# Homework 6

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**This homework is due on March 29, 2021 at 11:00pm. Please submit as a pdf file on Canvas.**

For all problems in this homework, we will work with the `BA_degrees` dataset. It contains the proportions of Bachelor's degrees awarded in the US between 1970 and 2015.

```
BA_degrees <- read_csv("https://wilkelab.org/SDS375/datasets/BA_degrees.csv")
BA_degrees
```

```
## # A tibble: 594 x 4
##    field                                          year  count     perc
##    <chr>                                         <dbl>  <dbl>    <dbl>
##  1 Agriculture and natural resources              1971  12672 0.0151
##  2 Architecture and related services              1971   5570 0.00663
##  3 Area, ethnic, cultural, gender, and group studies  1971   2579 0.00307
##  4 Biological and biomedical sciences             1971  35705 0.0425
##  5 Business                                       1971 115396 0.137
##  6 Communication, journalism, and related programs  1971  10324 0.0123
##  7 Communications technologies                    1971    478 0.000569
##  8 Computer and information sciences              1971   2388 0.00284
##  9 Education                                      1971 176307 0.210
## 10 Engineering                                    1971  45034 0.0536
## # ... with 584 more rows
```

**Problem 1: (3 pts)**

Consider the Bachelor's degrees awarded in 2015. There are 32 different areas:

```
BA_degrees_2015 <- BA_degrees %>%
  filter(year == 2015) %>%
  arrange(desc(perc))

print(BA_degrees_2015, n = nrow(BA_degrees_2015))
```

```
## # A tibble: 33 x 4
##    field                                                year  count     perc
##    <chr>                                               <dbl>  <dbl>    <dbl>
##  1 Business                                             2015 363799  1.92e-1
##  2 Health professions and related programs              2015 216228  1.14e-1
##  3 Social sciences and history                          2015 166944  8.81e-2
##  4 Psychology                                           2015 117557  6.20e-2
##  5 Biological and biomedical sciences                   2015 109896  5.80e-2
##  6 Engineering                                          2015  97858  5.16e-2
##  7 Visual and performing arts                           2015  95832  5.06e-2
##  8 Education                                            2015  91623  4.84e-2
##  9 Communication, journalism, and related programs      2015  90650  4.78e-2
## 10 Homeland security, law enforcement, and firefighting  2015  62723  3.31e-2
## 11 Computer and information sciences                    2015  59581  3.14e-2
## 12 Parks, recreation, leisure, and fitness studies      2015  49006  2.59e-2
```

```
## 13 Multi/interdisciplinary studies                          2015  47556  2.51e-2
## 14 English language and literature/letters                  2015  45847  2.42e-2
## 15 Liberal arts and sciences, general studies, and humani~  2015  43647  2.30e-2
## 16 Agriculture and natural resources                        2015  36277  1.91e-2
## 17 Public administration and social services                2015  34363  1.81e-2
## 18 Physical sciences and science technologies               2015  30038  1.59e-2
## 19 Family and consumer sciences/human sciences              2015  24584  1.30e-2
## 20 Mathematics and statistics                               2015  21853  1.15e-2
## 21 Foreign languages, literatures, and linguistics          2015  19493  1.03e-2
## 22 Engineering technologies                                 2015  17238  9.10e-3
## 23 Philosophy and religious studies                         2015  11072  5.84e-3
## 24 Theology and religious vocations                         2015   9708  5.12e-3
## 25 Architecture and related services                        2015   9090  4.80e-3
## 26 Area, ethnic, cultural, gender, and group studies        2015   7782  4.11e-3
## 27 Communications technologies                              2015   5135  2.71e-3
## 28 Transportation and materials moving                      2015   4711  2.49e-3
## 29 Legal professions and studies                            2015   4420  2.33e-3
## 30 Military technologies and applied sciences               2015    276  1.46e-4
## 31 Library science                                          2015     99  5.22e-5
## 32 Precision production                                     2015     48  2.53e-5
## 33 Not classified by field of study                         2015      0  0.
```

If you wanted to visualize the relative proportion of these different degree areas, which plot would be most appropriate? A pie chart, a stacked bar chart, or side-by-side bars? Please explain your reasoning. You do not have to make the chart.

**Answer:** *I think side-by-side bars would be the most appropriate.Side-by-side bars work well for datasets that contain large number of subsets, and* ***BA_degrees_2015*** *has 32 subsets. Pie chars and stacked bar charts are not the most appropriate visualization for this dataset due to this large number of subsets.*

**Problem 2: (5 pts)** Now make a pie chart of the `BA_degrees_2015` dataset, but show only the four most common areas, plus all others lumped together into "Other". (The code to prepare this lumped dataset has been provided for your convenience.) Make sure the pie slices are arranged in a reasonable order. Choose a reasonable color scale and a clean theme that avoids distracting visual elements.

Grading rubric: 3 pts for making the right plot, 2 pts for visual design

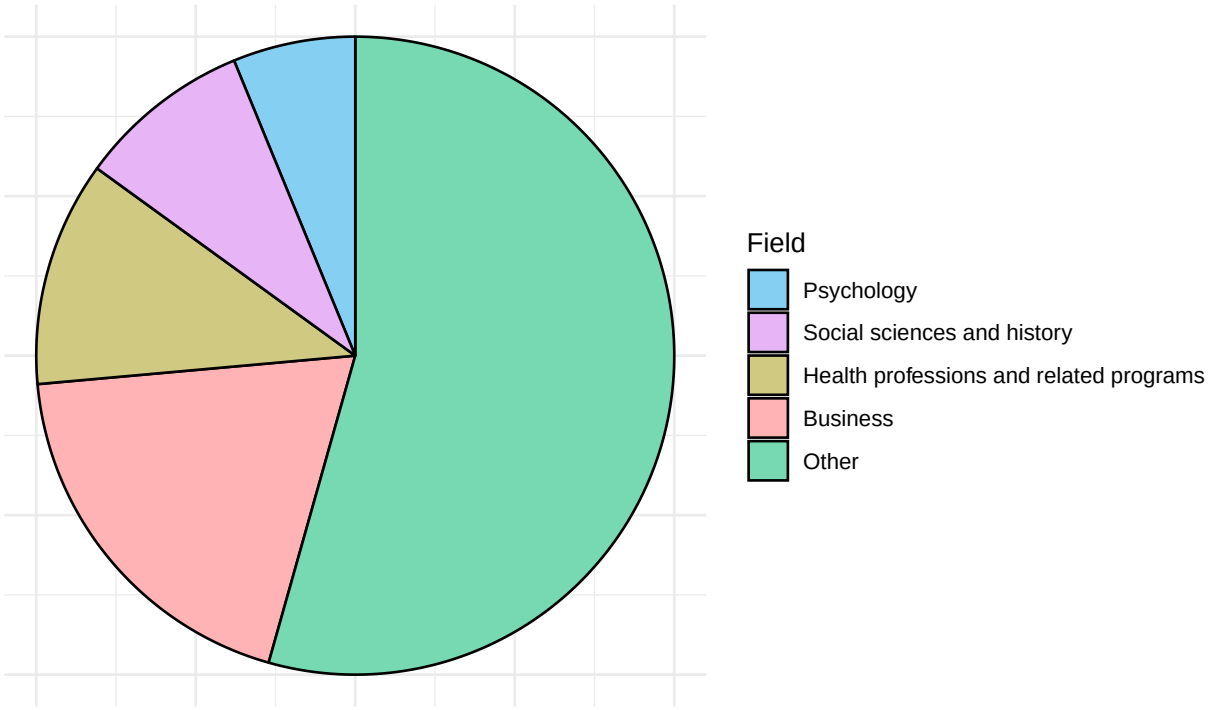
```
# data preparation
top_four <- BA_degrees_2015$field[1:4]  # works because we sorted by perc in Problem 1
BA_degrees_lumped <- BA_degrees_2015 %>%
  mutate(field = ifelse(field %in% top_four, field, "Other")) %>%
  group_by(field) %>%
  summarize(perc = sum(perc))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
# order the field
BA_degrees_lumped <- BA_degrees_lumped %>% arrange(desc(perc))

ggplot(BA_degrees_lumped) +
  aes(
    x0 = 0, y0 = 0, # position of pie center
    r0 = 0, r = 1,  # inner and outer radius
    amount = perc, # size of pie slices
    fill = field
  ) +
  geom_arc_bar(stat = "pie") +
```

```
  coord_fixed() +
  labs(x = NULL, y = NULL) +
  scale_fill_discrete_qualitative(palette = "Set 3", name = 'Field',
                                  breaks = BA_degrees_lumped$field) +
  # reorder the legend
  guides(fill = guide_legend(reverse = TRUE)) +
  theme_minimal() +
  theme(axis.text.x=element_blank(), axis.text.y=element_blank())
```

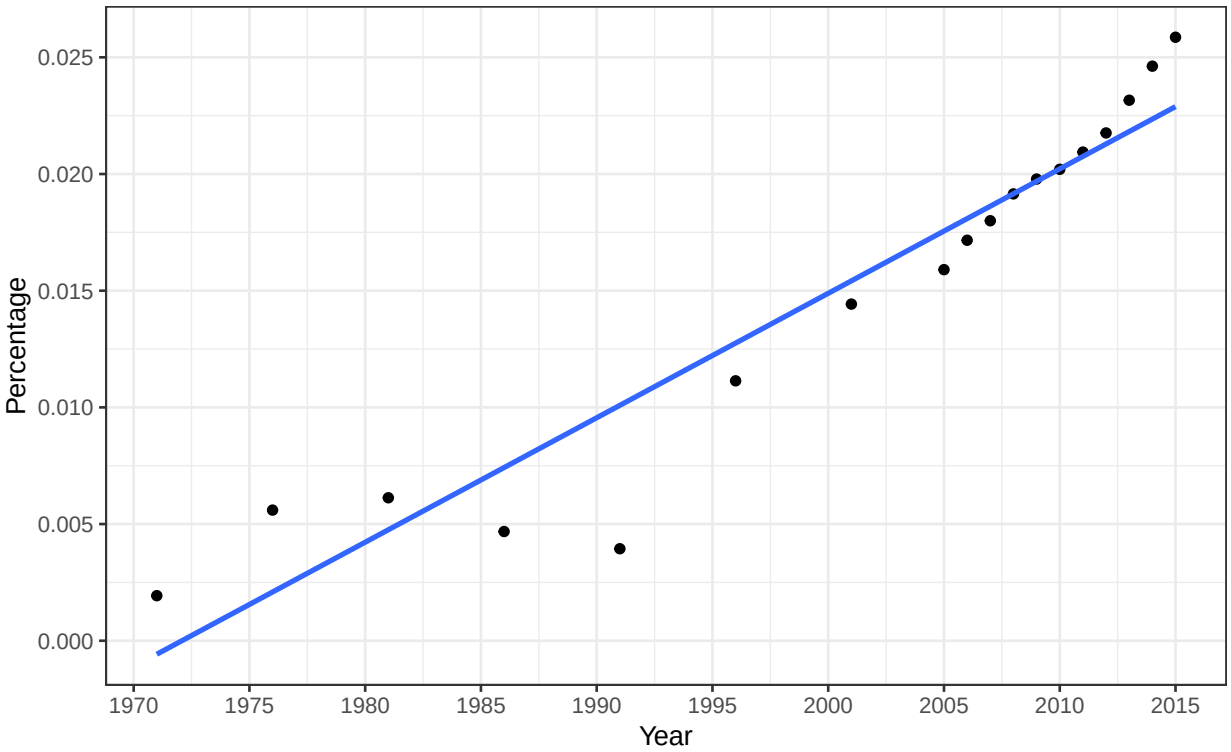



**Problem 3: (2 pts)** Now go back to the entire dataset `BA_degrees` but focus only on the degree field `"Parks, recreation, leisure, and fitness studies"`. Plot a time series of the proportion of degrees (colum `perc`) in this field over time. Also plot a straight line fit to the data. What do you observe?

```
# only look at the field of Parks, recreation, leisure, and fitness studies
BA_degrees_park <- BA_degrees %>%
  filter(field == 'Parks, recreation, leisure, and fitness studies')

ggplot(BA_degrees_park, aes(x = year, y = perc)) + geom_point() +
  geom_smooth(method = 'lm', se = FALSE) +
  scale_x_continuous(name = 'Year', breaks = seq(1970, 2015, by = 5)) +
  scale_y_continuous(name = 'Percentage', breaks = seq(0, 0.03, by = 0.005)) +
  theme_bw()
```

```
## `geom_smooth()` using formula 'y ~ x'
```




*The proportion of degrees in the field of Parks, recreation, leisure, and fitness studies grows rapidly over time from 1970 to 2015. However, before 1996, the proportion of degrees of this field remained low, and the rapid growth starts in 1996.*