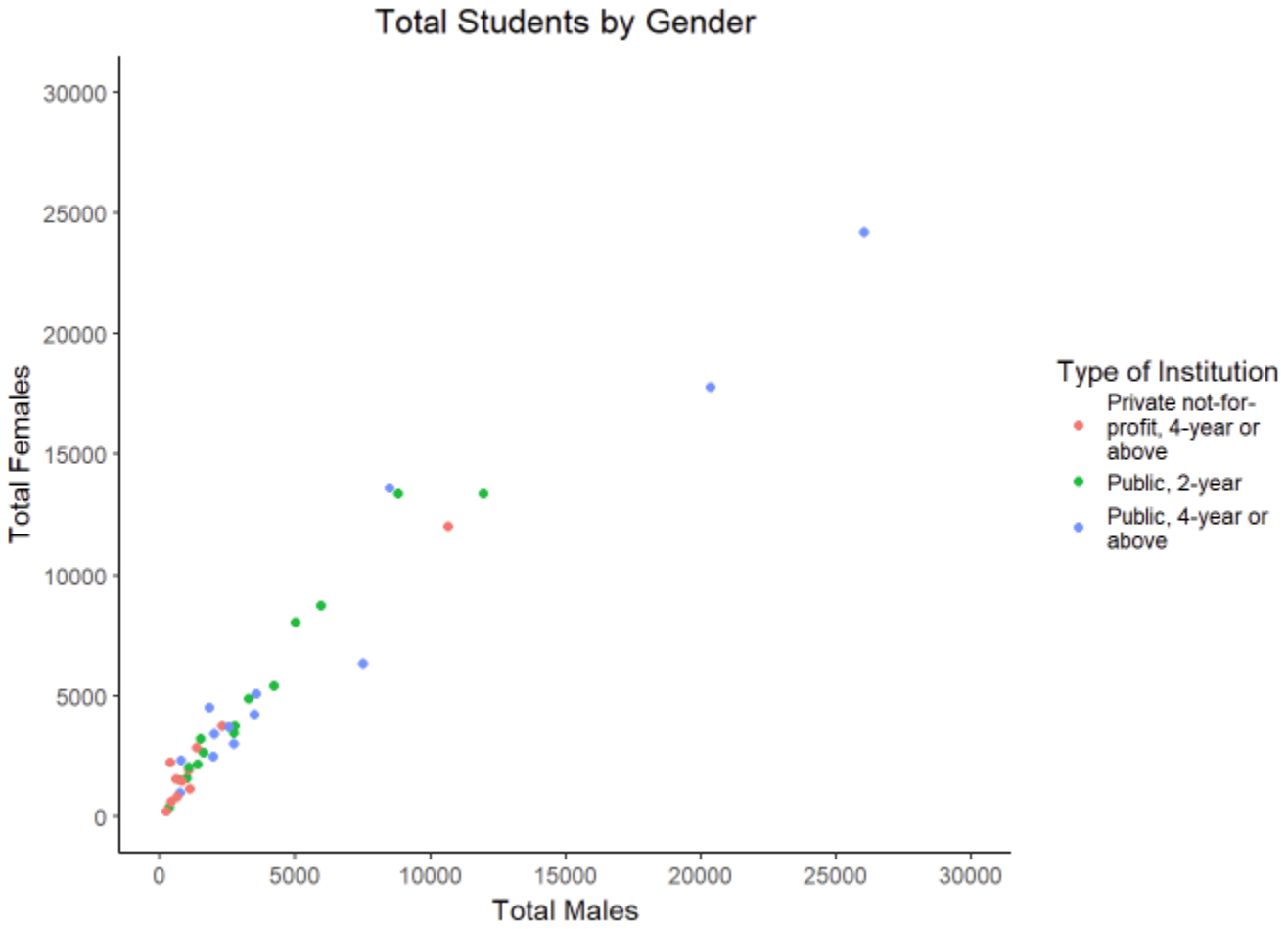
Tweaking the Scatter Plot-Part 4-Editing the Legend

```
vis_scatter_edited_legend <- vis_scatter_point_colors + labs(color = "Type of Institution
")

vis_scatter_edited_legend
```



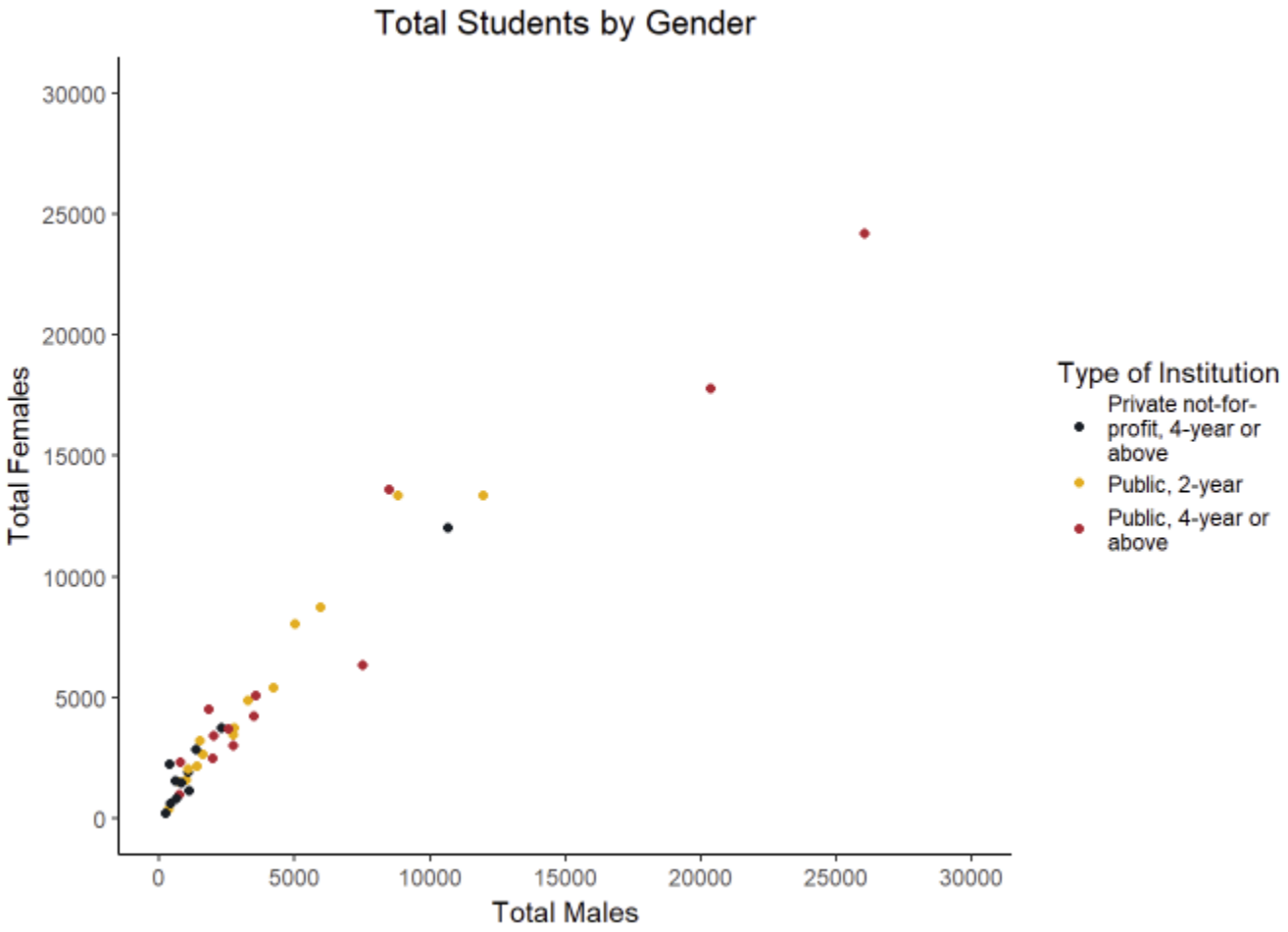
Tweaking the Scatter Plot-Part 5-Wrapping the Legend, added "color=str_wrap(Inst_Sector,20)"

```
vis_scatter_wrapped_legend <- ggplot(IPEDS, aes(x=Grand_Total_Male, y=Grand_Total_Female,
 color=str_wrap(Inst_Sector,20))) + geom_point() + labs(title="Total Students by Gender")
 + labs(x="Total Males",y="Total Females") + scale_y_continuous(breaks = seq(0, 30000, by
=5000), limits=c(0,30000)) + scale_x_continuous(breaks = seq(0, 30000, by=5000), limits=c
(0,30000)) + theme_bw() + theme(panel.border = element_blank(), panel.grid.major = elemen
t_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black")
) + theme(plot.title = element_text(hjust = 0.5)) + labs(color = "Type of Institution")

vis_scatter_wrapped_legend
```



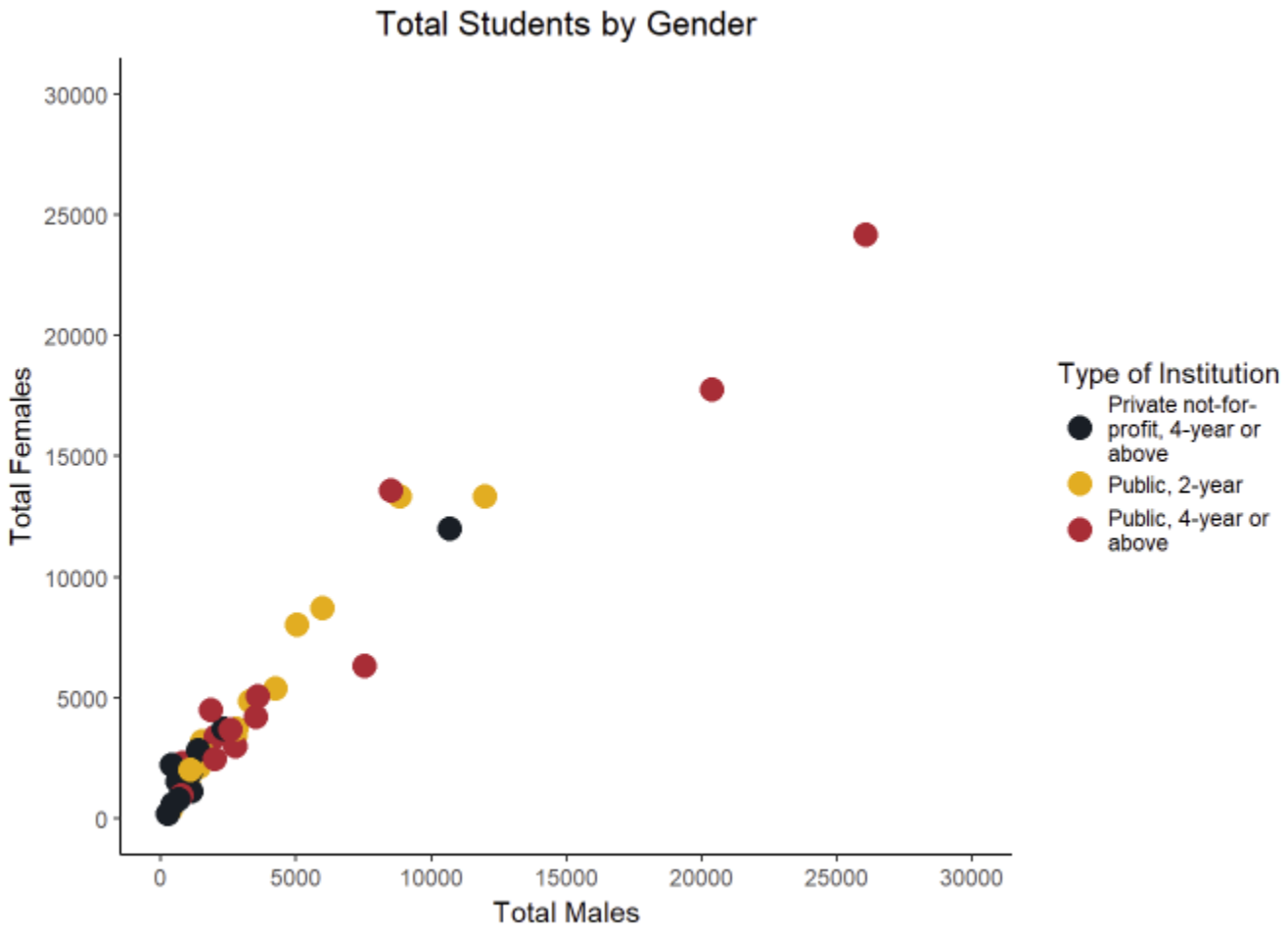
Tweaking the Scatter Plot-Part 6-Custom Colors

```
vis_scatter_custom_colors <- vis_scatter_wrapped_legend + scale_color_manual(values = manual_colors)

vis_scatter_custom_colors
```



Tweaking the Scatter Plot-Part 7-Size

```
vis_scatter_adj_size <- vis_scatter_custom_colors + geom_point(size = 4)
vis_scatter_adj_size
```

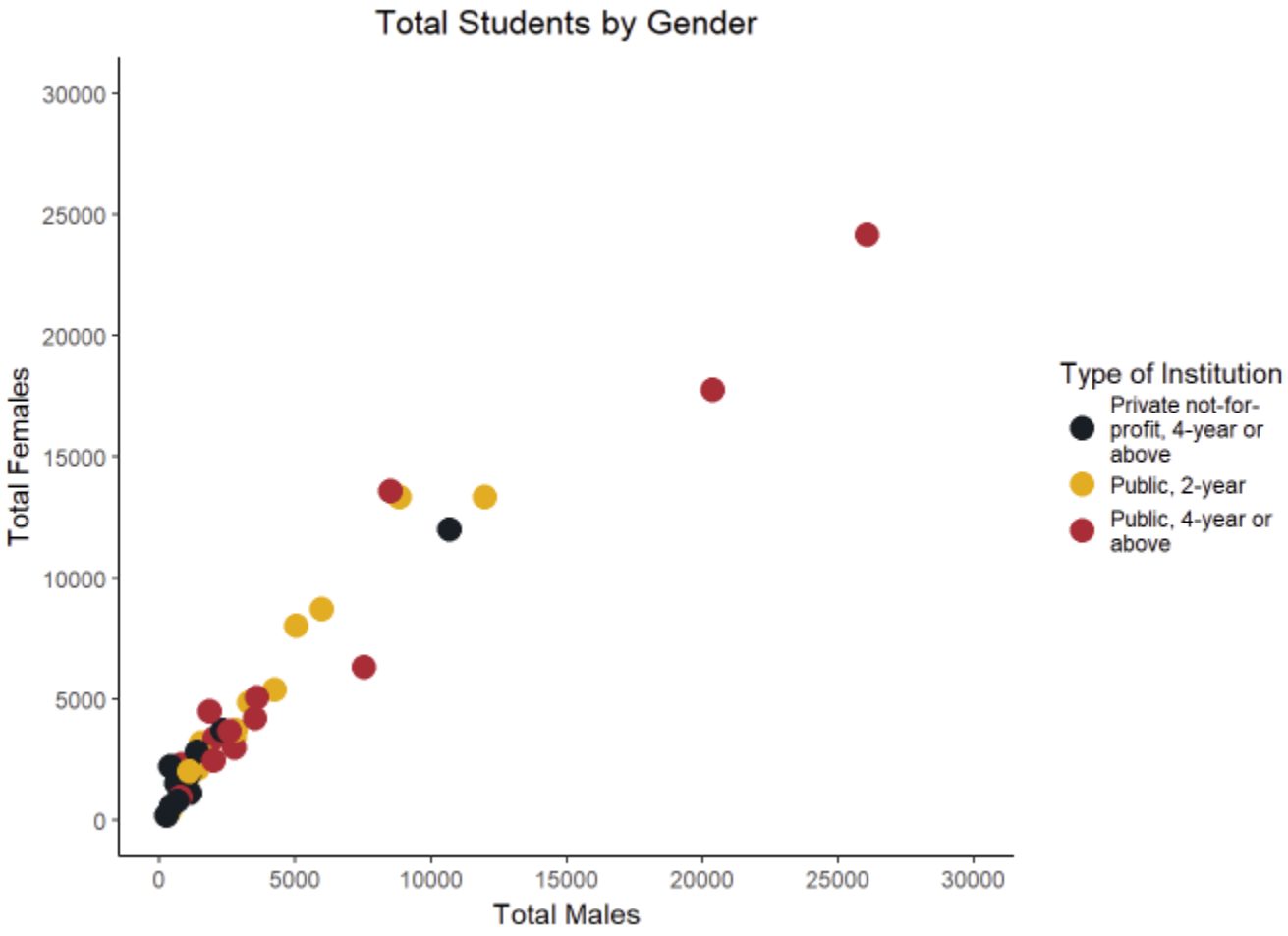


Review of Components

```
vis_scatter <- ggplot(IPEDS, aes(x=Grand_Total_Male, y=Grand_Total_Female, color=str_wrap
(Inst_Sector,20)))

#Sets what variables are on each axis

# str_wrap(Inst_Sector,20) - Allows the legend to be wrapped

+ geom_point() # Makes this plot a scatter plot

+ labs(title="Total Students by Gender") # Adds Plot Title

+ theme(plot.title = element_text(hjust = 0.5)) # Centers Plot Title

+ labs(x="Total Males",y="Total Females") # Sets Axis Names

+ scale_y_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000)) # Sets Y Axis li
mits. Min=0 Max=30000 Increments=5000

+ scale_x_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000)) # Sets X Axis li
mits. Min=0 Max=3000 Increments=5000

+ theme_bw() # Gets rid of grey background

+ theme(panel.border = element_blank(), panel.grid.major = element_blank(),

panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"))

# panel.border = element_blank() - removes border around entire output

# panel.grid.major = element_blank() - removes major gridlines

# panel.grid.minor = element_blank() - removes minor gridlines

# axis.line = element_line(colour = "black") - adds black axis line

+ labs(color = "Type of Institution") # Changes the Legend Title

+ scale_color_manual(values = manual_colors) # Changes the dot colors to our custom color
s

+ geom_point(size = 4) # Increases the size of the dots

+ theme(plot.title = element_text(hjust = 0.5))
```

Scatter Plot-Final

```
vis_scatter_final <- ggplot(IPEDS, aes(x=Grand_Total_Male, y=Grand_Total_Female, color=str_wrap(Inst_Sector,20))) + geom_point() + labs(title="Total Students by Gender") + theme(plot.title = element_text(hjust = 0.5)) + labs(x="Total Males",y="Total Females") + scale_y_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000))+ scale_x_continuous(breaks = seq(0, 30000, by=5000), limits=c(0,30000)) + theme_bw() + theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black")) + labs(color = "Type of Institution")+ scale_color_manual(values = manual_colors)+ geom_point(size = 4) + theme(plot.title = element_text(hjust = 0.5))

vis_scatter_final
```

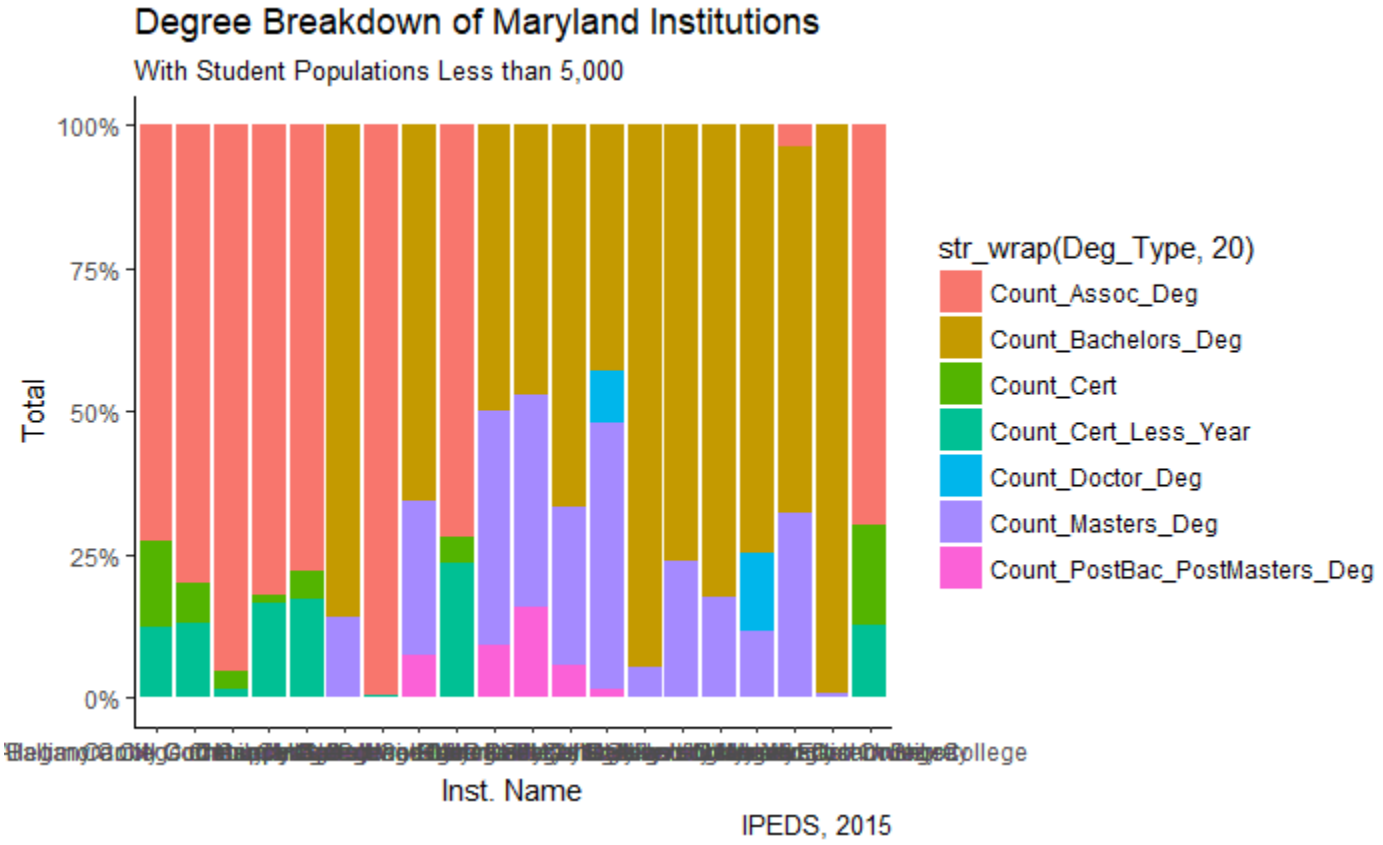


Composition–Stacked 100% Chart

```
IPEDS_small_pops <- subset(IPEDS, Grand_Total_All_Students < 5000)

# Goal: Construct a Stacked 100% Chart on Degree/Certificate Counts by Institution and, eventually, sector.

# Step 1-Move our data from wide to short. We will need data transposed from wide to short. Race and Gender Data is not needed for this graph.

# The arguments to gather():

# - data: the name of the dataframe that needs to be transposed.

# - key: Name of new key column (made from names of data columns), in this case the various degree/certificate types

# - value: Name of new value column

# - ...: Names of source columns that contain values

# - factor_key: Treat the new key column as a factor (instead of character vector)

IPEDS_small_pops_long <- gather(IPEDS_small_pops, Deg_Type, Total, Count_Doctor_Deg:Count_Cert_Less_Year, factor_key=TRUE)

# Step 2-Removing columns we don't need:

IPEDS_small_pops_long <- subset(IPEDS_small_pops_long, select=-c(Grand_Total_All_Students, Grand_Total_Male, Grand_Total_Female, Grand_Total_Amer_Ind_AK_Native, Grand_Total_Asian, Grand_Total_Black_AA, Grand_Total_Hispanic, Grand_Total_Native_Hawaiian_PI, Grand_Total_White, Grand_Total_Two_More, Grand_Total_Race_Unknown, Grand_Total_Nonresident_Alien))
```

Stacked 100% Chart

```
vis_stacked <-ggplot(IPEDS_small_pops_long, aes(x=Inst_Name, y=Total, fill=str_wrap(Deg_Type, 20))) + geom_bar(stat="identity", position = "fill") + scale_y_continuous(labels = percent_format()) + theme_bw() + labs(title = "Degree Breakdown of Maryland Institutions",
 subtitle = "With Student Populations Less than 5,000", caption = "IPEDS, 2015", x = "Inst. Name", y = "Total") + theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"))

vis_stacked
```

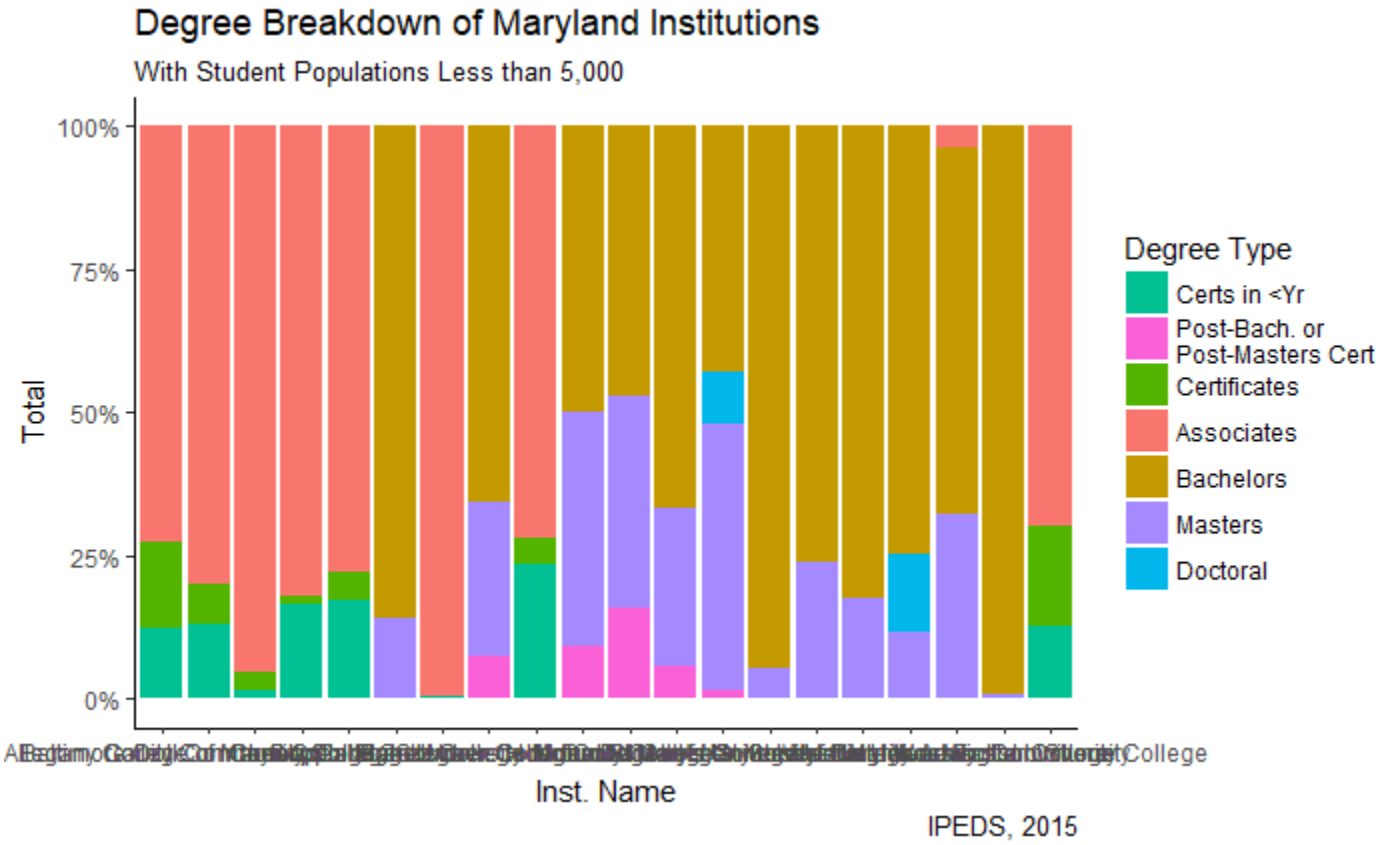


Tweaking the Stacked 100% Chart-Part 1-Legend

```
# getting unique types of degrees:
list <- unique(c(as.character(IPEDS_small_pops_long$Deg_Type)))
list
```

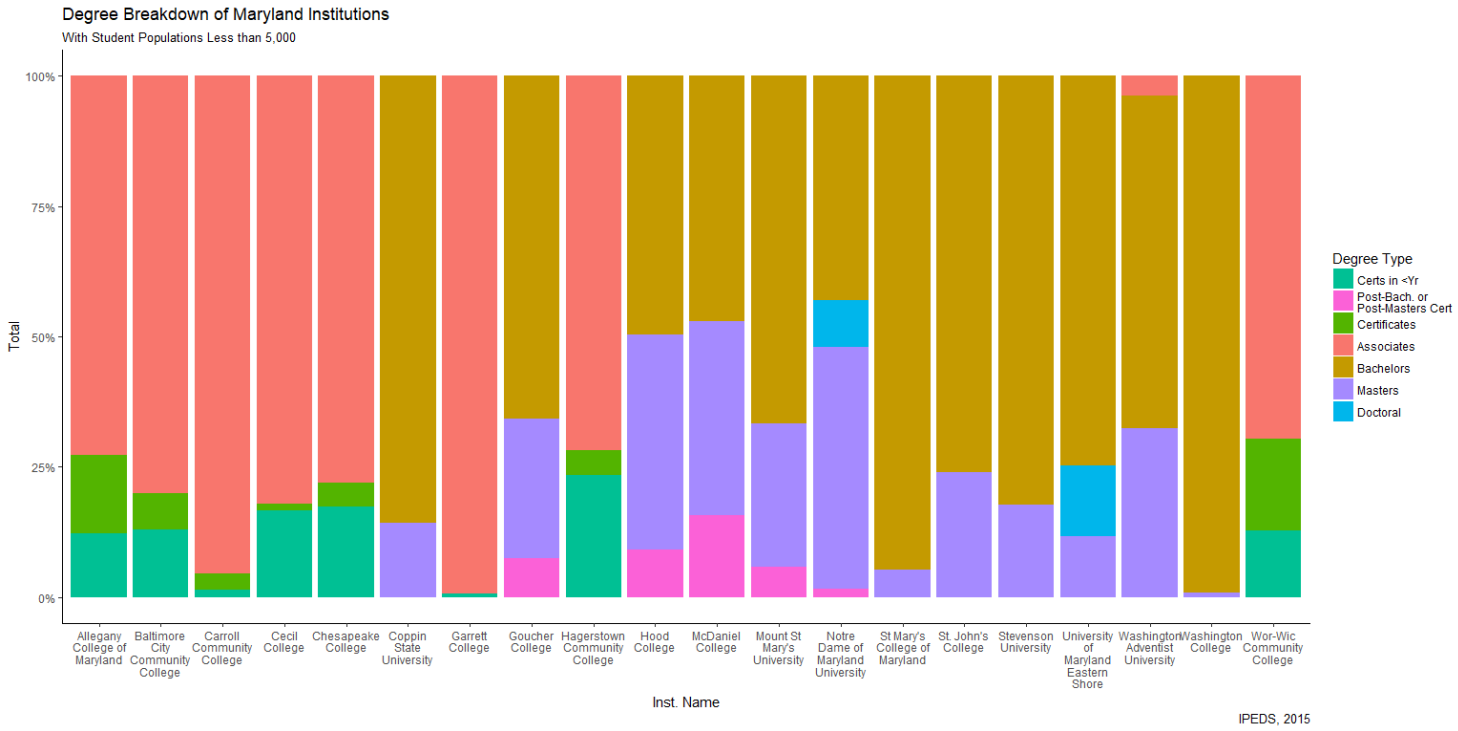
```
## [1] "Count_Doctor_Deg"              "Count_Masters_Deg"
## [3] "Count_Bachelors_Deg"           "Count_Assoc_Deg"
## [5] "Count_PostBac_PostMasters_Deg" "Count_Cert"
## [7] "Count_Cert_Less_Year"
```

```
# Note: "\n" adds lines breaks
vis_edited_legend <- vis_stacked + scale_fill_discrete(name="Degree Type",
                     breaks=c("Count_Cert_Less_Year", "Count_PostBac_PostMasters_Deg", "Count_
Cert", "Count_Assoc_Deg", "Count_Bachelors_Deg", "Count_Masters_Deg", "Count_Doctor_Deg")
,
                     labels=c("Certs in <Yr", "Post-Bach. or\nPost-Masters Cert", "Certificate
s", "Associates", "Bachelors", "Masters", "Doctoral"))
vis_edited_legend
```



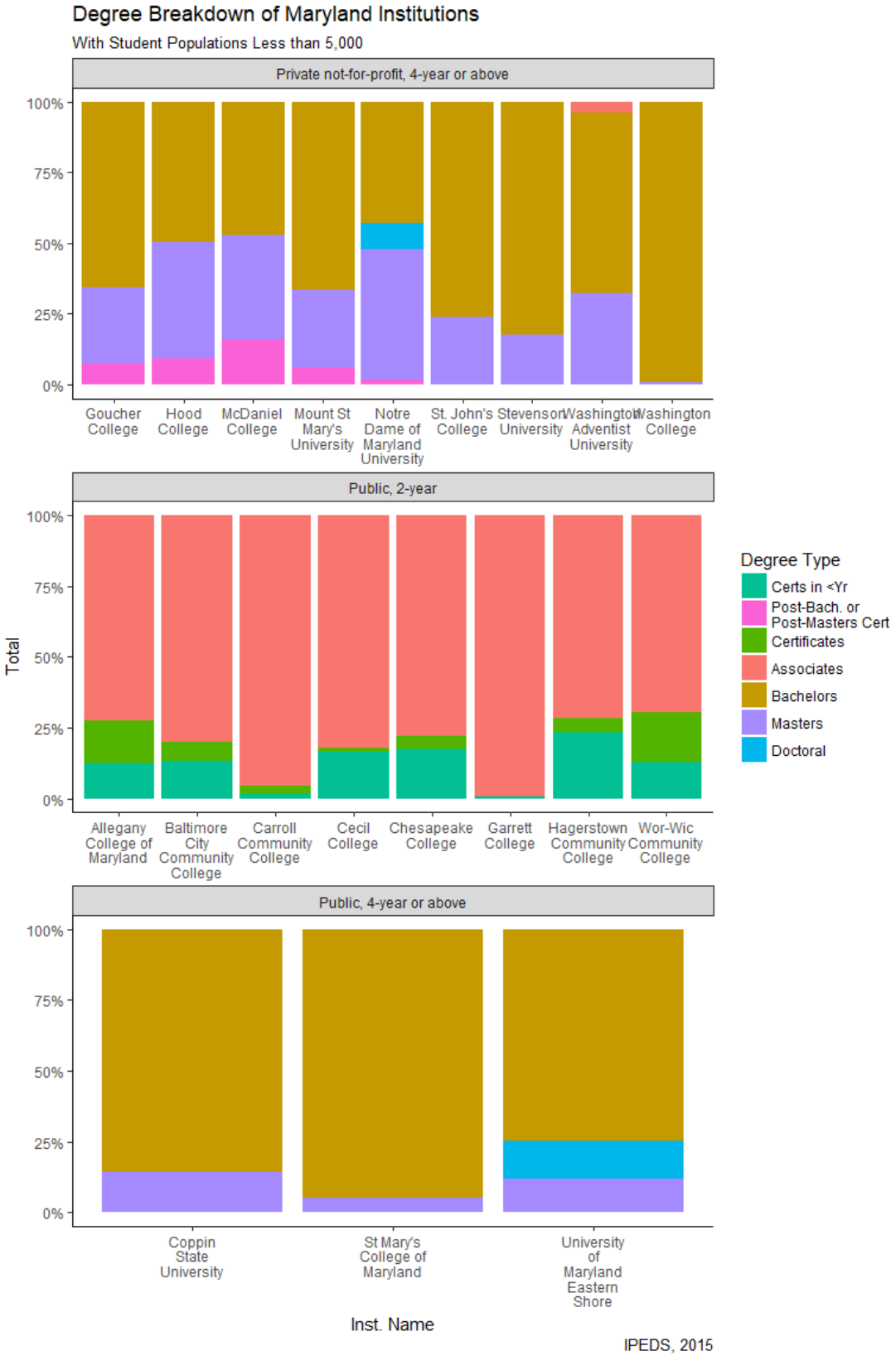
Tweaking the Stacked 100% Chart-Part 2-The X Axis

```
# "fig.width=16,fig.height=8" From above allows for the plot to be widened
# "+ scale_x_discrete(labels = function(x) str_wrap(x, width = 10))"
# allows for institution names to be moved to multiple lines
vis_edited_x_axis <- vis_edited_legend + scale_x_discrete(labels = function(x) str_wrap(x, width = 10))
vis_edited_x_axis
```



Tweaking the Stacked 100% Chart-Part 3-Let's Group this!

```
vis_edited_facet <- vis_edited_x_axis + facet_wrap(~Inst_Sector, scales="free", ncol=1)

vis_edited_facet
```



```
vis_stacked <-ggplot(IPEDS_small_pops_long, aes(x=Inst_Name, y=Total, fill=str_wrap(Deg_Type, 20))) #Sets what variables are on each axis

# str_wrap(Inst_Sector,20) - Allows the legend to be wrapped

+ geom_bar(stat="identity", position = "fill") #heights of the bars to represent values in the data

+ scale_y_continuous(labels = percent_format()) # graph is a stacked 100% chart

+ theme_bw() + labs(title = "Degree Breakdown of Maryland Institutions", subtitle = "With Student Populations Less than 5,000", caption = "IPEDS, 2015", x = "Inst. Name", y = "Total")  # Title, Subtitle, Source Title and Axis Titles added

+ theme(panel.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colour = "black"))

# panel.border = element_blank() - removes border around entire output

# panel.grid.major = element_blank() - removes major gridlines

# panel.grid.minor = element_blank() - removes minor gridlines

# axis.line = element_line(colour = "black") - adds black axis line

+ scale_fill_discrete(name="Degree Type",

                       breaks=c("Count_Cert_Less_Year", "Count_PostBac_PostMasters_Deg", "Count_Cert", "Count_Assoc_Deg", "Count_Bachelors_Deg", "Count_Masters_Deg", "Count_Doctor_Deg"),
                       labels=c("Certs in <Yr", "Post-Bach. or\nPost-Masters Cert", "Certificates", "Associates", "Bachelors", "Masters", "Doctoral"))

# Custom labels for the Legend based on Degree Types

+ scale_x_discrete(labels = function(x) str_wrap(x, width = 10))

# Allows for the Institution names to be multiple lines

+ facet_wrap(~Inst_Sector, scales="free", ncol=1)

# Groups the plot by sector in one column
```

Stacked 100% Chart-Final

```
vis_stacked_final <-ggplot(IPEDS_small_pops_long, aes(x=Inst_Name, y=Total, fill=str_wrap(Deg_Type,
 20))) + geom_bar(stat="identity", position = "fill") + scale_y_continuous(labels = percent_format(
)) + theme_bw() + labs(title = "Degree Breakdown of Maryland Institutions", subtitle = "With Studen
t Populations Less than 5,000", caption = "IPEDS, 2015", x = "Inst. Name", y = "Total") + theme(pan
el.border = element_blank(), panel.grid.major = element_blank(), panel.grid.minor = element_blank()
, axis.line = element_line(colour = "black")) + scale_fill_discrete(name="Degree Type",breaks=c("Co
unt_Cert_Less_Year", "Count_PostBac_PostMasters_Deg", "Count_Cert", "Count_Assoc_Deg", "Count_Bache
lors_Deg", "Count_Masters_Deg", "Count_Doctor_Deg"), labels=c("Certs in <Yr", "Post-Bach. or\nPost-
Masters Cert", "Certificates", "Associates", "Bachelors", "Masters", "Doctoral")) + scale_x_discret
e(labels = function(x) str_wrap(x, width = 10)) + facet_wrap(~Inst_Sector, scales="free", ncol=1)

vis_stacked_final
```

Helpful Websites

Datacamp Courses

R Cheat Sheets
Cookbook for R

GGPlot Book by Hadley Wickham Building Plots Layer by Layer
GGPlot Themes
Customizing Themes with R Package, "ggthemr"

Gallery of R Markdown Files

For Extra Challenges

Histograms Using R's 'airquality' Dataset
Scatter Plots-Corruption and Human Development
Stacked Bar Plots-Exports to China