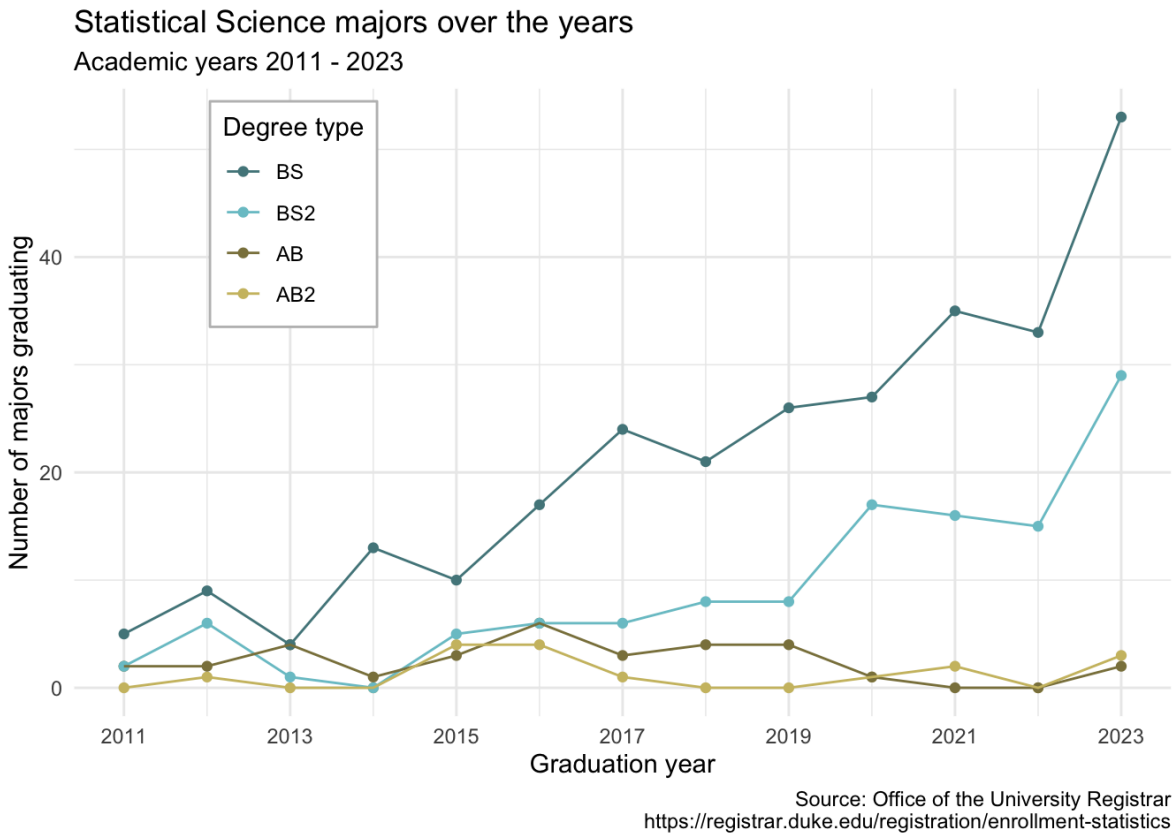
AE 05: Tidying StatSci Majors

Jessica St Jean

Goal

Our ultimate goal in this application exercise is to make the following data visualization.



Data

The data come from Duke's Office of the University Registrar. The data were downloaded from Duke as a PDF file. The data have been exported to a CSV file for you. Let's load that in.

```
library(tidyverse)

statsci <- read_csv("data/statsci.csv")
```

And let's take a look at the data.

```
statsci
```

```
# A tibble: 4 x 14
  degree   `2011` `2012` `2013` `2014` `2015` `2016` `2017` `2018` `2019` `2020`
  <chr>     <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
1 Statist~     NA      1     NA     NA      4      4      1     NA     NA      1
2 Statist~      2      2      4      1      3      6      3      4      4      1
3 Statist~      2      6      1     NA      5      6      6      8      8     17
4 Statist~      5      9      4     13     10     17     24     21     26     27
# i 3 more variables: `2021` <dbl>, `2022` <dbl>, `2023` <dbl>
```

Pivoting

- **Demo:** Pivot the `statsci` data frame *longer* such that each row represents a degree type / year combination and `year` and number of graduates for that year are columns in the data frame.

```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    values_to = "n",
  )
```

```
# A tibble: 52 x 3
   degree                    year      n
   <chr>                     <chr> <dbl>
 1 Statistical Science (AB2) 2011     NA
 2 Statistical Science (AB2) 2012      1
```

```
 3 Statistical Science (AB2) 2013     NA
 4 Statistical Science (AB2) 2014     NA
 5 Statistical Science (AB2) 2015      4
 6 Statistical Science (AB2) 2016      4
 7 Statistical Science (AB2) 2017      1
 8 Statistical Science (AB2) 2018     NA
 9 Statistical Science (AB2) 2019     NA
10 Statistical Science (AB2) 2020      1
# i 42 more rows
```

- **Question:** What is the type of the `year` variable? Why? What should it be?

It is a character because it came from the original data and R doesn't understand that they represent years. It should instead be a numerical variable.

- **Demo:** Start over with pivoting, and this time also make sure `year` is a numerical variable in the resulting data frame.

```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  )
```

```
# A tibble: 52 x 3
   degree                     year     n
   <chr>                     <dbl> <dbl>
 1 Statistical Science (AB2)  2011    NA
 2 Statistical Science (AB2)  2012     1
 3 Statistical Science (AB2)  2013    NA
 4 Statistical Science (AB2)  2014    NA
 5 Statistical Science (AB2)  2015     4
 6 Statistical Science (AB2)  2016     4
 7 Statistical Science (AB2)  2017     1
 8 Statistical Science (AB2)  2018    NA
 9 Statistical Science (AB2)  2019    NA
10 Statistical Science (AB2)  2020     1
# i 42 more rows
```

- **Question:** What does an `NA` mean in this context? *Hint:* The data come from the university registrar, and they have records on every single graduates, there shouldn't be anything "unknown" to them about who graduated when.

It means they should be a value of 0.

- **Demo:** Add on to your pipeline that you started with pivoting and convert `NA`s in `n` to 0s.

```
#| label: convert-na

statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n))
```

```
# A tibble: 52 x 3
   degree                      year     n
   <chr>                      <dbl> <dbl>
 1 Statistical Science (AB2)  2011     0
 2 Statistical Science (AB2)  2012     1
 3 Statistical Science (AB2)  2013     0
 4 Statistical Science (AB2)  2014     0
 5 Statistical Science (AB2)  2015     4
 6 Statistical Science (AB2)  2016     4
 7 Statistical Science (AB2)  2017     1
 8 Statistical Science (AB2)  2018     0
 9 Statistical Science (AB2)  2019     0
10 Statistical Science (AB2)  2020     1
# i 42 more rows
```

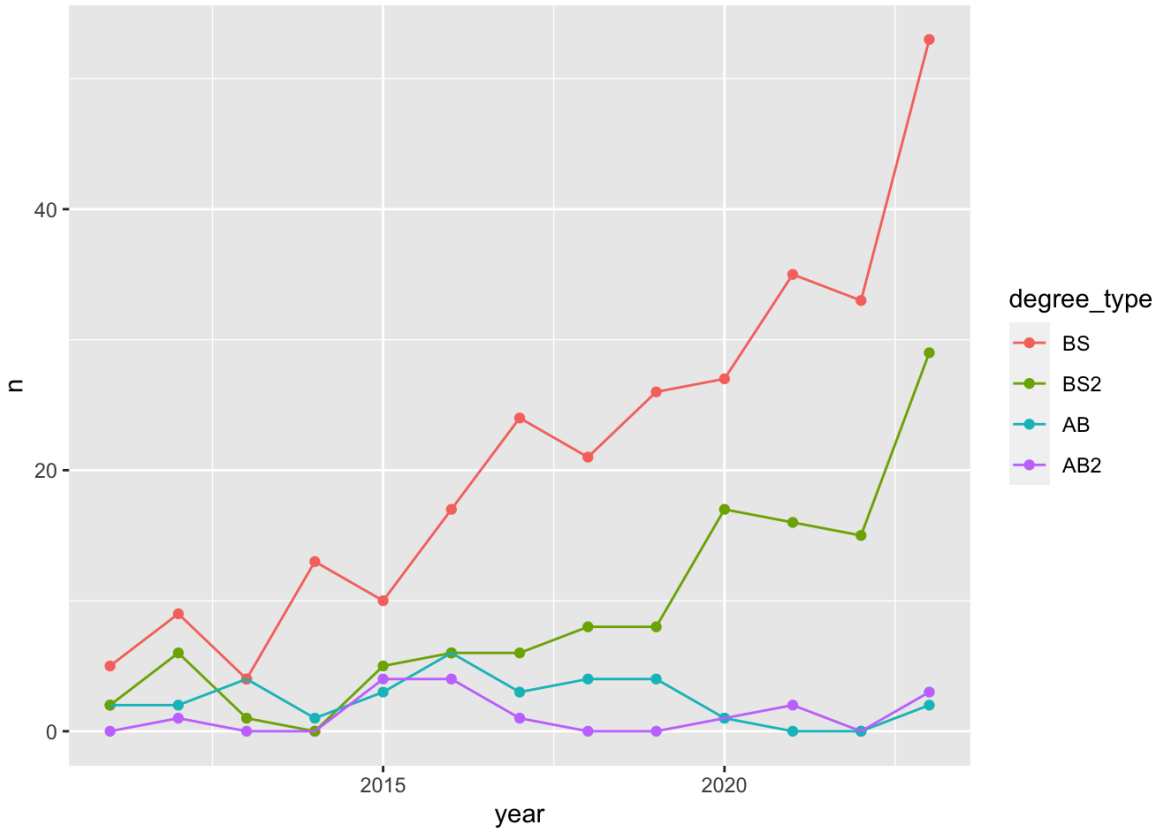
- **Demo:** In our plot the degree types are BS, BS2, AB, and AB2. This information is in our dataset, in the `degree` column, but this column also has additional characters we don't need. Create a new column called `degree_type` with levels BS, BS2, AB, and AB2 (in this order) based on `degree`. Do this by adding on to your pipeline from earlier.

```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
```

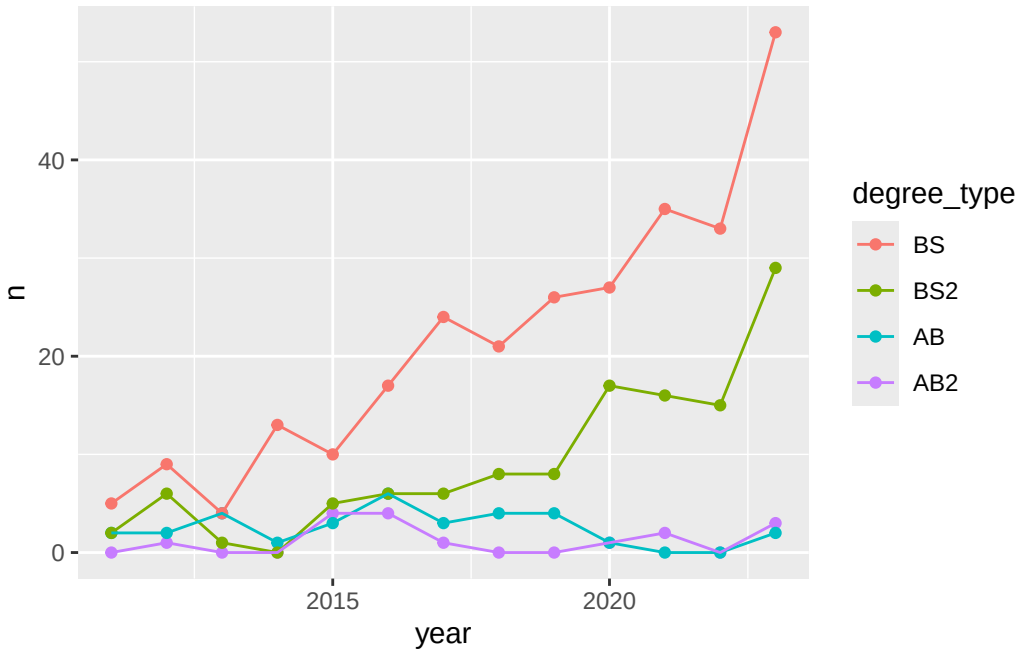
```
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
  )
```

```
# A tibble: 52 x 4
   major                  degree_type  year     n
   <chr>                  <fct>       <dbl> <dbl>
 1 "Statistical Science " AB2          2011     0
 2 "Statistical Science " AB2          2012     1
 3 "Statistical Science " AB2          2013     0
 4 "Statistical Science " AB2          2014     0
 5 "Statistical Science " AB2          2015     4
 6 "Statistical Science " AB2          2016     4
 7 "Statistical Science " AB2          2017     1
 8 "Statistical Science " AB2          2018     0
 9 "Statistical Science " AB2          2019     0
10 "Statistical Science " AB2          2020     1
# i 42 more rows
```

- **Your turn:** Now we start making our plot, but let's not get too fancy right away. Create the following plot, which will serve as the "first draft" on the way to our Goal. Do this by adding on to your pipeline from earlier.

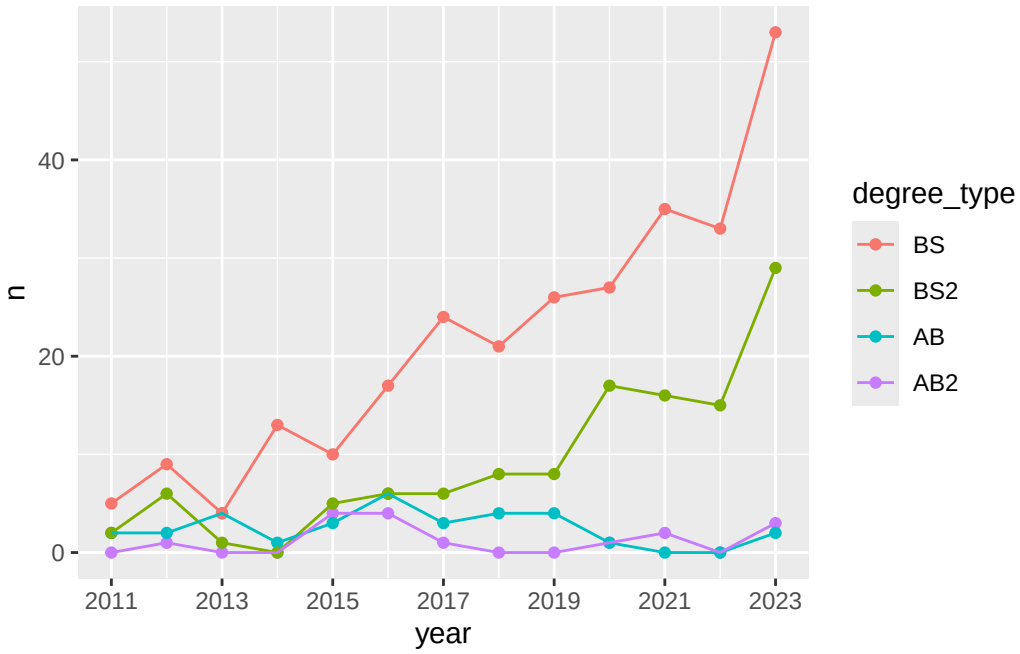



```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
  ) |>
  ggplot(aes( x= year, y = n, colour = degree_type))+
  geom_point()+
  geom_line()
```



- **Your turn:** What aspects of the plot need to be updated to go from the draft you created above to the Goal plot at the beginning of this application exercise.
- Colours of the lines, theme, labels, x axis scale, legend
- **Demo:** Update x-axis scale such that the years displayed go from 2011 to 2023 in increments of 2 years. Do this by adding on to your pipeline from earlier.

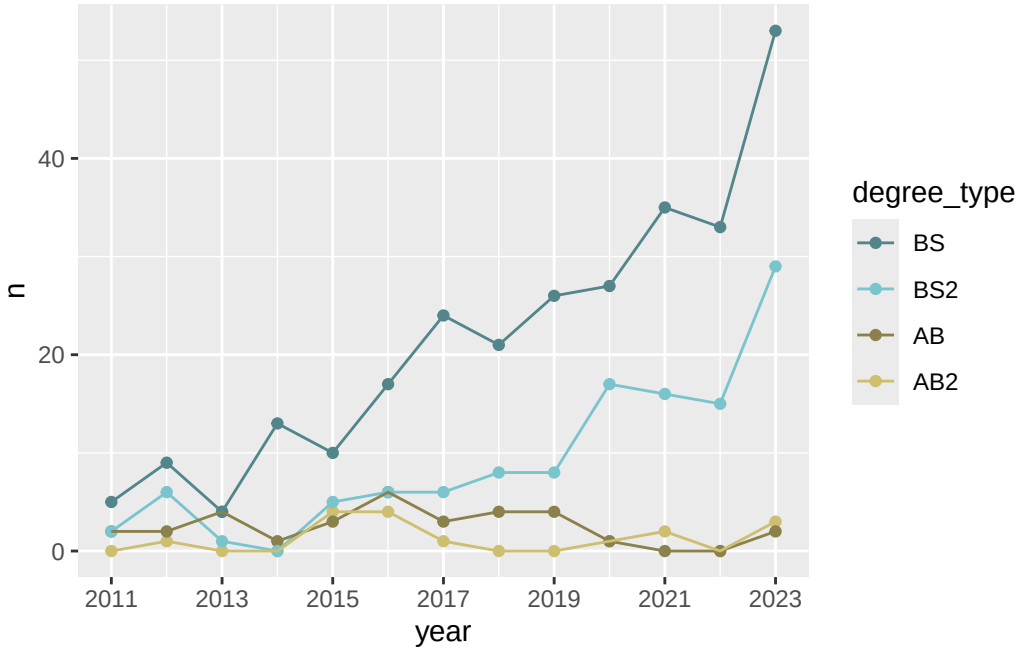
```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
  ) |>
  ggplot(aes( x= year, y = n, colour = degree_type))+
  geom_point()+
  geom_line()+
  scale_x_continuous(breaks= seq(2011,2023,2))
```



- **Demo:** Update line colors using the following level / color assignments. Once again, do this by adding on to your pipeline from earlier.
  - "BS" = "cadetblue4"
  - "BS2" = "cadetblue3"
  - "AB" = "lightgoldenrod4"
  - "AB2" = "lightgoldenrod3"

```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
  ) |>
  ggplot(aes( x= year, y = n, colour = degree_type))+
  geom_point()+
```

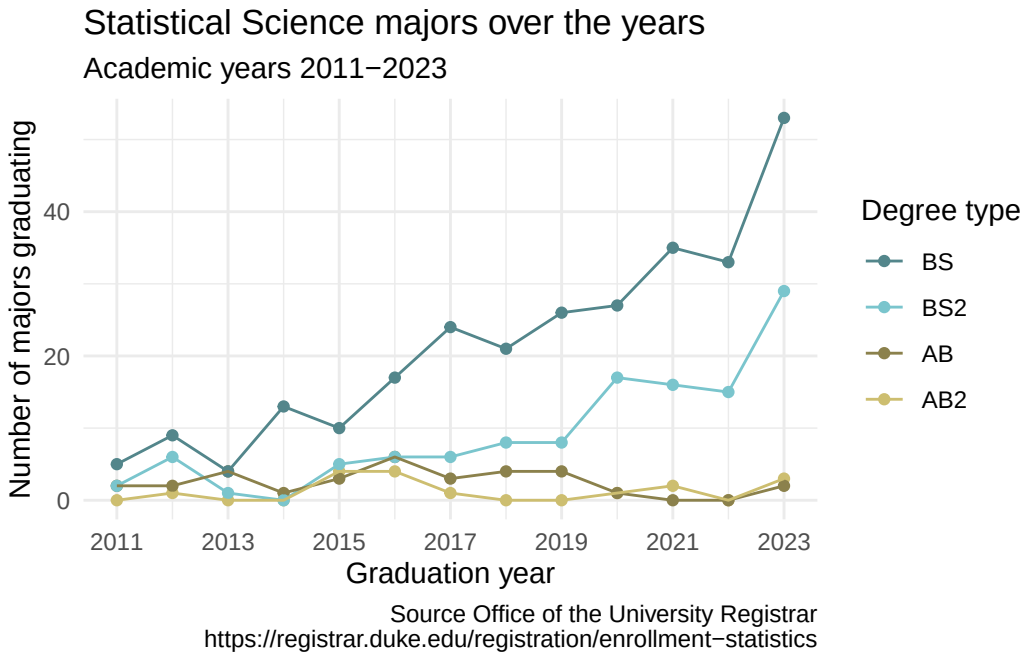
```
  geom_line()+
  scale_x_continuous(breaks= seq(2011,2023,2)) +
  scale_colour_manual(
    values = c( "BS" = "cadetblue4",
                "BS2" = "cadetblue3",
                "AB" = "lightgoldenrod4",
                "AB2" = "lightgoldenrod3"))
```



- **Your turn:** Update the plot labels (`title`, `subtitle`, `x`, `y`, and `caption`) and use `theme_minimal()`. Once again, do this by adding on to your pipeline from earlier.

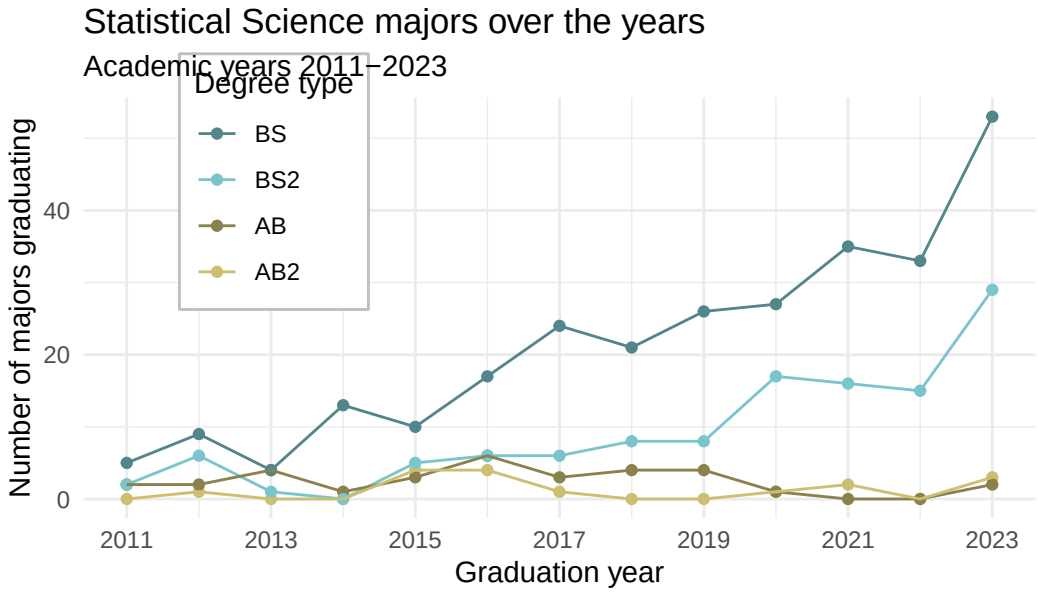
```
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
```

```
) |>
ggplot(aes( x= year, y = n, colour = degree_type))+
geom_point()+
geom_line()+
scale_x_continuous(breaks= seq(2011,2023,2)) +
scale_colour_manual(
  values = c( "BS" = "cadetblue4",
              "BS2" = "cadetblue3",
              "AB" = "lightgoldenrod4",
              "AB2" = "lightgoldenrod3")) +
labs(
  title = "Statistical Science majors over the years",
  subtitle = "Academic years 2011-2023",
  colour = "Degree type",
  x= "Graduation year",
  y= "Number of majors graduating",
  caption = " Source Office of the University Registrar\nhttps://registrar.duke.edu/registi
) +
theme_minimal()
```



- **Demo:** Finally, adding to your pipeline you've developed so far, move the legend into the plot, make its background white, and its border gray. Set `fig-width: 7` and `fig-height: 5` for your plot in the chunk options.

```r
statsci |>
  pivot_longer(
    cols = -degree,
    names_to = "year",
    names_transform = as.numeric,
    values_to = "n",
  ) |>
  mutate(n = if_else(is.na(n), 0, n)) |>
  separate_wider_delim(degree, delim = "(", names = c("major","degree_type")) |>
  mutate(
    degree_type = str_remove(degree_type, "\\)"),
    degree_type = fct_relevel(degree_type, "BS", "BS2","AB","AB2")
  ) |>
  ggplot(aes( x= year, y = n, colour = degree_type))+
  geom_point()+
  geom_line()+
  scale_x_continuous(breaks= seq(2011,2023,2)) +
  scale_colour_manual(
    values = c( "BS" = "cadetblue4",
                "BS2" = "cadetblue3",
                "AB" = "lightgoldenrod4",
                "AB2" = "lightgoldenrod3")) +
  labs(
    title = "Statistical Science majors over the years",
    subtitle = "Academic years 2011-2023",
    colour = "Degree type",
    x= "Graduation year",
    y= "Number of majors graduating",
    caption = " Source Office of the University Registrar\nhttps://registrar.duke.edu/registi
  ) +
  theme_minimal()+
  theme(
    legend.position = c(0.2,0.8),
    legend.background = element_rect(fill = "white", colour = "grey")
  )
```



Source Office of the University Registrar
https://registrar.duke.edu/registration/enrollment−statistics