Lab 3

Math 241, Week 3

```
libs <- c('tidyverse','knitr','viridis', 'mosaic', 'Lahman', "readr", "dplyr", "tidyr", "ggplot2")
for(l in libs){
  if(!require(l,character.only = TRUE, quietly = TRUE)){
    message( sprintf('Did not have the required package << %s >> installed. Downloading now ... ',l))
    install.packages(l)
  }
  library(l, character.only = TRUE, quietly = TRUE)
}
```

```
data_science <- read_csv(file = "data/jobs_in_data.csv", show_col_types = FALSE)
dim(data_science)
```

```
## [1] 9355   12
```

```
data_science$job_title <- as.factor(data_science$job_title)
data_science$experience_level <- as.factor(data_science$experience_level)
data_science$employment_type <- as.factor(data_science$employment_type)
data_science$work_setting <- as.factor(data_science$work_setting)
data_science$company_size <- as.factor(data_science$company_size)


model <- lm(salary ~ job_title + experience_level + employment_type + work_setting + company_size, data

# Summarize the model
summary(model)
```

```
##
## Call:
## lm(formula = salary ~ job_title + experience_level + employment_type +
##     work_setting + company_size, data = data_science)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -168172  -35547   -4480   29442  346253
##
## Coefficients:
##                                                 Estimate Std. Error t value
## (Intercept)                                       159452      21343   7.471
## job_titleAI Developer                             -68886      19915  -3.459
## job_titleAI Engineer                              -63921      17779  -3.595
## job_titleAI Programmer                           -118422      28466  -4.160
## job_titleAI Research Engineer                    -130522      30818  -4.235
## job_titleAI Scientist                             -81106      19957  -4.064
## job_titleAnalytics Engineer                       -87465      15750  -5.553
## job_titleAnalytics Engineering Manager            118403      55646   2.128
## job_titleApplied Data Scientist                   -87930      22314  -3.941
```

```
## job_titleApplied Machine Learning Engineer          -77593      34465  -2.251
## job_titleApplied Machine Learning Scientist         -92927      21932  -4.237
## job_titleApplied Scientist                          -47880      15752  -3.040
## job_titleAutonomous Vehicle Technician              -67025      41882  -1.600
## job_titleAWS Data Architect                          59246      55533   1.067
## job_titleAzure Data Engineer                        -83581      40825  -2.047
## job_titleBI Analyst                                 -95138      18305  -5.197
## job_titleBI Data Analyst                           -119281      20424  -5.840
## job_titleBI Data Engineer                          -129334      55548  -2.328
## job_titleBI Developer                              -118456      17082  -6.935
## job_titleBig Data Architect                        -100424      40767  -2.463
## job_titleBig Data Engineer                         -102550      24438  -4.196
## job_titleBusiness Data Analyst                     -118087      20026  -5.897
## job_titleBusiness Intelligence Analyst             -109963      17023  -6.460
## job_titleBusiness Intelligence Data Analyst         -80218      40805  -1.966
## job_titleBusiness Intelligence Developer           -133117      20101  -6.622
## job_titleBusiness Intelligence Engineer             -91558      16039  -5.709
## job_titleBusiness Intelligence Manager              -72327      40743  -1.775
## job_titleBusiness Intelligence Specialist           -88074      30786  -2.861
## job_titleCloud Data Architect                        43403      55646   0.780
## job_titleCloud Data Engineer                        -46790      30886  -1.515
## job_titleCloud Database Engineer                    -87534      28383  -3.084
## job_titleCompliance Data Analyst                   -135761      40841  -3.324
## job_titleComputer Vision Engineer                   -52078      18758  -2.776
## job_titleComputer Vision Software Engineer          -86764      28579  -3.036
## job_titleConsultant Data Engineer                   -83447      57237  -1.458
## job_titleData Analyst                              -123459      15466  -7.983
## job_titleData Analytics Consultant                  -66494      41696  -1.595
## job_titleData Analytics Engineer                   -138241      28405  -4.867
## job_titleData Analytics Lead                        -24402      34419  -0.709
## job_titleData Analytics Manager                     -84105      17665  -4.761
## job_titleData Analytics Specialist                 -155688      40711  -3.824
## job_titleData Architect                             -79551      15822  -5.028
## job_titleData Developer                            -118042      26674  -4.425
## job_titleData DevOps Engineer                      -105818      40972  -2.583
## job_titleData Engineer                              -92575      15435  -5.998
## job_titleData Infrastructure Engineer               -34859      21770  -1.601
## job_titleData Integration Engineer                 -126249      40718  -3.101
## job_titleData Integration Specialist                -95304      22990  -4.146
## job_titleData Lead                                  -69556      21013  -3.310
## job_titleData Management Analyst                   -133334      40808  -3.267
## job_titleData Management Specialist                -142755      28374  -5.031
## job_titleData Manager                              -125302      16090  -7.788
## job_titleData Modeler                              -116428      19134  -6.085
## job_titleData Modeller                             -146266      40736  -3.591
## job_titleData Operations Analyst                   -147829      22828  -6.476
## job_titleData Operations Engineer                  -100191      20368  -4.919
## job_titleData Operations Manager                   -108249      40718  -2.659
## job_titleData Operations Specialist                -173652      30784  -5.641
## job_titleData Product Manager                       -98707      24338  -4.056
## job_titleData Product Owner                        -141266      40736  -3.468
## job_titleData Quality Analyst                      -148423      19476  -7.621
## job_titleData Quality Engineer                     -122686      34440  -3.562
## job_titleData Science Consultant                   -124682      17376  -7.175
```

```
## job_titleData Science Director                          -72334      30962  -2.336
## job_titleData Science Engineer                          -85243      20985  -4.062
## job_titleData Science Lead                              -55236      19494  -2.833
## job_titleData Science Manager                           -41361      16403  -2.522
## job_titleData Science Practitioner                     -106208      22829  -4.652
## job_titleData Science Tech Lead                         168403      55646   3.026
## job_titleData Scientist                                 -81648      15440  -5.288
## job_titleData Scientist Lead                            -68675      40794  -1.683
## job_titleData Specialist                               -124962      17560  -7.116
## job_titleData Strategist                               -145218      19872  -7.308
## job_titleData Strategy Manager                         -105499      30786  -3.427
## job_titleData Visualization Analyst                    -130688      40711  -3.210
## job_titleData Visualization Engineer                   -127713      30778  -4.150
## job_titleData Visualization Specialist                 -128413      30778  -4.172
## job_titleDecision Scientist                             -79202      17658  -4.485
## job_titleDeep Learning Engineer                         -25564      21777  -1.174
## job_titleDeep Learning Researcher                      -127115      55512  -2.290
## job_titleDirector of Data Science                       -39486      18510  -2.133
## job_titleETL Developer                                 -115538      19872  -5.814
## job_titleETL Engineer                                  -148577      40743  -3.647
## job_titleFinance Data Analyst                           -78060      34756  -2.246
## job_titleFinancial Data Analyst                         -88596      30878  -2.869
## job_titleHead of Data                                   -54492      18172  -2.999
## job_titleHead of Data Science                           -76306      22464  -3.397
## job_titleHead of Machine Learning                       -14334      40851  -0.351
## job_titleInsight Analyst                               -172031      24374  -7.058
## job_titleLead Data Analyst                             -104874      34476  -3.042
## job_titleLead Data Engineer                             -68016      26850  -2.533
## job_titleLead Data Scientist                            -93446      24431  -3.825
## job_titleLead Machine Learning Engineer                -144802      34446  -4.204
## job_titleMachine Learning Developer                    -105120      24501  -4.290
## job_titleMachine Learning Engineer                      -56780      15486  -3.667
## job_titleMachine Learning Infrastructure Engineer       -85465      18500  -4.620
## job_titleMachine Learning Manager                       -75943      30802  -2.465
## job_titleMachine Learning Modeler                       -77338      40711  -1.900
## job_titleMachine Learning Operations Engineer          -175676      55516  -3.164
## job_titleMachine Learning Research Engineer            -122864      30870  -3.980
## job_titleMachine Learning Researcher                    -72914      20151  -3.618
## job_titleMachine Learning Scientist                     -59485      16568  -3.590
## job_titleMachine Learning Software Engineer             -29623      21343  -1.388
## job_titleMachine Learning Specialist                   -152327      40743  -3.739
## job_titleManager Data Management                       -110676      55516  -1.994
## job_titleManaging Director Data Science                  41677      55618   0.749
## job_titleMarketing Data Analyst                         -84858      40793  -2.080
## job_titleMarketing Data Engineer                        -61682      55674  -1.108
## job_titleML Engineer                                    -36567      16247  -2.251
## job_titleMLOps Engineer                                 -83701      22278  -3.757
## job_titleNLP Engineer                                   -93296      21806  -4.278
## job_titlePower BI Developer                            -138754      55533  -2.499
## job_titlePrincipal Data Analyst                         -85684      40783  -2.101
## job_titlePrincipal Data Engineer                        -84725      34416  -2.462
## job_titlePrincipal Data Scientist                       -47378      22897  -2.069
## job_titlePrincipal Machine Learning Engineer            -44316      34478  -1.285
## job_titleProduct Data Analyst                          -108702      28568  -3.805
```

```
## job_titleResearch Analyst                          -134003      17616  -7.607
## job_titleResearch Engineer                          -54289      16027  -3.387
## job_titleResearch Scientist                         -50092      15735  -3.183
## job_titleSales Data Analyst                        -161536      57226  -2.823
## job_titleSoftware Data Engineer                     -77570      34940  -2.220
## job_titleStaff Data Analyst                        -116636      34768  -3.355
## job_titleStaff Data Scientist                       -99095      41383  -2.395
## job_titleStaff Machine Learning Engineer            -30170      55661  -0.542
## experience_levelExecutive                            77562       4474  17.335
## experience_levelMid-level                            17993       2845   6.325
## experience_levelSenior                               54915       2694  20.382
## employment_typeFreelance                            -64661      22183  -2.915
## employment_typeFull-time                             -7771      13987  -0.556
## employment_typePart-time                             -5886      19672  -0.299
## work_settingIn-person                                35518       4465   7.954
## work_settingRemote                                   29079       4470   6.505
## company_sizeM                                         8573       2419   3.544
## company_sizeS                                       -26635       5006  -5.321
##                                                   Pr(>|t|)
## (Intercept)                                       8.68e-14 ***
## job_titleAI Developer                             0.000545 ***
## job_titleAI Engineer                              0.000326 ***
## job_titleAI Programmer                            3.21e-05 ***
## job_titleAI Research Engineer                     2.31e-05 ***
## job_titleAI Scientist                             4.86e-05 ***
## job_titleAnalytics Engineer                       2.88e-08 ***
## job_titleAnalytics Engineering Manager            0.033383 *
## job_titleApplied Data Scientist                   8.19e-05 ***
## job_titleApplied Machine Learning Engineer        0.024387 *
## job_titleApplied Machine Learning Scientist       2.29e-05 ***
## job_titleApplied Scientist                        0.002376 **
## job_titleAutonomous Vehicle Technician            0.109558
## job_titleAWS Data Architect                       0.286057
## job_titleAzure Data Engineer                      0.040656 *
## job_titleBI Analyst                               2.07e-07 ***
## job_titleBI Data Analyst                          5.39e-09 ***
## job_titleBI Data Engineer                         0.019916 *
## job_titleBI Developer                             4.35e-12 ***
## job_titleBig Data Architect                       0.013783 *
## job_titleBig Data Engineer                        2.74e-05 ***
## job_titleBusiness Data Analyst                    3.84e-09 ***
## job_titleBusiness Intelligence Analyst            1.10e-10 ***
## job_titleBusiness Intelligence Data Analyst       0.049340 *
## job_titleBusiness Intelligence Developer          3.73e-11 ***
## job_titleBusiness Intelligence Engineer           1.17e-08 ***
## job_titleBusiness Intelligence Manager            0.075901 .
## job_titleBusiness Intelligence Specialist         0.004235 **
## job_titleCloud Data Architect                     0.435426
## job_titleCloud Data Engineer                      0.129833
## job_titleCloud Database Engineer                  0.002048 **
## job_titleCompliance Data Analyst                  0.000890 ***
## job_titleComputer Vision Engineer                 0.005510 **
## job_titleComputer Vision Software Engineer        0.002405 **
## job_titleConsultant Data Engineer                 0.144897
```

```
## job_titleData Analyst                              1.60e-15 ***
## job_titleData Analytics Consultant                 0.110800
## job_titleData Analytics Engineer                   1.15e-06 ***
## job_titleData Analytics Lead                       0.478357
## job_titleData Analytics Manager                    1.96e-06 ***
## job_titleData Analytics Specialist                 0.000132 ***
## job_titleData Architect                            5.05e-07 ***
## job_titleData Developer                            9.74e-06 ***
## job_titleData DevOps Engineer                      0.009819 **
## job_titleData Engineer                             2.08e-09 ***
## job_titleData Infrastructure Engineer              0.109353
## job_titleData Integration Engineer                 0.001937 **
## job_titleData Integration Specialist               3.42e-05 ***
## job_titleData Lead                                 0.000936 ***
## job_titleData Management Analyst                   0.001090 **
## job_titleData Management Specialist                4.97e-07 ***
## job_titleData Manager                              7.56e-15 ***
## job_titleData Modeler                              1.21e-09 ***
## job_titleData Modeller                             0.000332 ***
## job_titleData Operations Analyst                   9.92e-11 ***
## job_titleData Operations Engineer                  8.84e-07 ***
## job_titleData Operations Manager                   0.007862 **
## job_titleData Operations Specialist                1.74e-08 ***
## job_titleData Product Manager                      5.04e-05 ***
## job_titleData Product Owner                        0.000527 ***
## job_titleData Quality Analyst                      2.77e-14 ***
## job_titleData Quality Engineer                     0.000369 ***
## job_titleData Science Consultant                   7.77e-13 ***
## job_titleData Science Director                     0.019499 *
## job_titleData Science Engineer                     4.90e-05 ***
## job_titleData Science Lead                         0.004615 **
## job_titleData Science Manager                      0.011699 *
## job_titleData Science Practitioner                 3.33e-06 ***
## job_titleData Science Tech Lead                    0.002483 **
## job_titleData Scientist                            1.26e-07 ***
## job_titleData Scientist Lead                       0.092322 .
## job_titleData Specialist                           1.19e-12 ***
## job_titleData Strategist                           2.94e-13 ***
## job_titleData Strategy Manager                     0.000613 ***
## job_titleData Visualization Analyst                0.001331 **
## job_titleData Visualization Engineer               3.36e-05 ***
## job_titleData Visualization Specialist             3.04e-05 ***
## job_titleDecision Scientist                        7.37e-06 ***
## job_titleDeep Learning Engineer                    0.240482
## job_titleDeep Learning Researcher                  0.022053 *
## job_titleDirector of Data Science                  0.032928 *
## job_titleETL Developer                             6.30e-09 ***
## job_titleETL Engineer                              0.000267 ***
## job_titleFinance Data Analyst                      0.024731 *
## job_titleFinancial Data Analyst                    0.004125 **
## job_titleHead of Data                              0.002719 **
## job_titleHead of Data Science                      0.000685 ***
## job_titleHead of Machine Learning                  0.725671
## job_titleInsight Analyst                           1.81e-12 ***
```

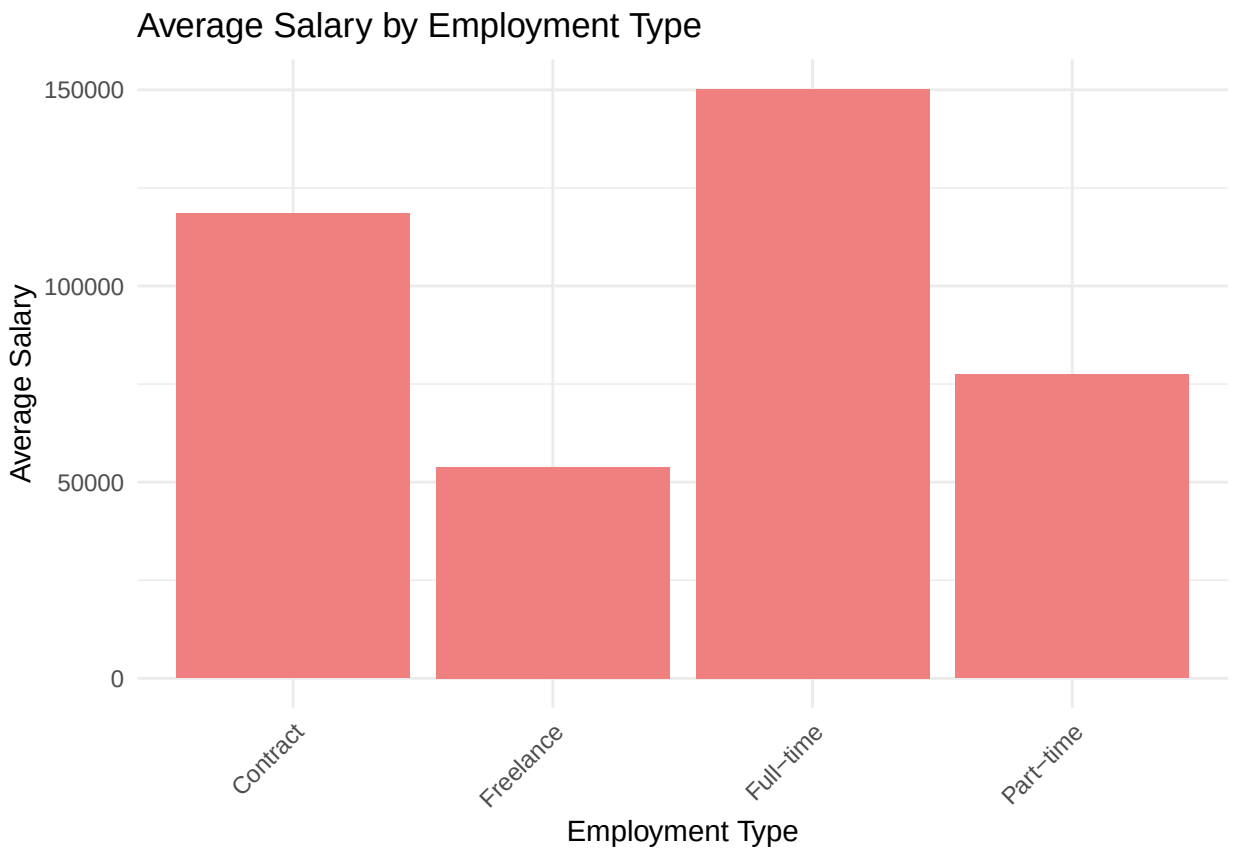
```
## job_titleLead Data Analyst                          0.002357 **
## job_titleLead Data Engineer                         0.011320 *
## job_titleLead Data Scientist                        0.000132 ***
## job_titleLead Machine Learning Engineer             2.65e-05 ***
## job_titleMachine Learning Developer                 1.80e-05 ***
## job_titleMachine Learning Engineer                  0.000247 ***
## job_titleMachine Learning Infrastructure Engineer 3.89e-06 ***
## job_titleMachine Learning Manager                   0.013700 *
## job_titleMachine Learning Modeler                   0.057509 .
## job_titleMachine Learning Operations Engineer       0.001559 **
## job_titleMachine Learning Research Engineer         6.95e-05 ***
## job_titleMachine Learning Researcher                0.000298 ***
## job_titleMachine Learning Scientist                 0.000332 ***
## job_titleMachine Learning Software Engineer         0.165185
## job_titleMachine Learning Specialist                0.000186 ***
## job_titleManager Data Management                    0.046227 *
## job_titleManaging Director Data Science             0.453670
## job_titleMarketing Data Analyst                     0.037533 *
## job_titleMarketing Data Engineer                    0.267930
## job_titleML Engineer                                0.024425 *
## job_titleMLOps Engineer                             0.000173 ***
## job_titleNLP Engineer                               1.90e-05 ***
## job_titlePower BI Developer                         0.012486 *
## job_titlePrincipal Data Analyst                     0.035671 *
## job_titlePrincipal Data Engineer                    0.013843 *
## job_titlePrincipal Data Scientist                   0.038561 *
## job_titlePrincipal Machine Learning Engineer        0.198696
## job_titleProduct Data Analyst                       0.000143 ***
## job_titleResearch Analyst                           3.08e-14 ***
## job_titleResearch Engineer                          0.000709 ***
## job_titleResearch Scientist                         0.001460 **
## job_titleSales Data Analyst                         0.004771 **
## job_titleSoftware Data Engineer                     0.026435 *
## job_titleStaff Data Analyst                         0.000798 ***
## job_titleStaff Data Scientist                       0.016660 *
## job_titleStaff Machine Learning Engineer            0.587807
## experience_levelExecutive                            < 2e-16 ***
## experience_levelMid-level                           2.65e-10 ***
## experience_levelSenior                               < 2e-16 ***
## employment_typeFreelance                            0.003567 **
## employment_typeFull-time                            0.578535
## employment_typePart-time                            0.764772
## work_settingIn-person                               2.02e-15 ***
## work_settingRemote                                  8.18e-11 ***
## company_sizeM                                       0.000396 ***
## company_sizeS                                       1.06e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 53300 on 9220 degrees of freedom
## Multiple R-squared:  0.308,  Adjusted R-squared:  0.2979
## F-statistic: 30.62 on 134 and 9220 DF,  p-value: < 2.2e-16
```

```r
exp_salary <- data_science %>%
  group_by(experience_level) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))

employment_salary <- data_science %>%
  group_by(employment_type) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))

work_salary <- data_science %>%
  group_by(work_setting) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))

company_salary <- data_science %>%
  group_by(company_size) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))
```

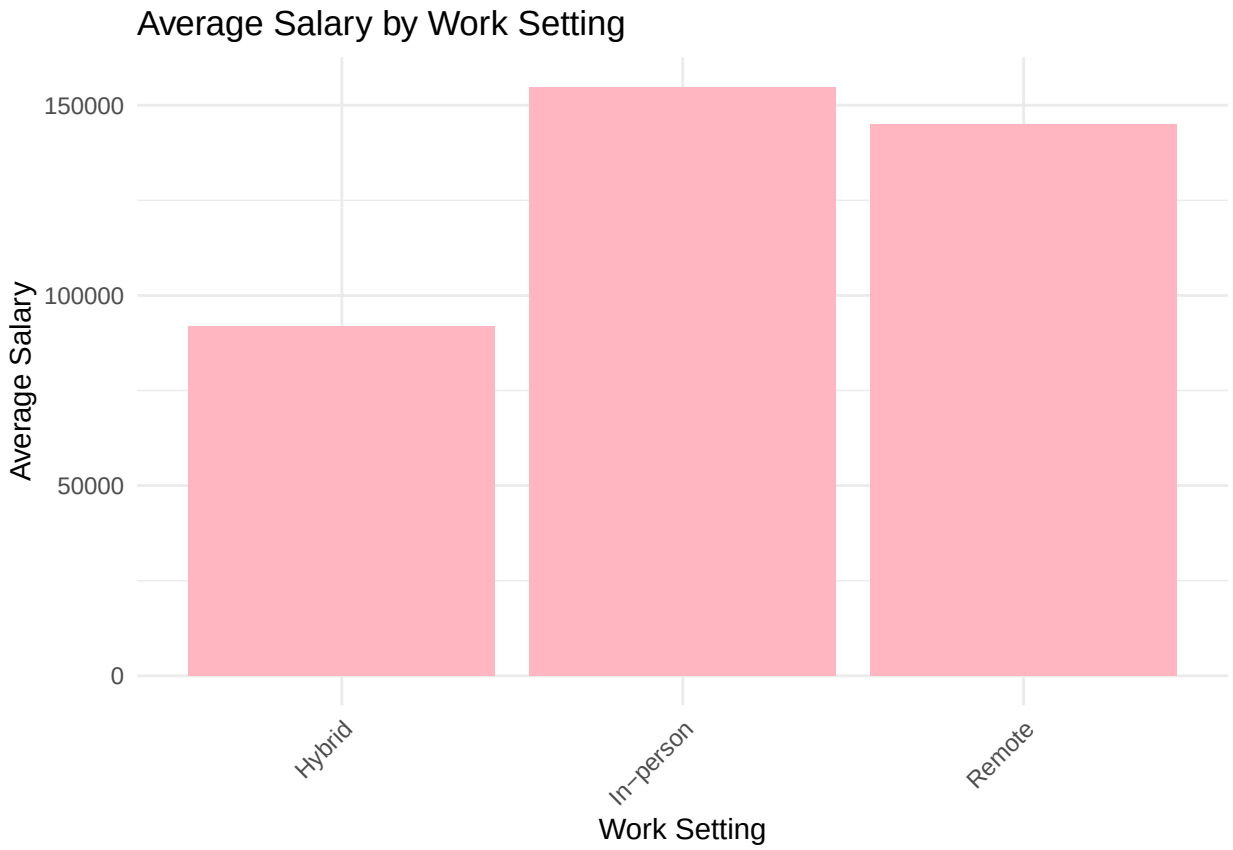
```r
#  experience level
ggplot(data = exp_salary, aes(x = experience_level, y = avg_salary)) +
  geom_bar(stat = "identity", fill = "lightgreen") +
  theme_minimal() +
  labs(title = "Average Salary by Experience Level",
       x = "Experience Level",
       y = "Average Salary")
```


```r
# employment type
ggplot(data = employment_salary, aes(x = employment_type, y = avg_salary)) +
  geom_bar(stat = "identity", fill = "lightcoral") +
```

```
  theme_minimal() +
  labs(title = "Average Salary by Employment Type",
       x = "Employment Type",
       y = "Average Salary") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




```
#  work setting
ggplot(data = work_salary, aes(x = work_setting, y = avg_salary, levels = c("Remote", "Hybrid", "In-Pers
  geom_bar(stat = "identity", fill = "lightpink") +
  theme_minimal() +
  labs(title = "Average Salary by Work Setting",
       x = "Work Setting",
       y = "Average Salary") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

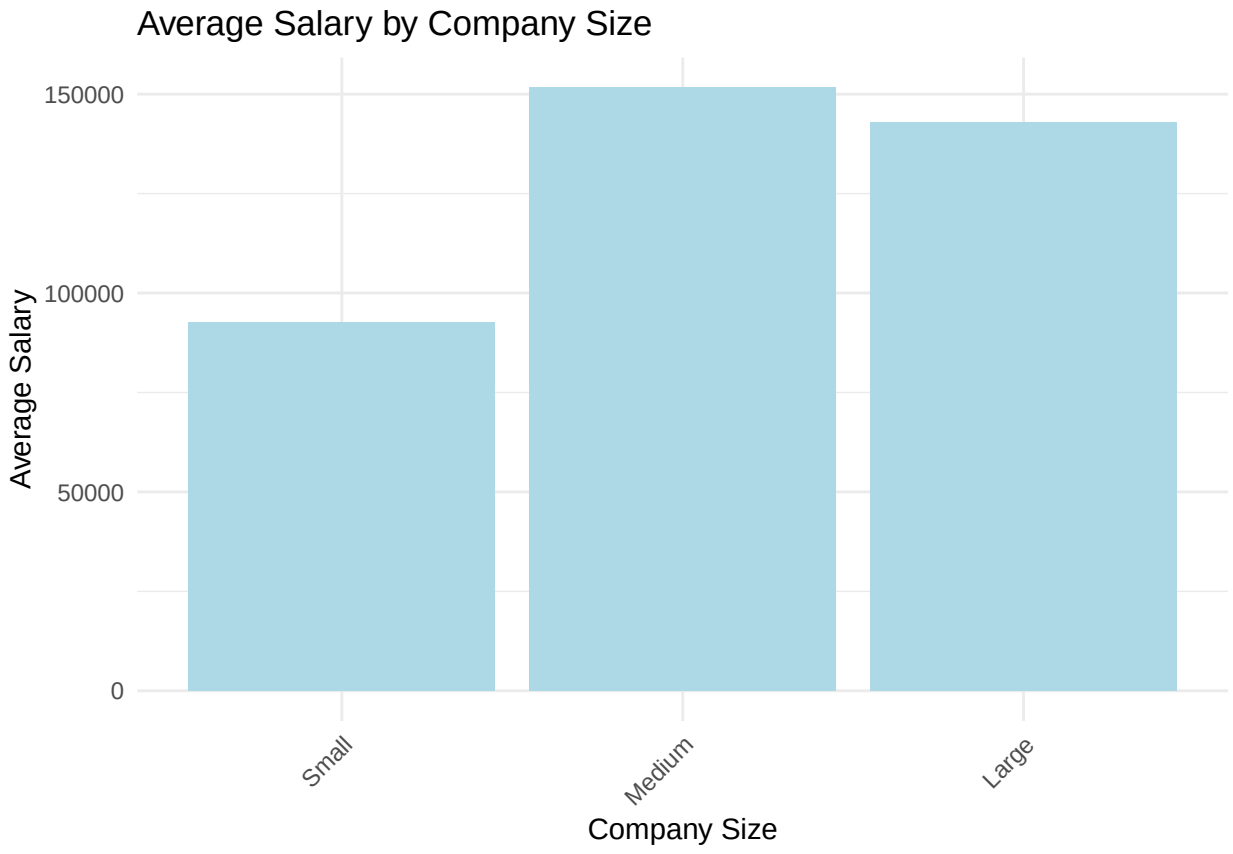



```
  scale_x_discrete(labels = c("Remote" = "Remote", "Hybrid" = "Hybrid", "In-Person" = "In-Person"))
```

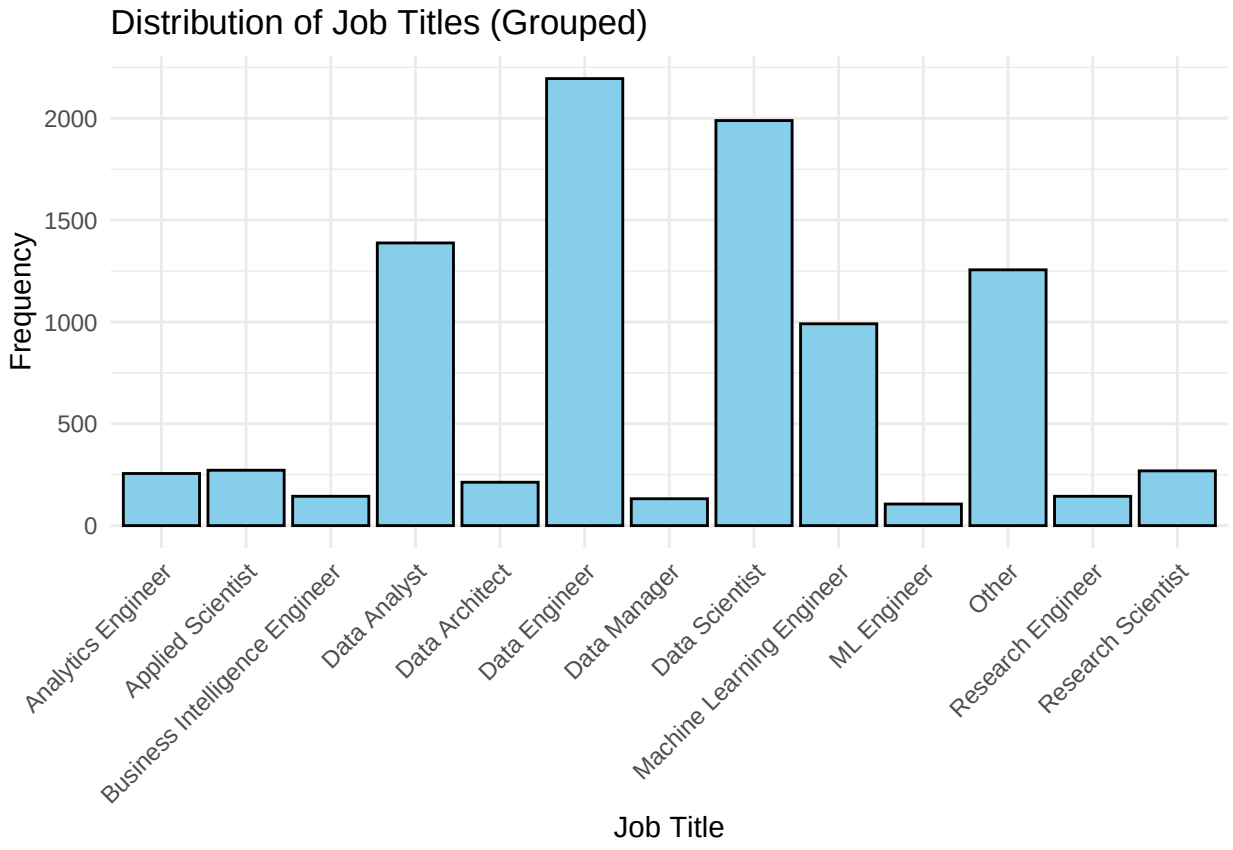
```
## <ggproto object: Class ScaleDiscretePosition, ScaleDiscrete, Scale, gg>
##     aesthetics: x xmin xmax xend
##     axis_order: function
##     break_info: function
##     break_positions: function
##     breaks: waiver
##     call: call
##     clone: function
##     dimension: function
##     drop: TRUE
##     expand: waiver
##     get_breaks: function
##     get_breaks_minor: function
##     get_labels: function
##     get_limits: function
##     guide: waiver
##     is_discrete: function
##     is_empty: function
##     labels: Remote Hybrid In-Person
##     limits: NULL
##     make_sec_title: function
##     make_title: function
##     map: function
##     map_df: function
##     n.breaks.cache: NULL
```

```
##     na.translate: TRUE
##     na.value: NA
##     name: waiver
##     palette: function
##     palette.cache: NULL
##     position: bottom
##     range: environment
##     range_c: environment
##     rescale: function
##     reset: function
##     scale_name: position_d
##     train: function
##     train_df: function
##     transform: function
##     transform_df: function
##     super:  <ggproto object: Class ScaleDiscretePosition, ScaleDiscrete, Scale, gg>
```

```r
# company size
ggplot(data = company_salary, aes(x = factor(company_size, levels = c("S", "M", "L")), y = avg_salary))
  geom_bar(stat = "identity", fill = "lightblue") +
  theme_minimal() +
  labs(title = "Average Salary by Company Size",
       x = "Company Size",
       y = "Average Salary") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_x_discrete(labels = c("S" = "Small", "M" = "Medium", "L" = "Large"))
```

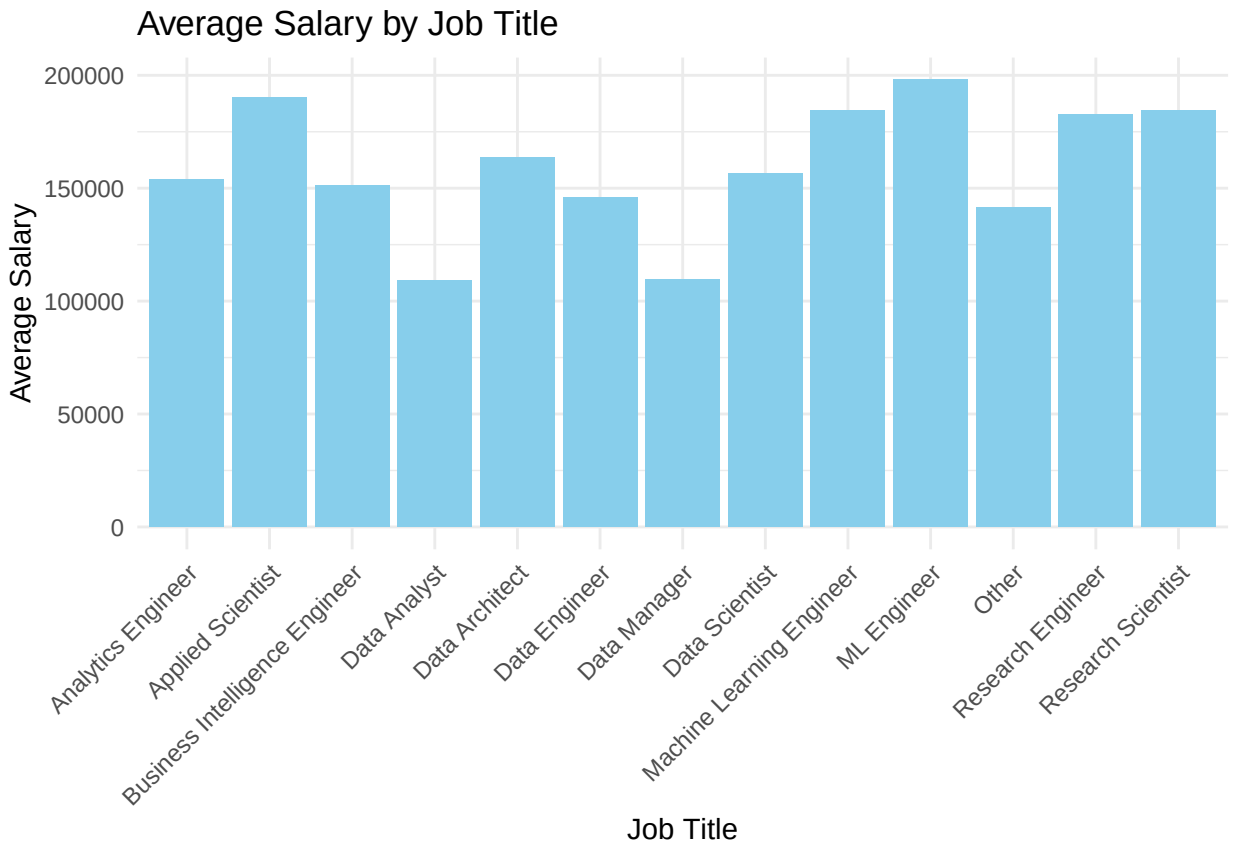


```r
# gets ride of extra titles
job_title_counts <- data_science %>%
  count(job_title)

other_jobs <- job_title_counts %>%
  filter(n < 100) %>%
  pull(job_title)

data_science_grouped <- data_science %>%
  mutate(job_title_grouped = if_else(job_title %in% other_jobs, "Other", job_title))

#frequency of titles
ggplot(data = data_science_grouped, aes(x = job_title_grouped)) +
  geom_bar(fill = "skyblue", color = "black") +
  theme_minimal() +
  labs(title = "Distribution of Job Titles (Grouped)",
       x = "Job Title",
       y = "Frequency") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```




```r
avg_salary_by_job <- data_science_grouped %>%
  group_by(job_title_grouped) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))

ggplot(data = avg_salary_by_job, aes(x = job_title_grouped, y = avg_salary)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  theme_minimal() +
```

```
  labs(title = "Average Salary by Job Title",
       x = "Job Title",
       y = "Average Salary") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



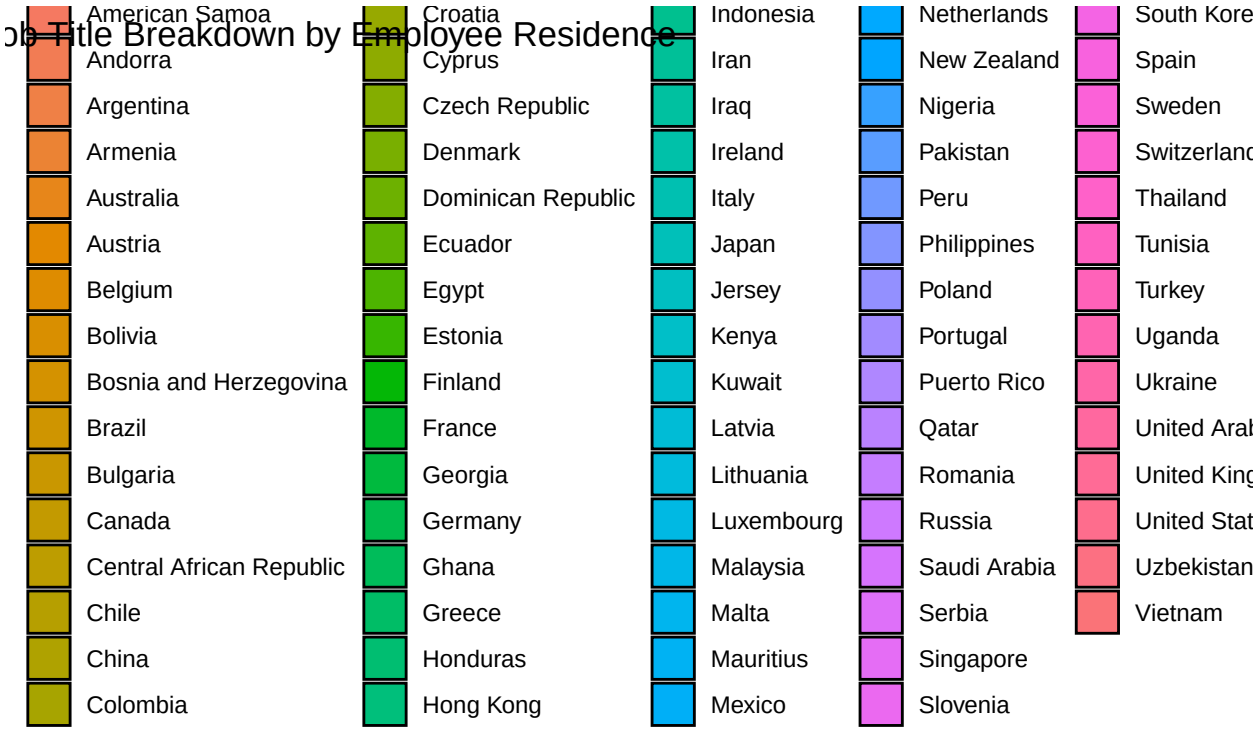

```
data_science$job_title <- as.factor(data_science$job_title)
data_science$experience_level <- as.factor(data_science$experience_level)
data_science$employment_type <- as.factor(data_science$employment_type)
data_science$work_setting <- as.factor(data_science$work_setting)
data_science$company_size <- as.factor(data_science$company_size)


model <- lm(salary ~  experience_level + employment_type + work_setting + company_size, data = data_sci

# Summarize the model
summary(model)
```

```
##
## Call:
## lm(formula = salary ~ experience_level + employment_type + work_setting +
##     company_size, data = data_science)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -178045  -39821   -6821   34339  330596
##
## Coefficients:
```

```
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   78609      14281   5.504 3.80e-08 ***
## experience_levelExecutive     94133       4416  21.315  < 2e-16 ***
## experience_levelMid-level     21998       3013   7.301 3.08e-13 ***
## experience_levelSenior        66910       2820  23.727  < 2e-16 ***
## employment_typeFreelance     -62647      22173  -2.825  0.00473 **
## employment_typeFull-time      -8202      13559  -0.605  0.54524
## employment_typePart-time      -9770      20293  -0.481  0.63020
## work_settingIn-person         32231       4626   6.967 3.45e-12 ***
## work_settingRemote            23104       4642   4.977 6.58e-07 ***
## company_sizeM                 -3727       2332  -1.598  0.11011
## company_sizeS                -29022       5202  -5.579 2.49e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 58450 on 9344 degrees of freedom
## Multiple R-squared:  0.1567, Adjusted R-squared:  0.1558
## F-statistic: 173.6 on 10 and 9344 DF,  p-value: < 2.2e-16
```

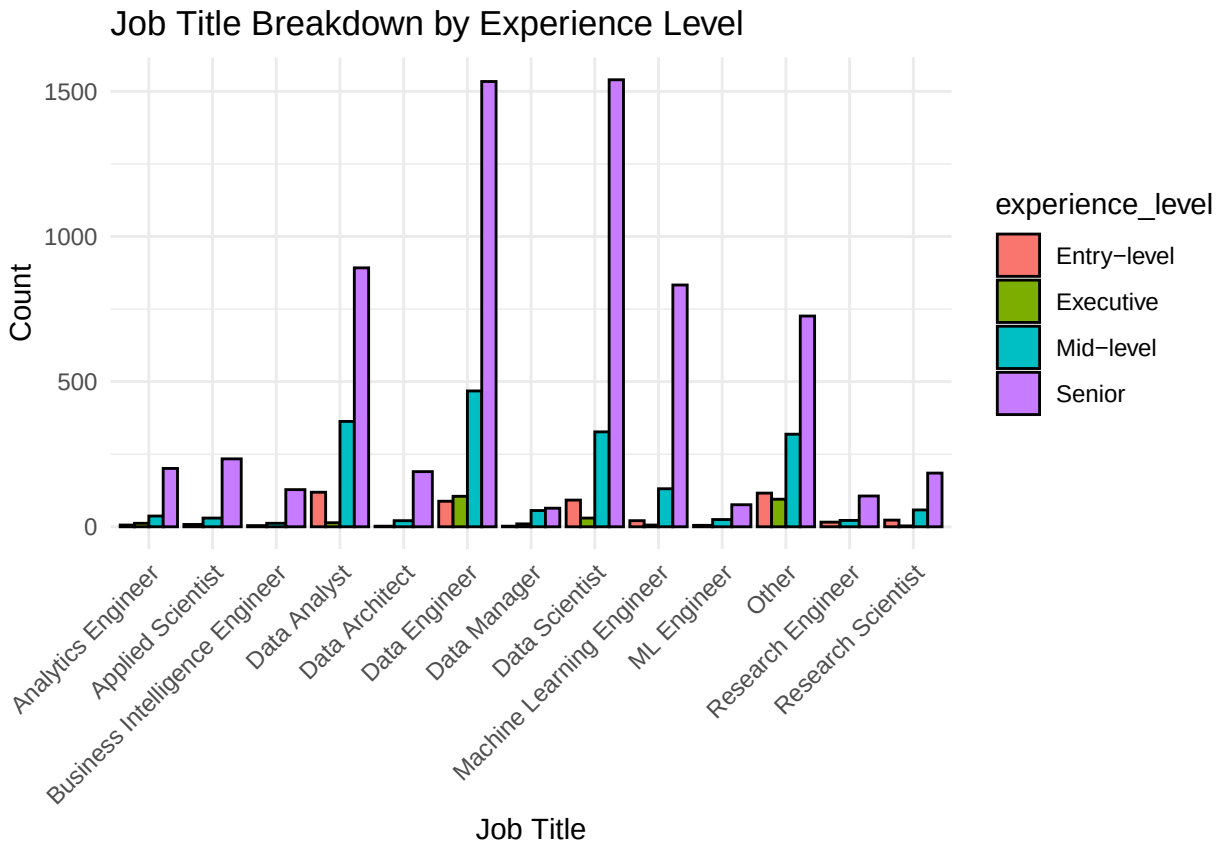
Q2

```r
# Plotting the breakdown of job titles by employee residence
ggplot(data = data_science_grouped, aes(x = job_title_grouped, fill = employee_residence)) +
  geom_bar(position = "dodge", color = "black") +
  theme_minimal() +
  labs(title = "Job Title Breakdown by Employee Residence",
       x = "Job Title",
       y = "Count") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

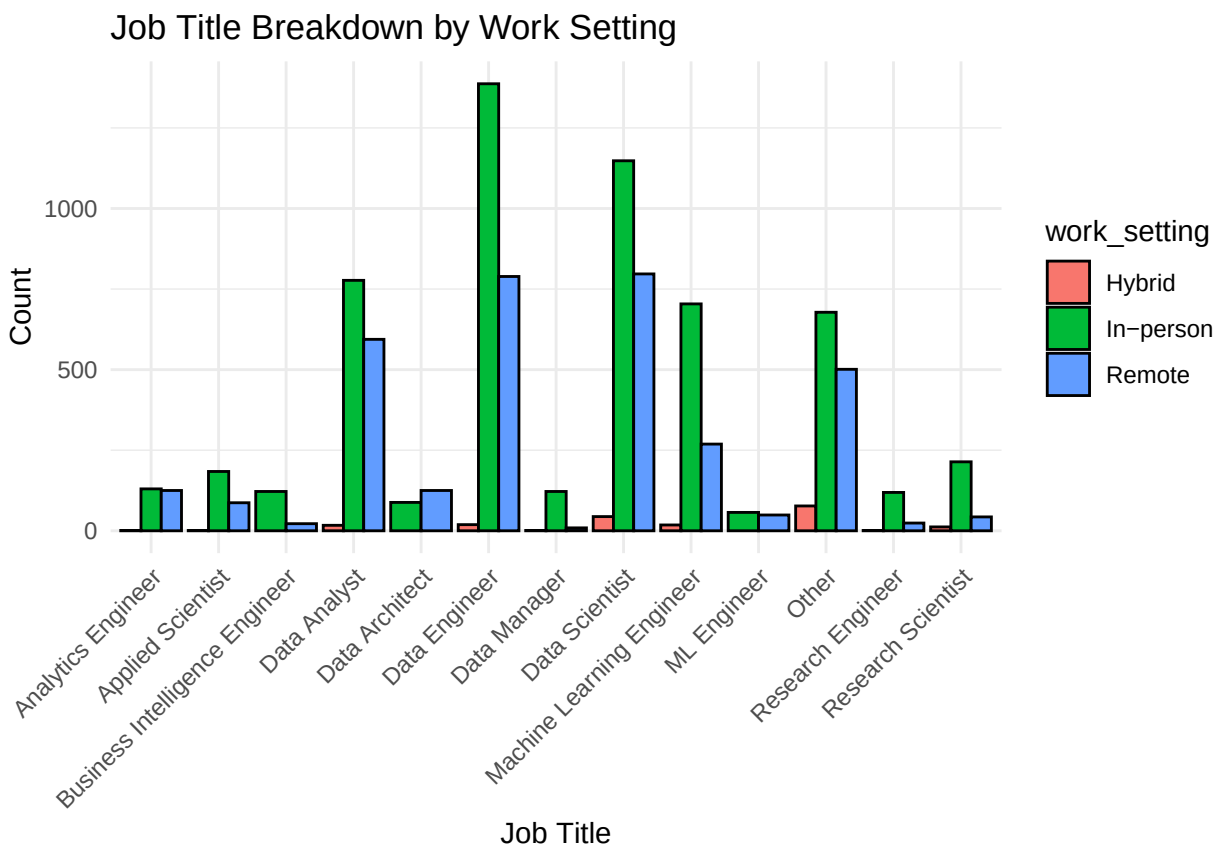


tle

```
# Plotting the breakdown of job titles by experience level
ggplot(data = data_science_grouped, aes(x = job_title_grouped, fill = experience_level)) +
  geom_bar(position = "dodge", color = "black") +
  theme_minimal() +
  labs(title = "Job Title Breakdown by Experience Level",
       x = "Job Title",
       y = "Count") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

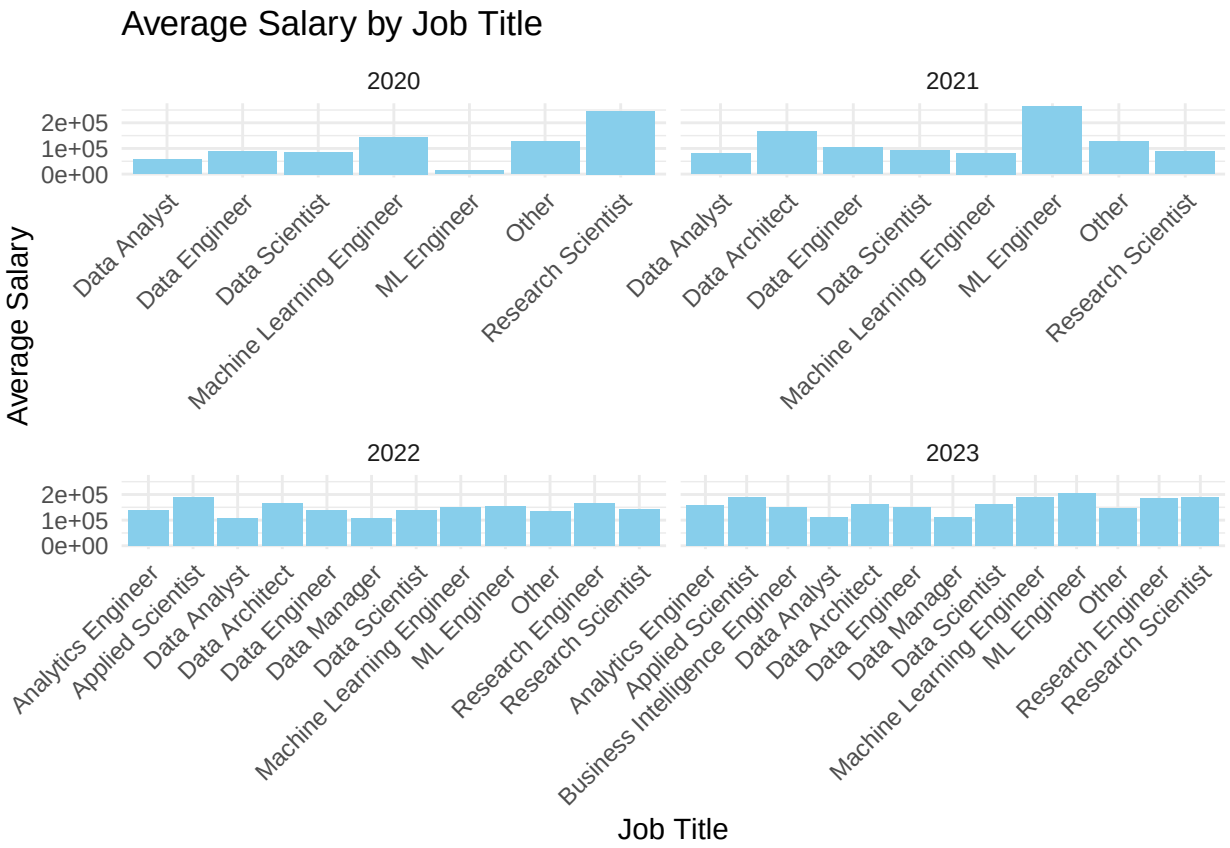



```r
# Plotting the breakdown of job titles by work setting
ggplot(data = data_science_grouped, aes(x = job_title_grouped, fill = work_setting)) +
  geom_bar(position = "dodge", color = "black") +
  theme_minimal() +
  labs(title = "Job Title Breakdown by Work Setting",
       x = "Job Title",
       y = "Count") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



Q3

```
avg_salary_by_job_year <- data_science_grouped %>%
  group_by(job_title_grouped, work_year) %>%
  summarize(avg_salary = mean(salary, na.rm = TRUE))

ggplot(data = avg_salary_by_job_year, aes(x = job_title_grouped, y = avg_salary)) +
  geom_bar(stat = "identity", fill = "skyblue") +
  theme_minimal() +
  labs(title = "Average Salary by Job Title",
       x = "Job Title",
       y = "Average Salary") +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  facet_wrap(~work_year, scales = "free_x", ncol = 2)
```


Average Salary by Job Title
2020
2021
2022
2023
2e+05
1e+05
0e+00
Average Salary
Data Analyst
Data Engineer
Data Scientist
Machine Learning Engineer
ML Engineer
Other
Research Scientist
Data Architect
Analytics Engineer
Applied Scientist
Business Intelligence Engineer
Data Manager
Research Engineer
Job Title