

# Rough Draft

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```
library(tidyverse)

## -- 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   2.1.2      v forcats 0.5.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
# IMPORTING DATASETS
tuition_cost <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/07/data/tuition_cost.csv')

## Rows: 2973 Columns: 10
## -- Column specification -----
## Delimiter: ","
## chr (5): name, state, state_code, type, degree_length
## dbl (5): room_and_board, in_state_tuition, in_state_total, out_of_state_tuit...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
tc = tuition_cost

tuition_income <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/07/data/tuition_income.csv')

## Rows: 209012 Columns: 7
## -- Column specification -----
## Delimiter: ","
## chr (4): name, state, campus, income_lvl
## dbl (3): total_price, year, net_cost
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
ti = tuition_income

salary_potential <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/07/data/salary_potential.csv')

## Rows: 935 Columns: 7
## -- Column specification -----
## Delimiter: ","
## chr (2): name, state_name
## dbl (5): rank, early_career_pay, mid_career_pay, make_world_better_percent, ...
```

```

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
sp = salary_potential

historical_tuition <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/07/data/historical_tuition.csv')

## Rows: 270 Columns: 4
## -- Column specification -----
## Delimiter: ","
## chr (3): type, year, tuition_type
## dbl (1): tuition_cost
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
ht = historical_tuition

diversity_school <- readr::read_csv('https://raw.githubusercontent.com/rfordatascience/tidytuesday/master/data/2020/07/data/diversity_school.csv')

## Rows: 50655 Columns: 5
## -- Column specification -----
## Delimiter: ","
## chr (3): name, state, category
## dbl (2): total_enrollment, enrollment
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
ds = diversity_school

tcFactored = tc %>%
  mutate(degFactor = as.factor(degree_length))
tcFactored

## # A tibble: 2,973 x 11
##   name      state state~1 type  degre~2 room_~3 in_st~4 in_st~5 out_o~6 out_o~7
##   <chr>    <chr> <chr>  <chr> <chr>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
## 1 Aaniiih ~ Mont~ MT      Publ~ 2 Year      NA      2380      2380      2380      2380
## 2 Abilene ~ Texas TX      Priv~ 4 Year    10350    34850    45200    34850    45200
## 3 Abraham ~ Geor~ GA      Publ~ 2 Year      8474      4128    12602    12550    21024
## 4 Academy ~ Minn~ MN      For ~ 2 Year      NA    17661    17661    17661    17661
## 5 Academy ~ Cali~ CA      For ~ 4 Year    16648    27810    44458    27810    44458
## 6 Adams St~ Colo~ CO      Publ~ 4 Year      8782      9440    18222    20456    29238
## 7 Adelphi ~ New ~ NY      Priv~ 4 Year    16030    38660    54690    38660    54690
## 8 Adironda~ New ~ NY      Publ~ 2 Year    11660      5375    17035      9935    21595
## 9 Adrian C~ Mich~ MI      Priv~ 4 Year    11318    37087    48405    37087    48405
## 10 Advanced~ Virg~ VA      For ~ 2 Year      NA    13680    13680    13680    13680
## # ... with 2,963 more rows, 1 more variable: degFactor <fct>, and abbreviated
## #   variable names 1: state_code, 2: degree_length, 3: room_and_board,
## #   4: in_state_tuition, 5: in_state_total, 6: out_of_state_tuition,
## #   7: out_of_state_total

gatheredtc = tcFactored %>%
  filter(type!='Other') %>%
  gather(key="in_out", value="totalCost",c(in_state_total,out_of_state_total))

```

```
gatheredtc
```

```
## # A tibble: 5,944 x 11
##   name      state state~1 type  degre~2 room_~3 in_st~4 out_o~5 degFa~6 in_out
##   <chr>      <chr> <chr>  <chr> <chr>      <dbl>    <dbl>    <dbl> <fct>    <chr>
## 1 Aaniiih N~ Mont~ MT      Publ~ 2 Year      NA      2380      2380 2 Year in_st~
## 2 Abilene C~ Texas TX      Priv~ 4 Year    10350    34850    34850 4 Year in_st~
## 3 Abraham B~ Geor~ GA      Publ~ 2 Year      8474     4128    12550 2 Year in_st~
## 4 Academy C~ Minn~ MN      For ~ 2 Year      NA     17661    17661 2 Year in_st~
## 5 Academy o~ Cali~ CA      For ~ 4 Year    16648    27810    27810 4 Year in_st~
## 6 Adams Sta~ Colo~ CO      Publ~ 4 Year      8782     9440    20456 4 Year in_st~
## 7 Adelphi U~ New ~ NY      Priv~ 4 Year    16030    38660    38660 4 Year in_st~
## 8 Adirondac~ New ~ NY      Publ~ 2 Year    11660     5375     9935 2 Year in_st~
## 9 Adrian Co~ Mich~ MI      Priv~ 4 Year    11318    37087    37087 4 Year in_st~
## 10 Advanced ~ Virg~ VA      For ~ 2 Year      NA     13680    13680 2 Year in_st~
## # ... with 5,934 more rows, 1 more variable: totalCost <dbl>, and abbreviated
## #   variable names 1: state_code, 2: degree_length, 3: room_and_board,
## #   4: in_state_tuition, 5: out_of_state_tuition, 6: degFactor
```

```
str(tcFactored)
```

```
## tibble [2,973 x 11] (S3: tbl_df/tbl/data.frame)
##  $ name      : chr [1:2973] "Aaniiih Nakoda College" "Abilene Christian University" "Abraham Christian University" ...
##  $ state      : chr [1:2973] "Montana" "Texas" "Georgia" "Minnesota" ...
##  $ state_code : chr [1:2973] "MT" "TX" "GA" "MN" ...
##  $ type       : chr [1:2973] "Public" "Private" "Public" "For Profit" ...
##  $ degree_length : chr [1:2973] "2 Year" "4 Year" "2 Year" "2 Year" ...
##  $ room_and_board : num [1:2973] NA 10350 8474 NA 16648 ...
##  $ in_state_tuition : num [1:2973] 2380 34850 4128 17661 27810 ...
##  $ in_state_total   : num [1:2973] 2380 45200 12602 17661 44458 ...
##  $ out_of_state_tuition: num [1:2973] 2380 34850 12550 17661 27810 ...
##  $ out_of_state_total : num [1:2973] 2380 45200 21024 17661 44458 ...
##  $ degFactor       : Factor w/ 3 levels "2 Year","4 Year",...: 1 2 1 1 2 2 2 1 2 1 ...
```

```
head(tcFactored)
```

```
## # A tibble: 6 x 11
##   name      state state~1 type  degre~2 room_~3 in_st~4 in_st~5 out_o~6 out_o~7
##   <chr>      <chr> <chr>  <chr> <chr>      <dbl>    <dbl>    <dbl>    <dbl>
## 1 Aaniiih N~ Mont~ MT      Publ~ 2 Year      NA      2380      2380      2380
## 2 Abilene C~ Texas TX      Priv~ 4 Year    10350    34850    45200    34850    45200
## 3 Abraham B~ Geor~ GA      Publ~ 2 Year      8474     4128    12602    12550    21024
## 4 Academy C~ Minn~ MN      For ~ 2 Year      NA     17661    17661    17661
## 5 Academy o~ Cali~ CA      For ~ 4 Year    16648    27810    44458    27810    44458
## 6 Adams Sta~ Colo~ CO      Publ~ 4 Year      8782     9440    18222    20456    29238
## # ... with 1 more variable: degFactor <fct>, and abbreviated variable names
## #   1: state_code, 2: degree_length, 3: room_and_board, 4: in_state_tuition,
## #   5: in_state_total, 6: out_of_state_tuition, 7: out_of_state_total
```

```
# Time to explore the data!
```

```
table(gatheredtc$state_code,gatheredtc$degFactor)
```

```
##
##      2 Year 4 Year Other
## AK         2    10     0
## AL        42    66     0
```

##	AR	48	44	0
##	AS	2	0	0
##	AZ	46	22	0
##	CA	238	270	0
##	CO	36	40	0
##	CT	28	44	0
##	DC	0	16	0
##	DE	8	10	0
##	FL	66	110	0
##	GA	58	100	0
##	GU	2	0	0
##	HI	16	12	0
##	IA	36	68	0
##	ID	8	18	0
##	IL	104	146	0
##	IN	36	88	0
##	KS	50	54	0
##	KY	30	58	0
##	LA	16	52	0
##	MA	42	144	0
##	MD	32	58	0
##	ME	18	36	0
##	MI	60	96	0
##	MN	66	76	0
##	MO	46	100	0
##	MS	30	34	0
##	MT	22	22	0
##	NC	118	116	0
##	ND	18	18	0
##	NE	20	46	0
##	NH	14	28	0
##	NJ	42	66	0
##	NM	28	20	0
##	NV	8	12	0
##	NY	116	326	0
##	OH	94	160	0
##	OK	30	50	0
##	OR	30	50	0
##	PA	62	258	0
##	PR	12	70	0
##	RI	2	20	0
##	SC	46	68	0
##	SD	10	26	0
##	TN	34	90	0
##	TX	134	164	0
##	UT	8	20	0
##	VA	60	98	0
##	VI	0	2	0
##	VT	6	32	0
##	WA	66	54	0
##	WI	62	72	0
##	WV	18	42	0
##	WY	14	2	0

```

bystate = gatheredtc %>%
  group_by(state) %>%
  mutate(freq = n()) %>%
  summarize(numSchools = sum(freq)) %>%
  mutate(prop=numSchools/sum(numSchools)) %>%
  arrange(desc(prop))
bystate

```

```

## # A tibble: 51 x 3
##   state      numSchools  prop
##   <chr>          <int>  <dbl>
## 1 California    258064 0.211
## 2 New York      195364 0.159
## 3 Pennsylvania  102400 0.0835
## 4 Texas         88804 0.0724
## 5 Ohio          64516 0.0526
## 6 Illinois      62500 0.0510
## 7 North Carolina 54756 0.0447
## 8 Massachusetts 34596 0.0282
## 9 Florida       30976 0.0253
## 10 Georgia      24964 0.0204
## # ... with 41 more rows

```

This table shows that California has a very high number of schools proportional to other states in the country.

```
prop.table(table(gatheredtc$degFactor))
```

```

##
##   2 Year   4 Year   Other
## 0.3768506 0.6231494 0.0000000

```

```
table(gatheredtc$state)
```

```

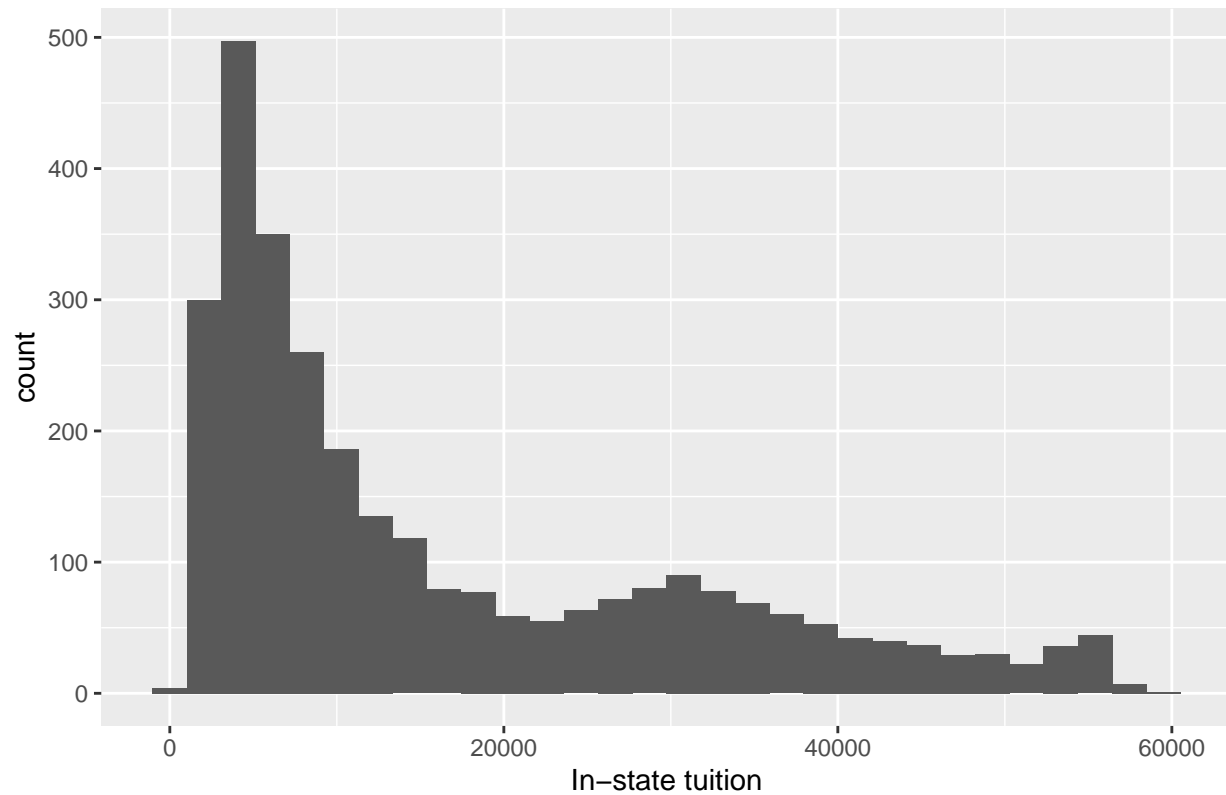
##
##   Alabama   Alaska   Arizona   Arkansas   California
##      108       12       68       92       508
##   Colorado Connecticut Delaware   Florida   Georgia
##      76       72       18      176      158
##   Hawaii     Idaho    Illinois   Indiana    Iowa
##      28       26      250      124      104
##   Kansas     Kentucky Louisiana   Maine      Maryland
##     104       88       68       54       90
## Massachusetts Michigan Minnesota Mississippi Missouri
##     186      156      142       64      146
##   Montana   Nebraska   Nevada New Hampshire New Jersey
##      44       66       20       42      108
##   New Mexico New York North Carolina North Dakota Ohio
##      48      442      234       36      254
##   Oklahoma   Oregon   Pennsylvania Rhode Island South Carolina
##      80       80      320       22      114
##   South Dakota Tennessee Texas      Utah      Vermont
##      36      124      298       28       38
##   Virginia   Washington West Virginia Wisconsin Wyoming
##     158      120       60      134       16

```

```
ggplot(tcFactored, aes(x=in_state_tuition)) + geom_histogram() +
  ggtitle("Distribution of tuition charged by schools in the U.S.") +
  xlab("In-state tuition")
```

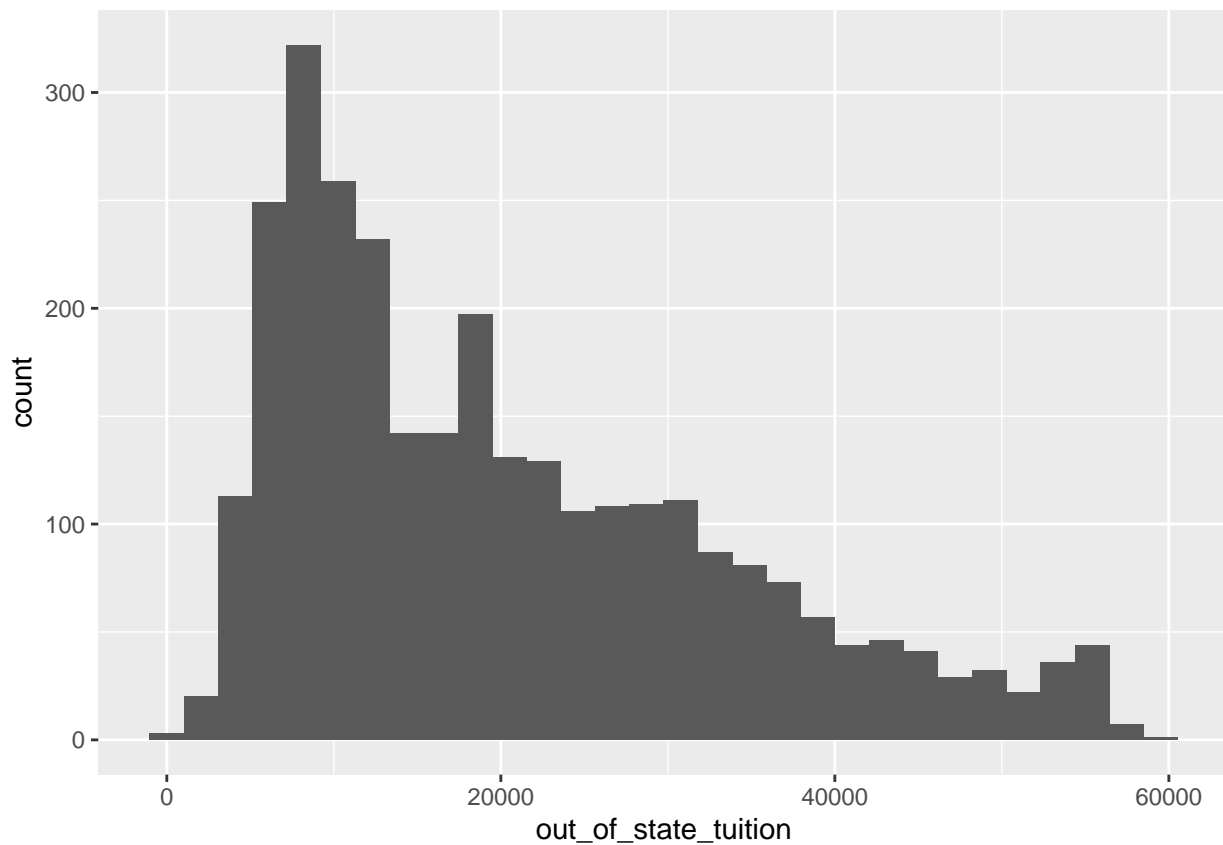
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

Distribution of tuition charged by schools in the U.S.



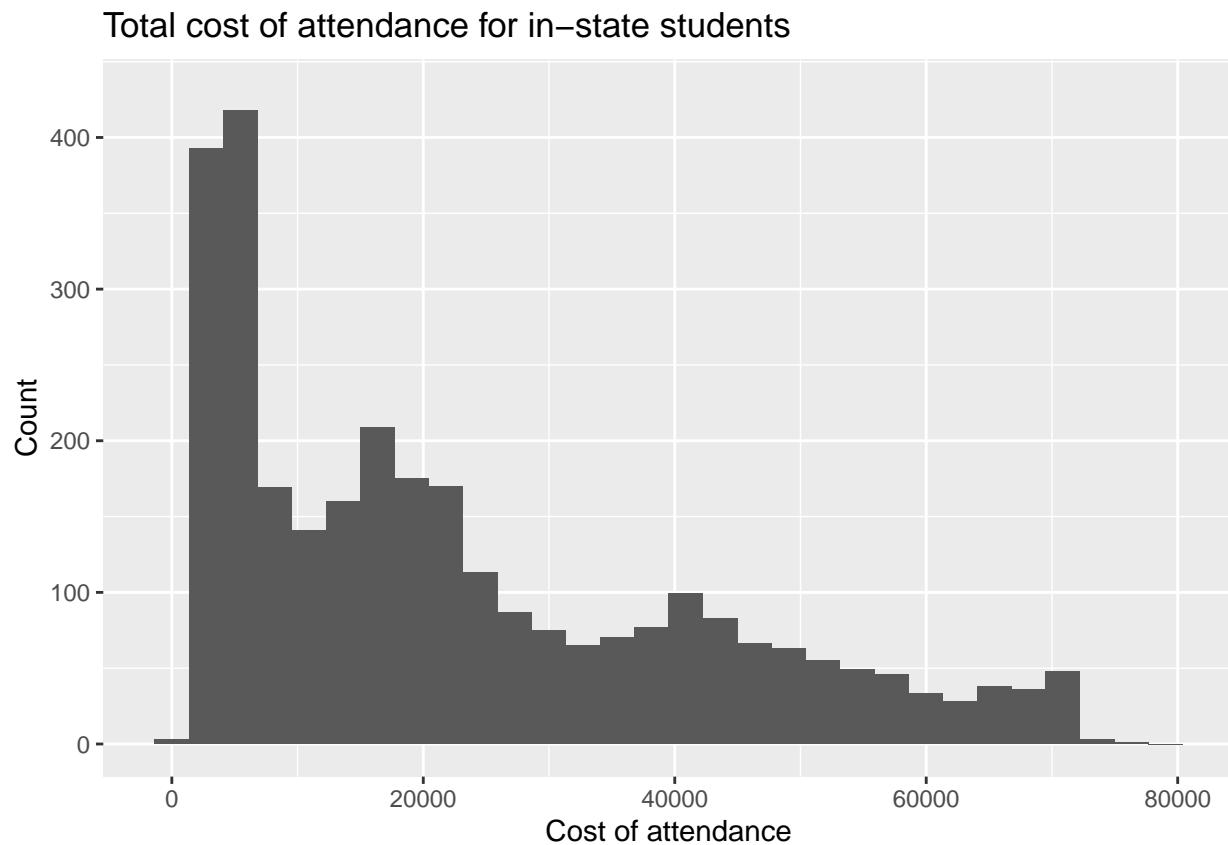
```
ggplot(tcFactored, aes(x=out_of_state_tuition))+geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



```
ggplot(tcFactored, aes(x=in_state_total))+geom_histogram()+expand_limits(x=80000,y=430) +
  ggtitle("Total cost of attendance for in-state students")+ # for the main title
  xlab("Cost of attendance")+ # for the x axis label
  ylab("Count") # for the y axis label
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

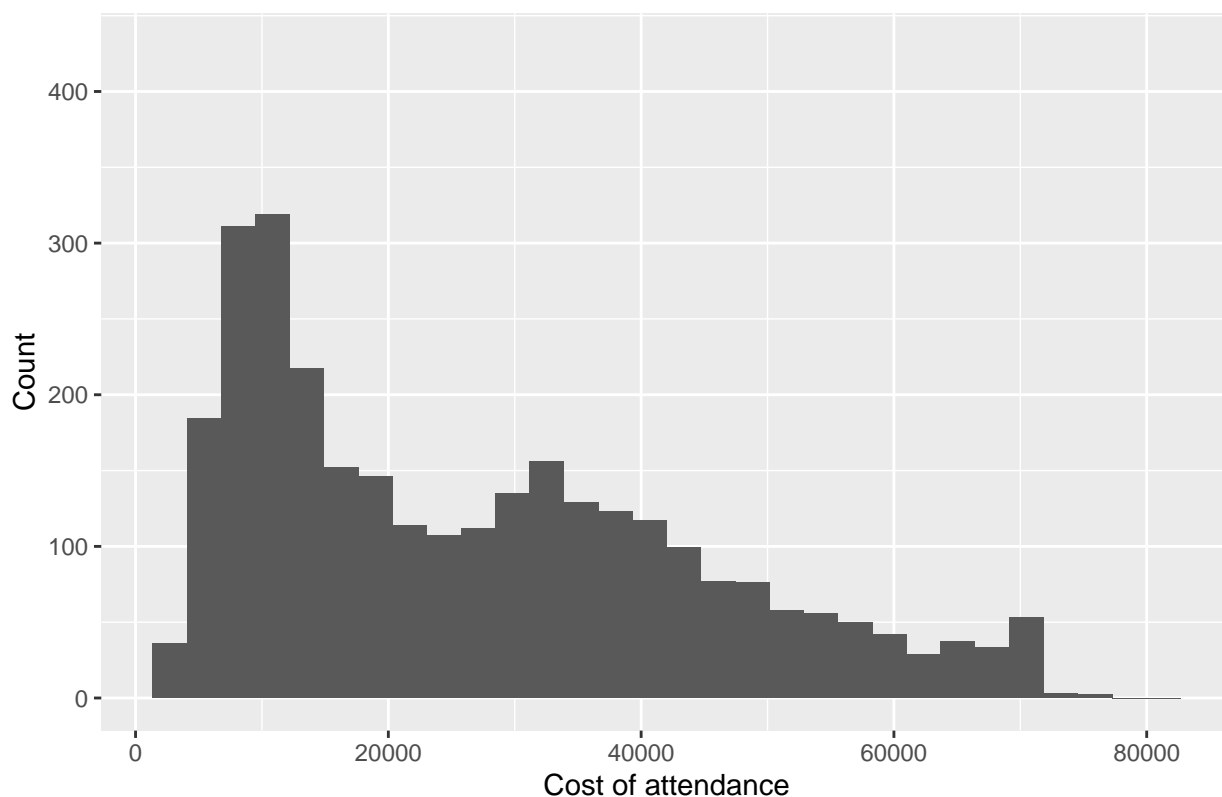


```
ggplot(tcFactored, aes(x=out_of_state_total))+geom_histogram()+expand_limits(x=80000,y=430) +  
  ggtitle("Total cost of attendance for out-of-state students")+ # for the main title  
  xlab("Cost of attendance")+ # for the x axis label  
  ylab("Count") # for the y axis label
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

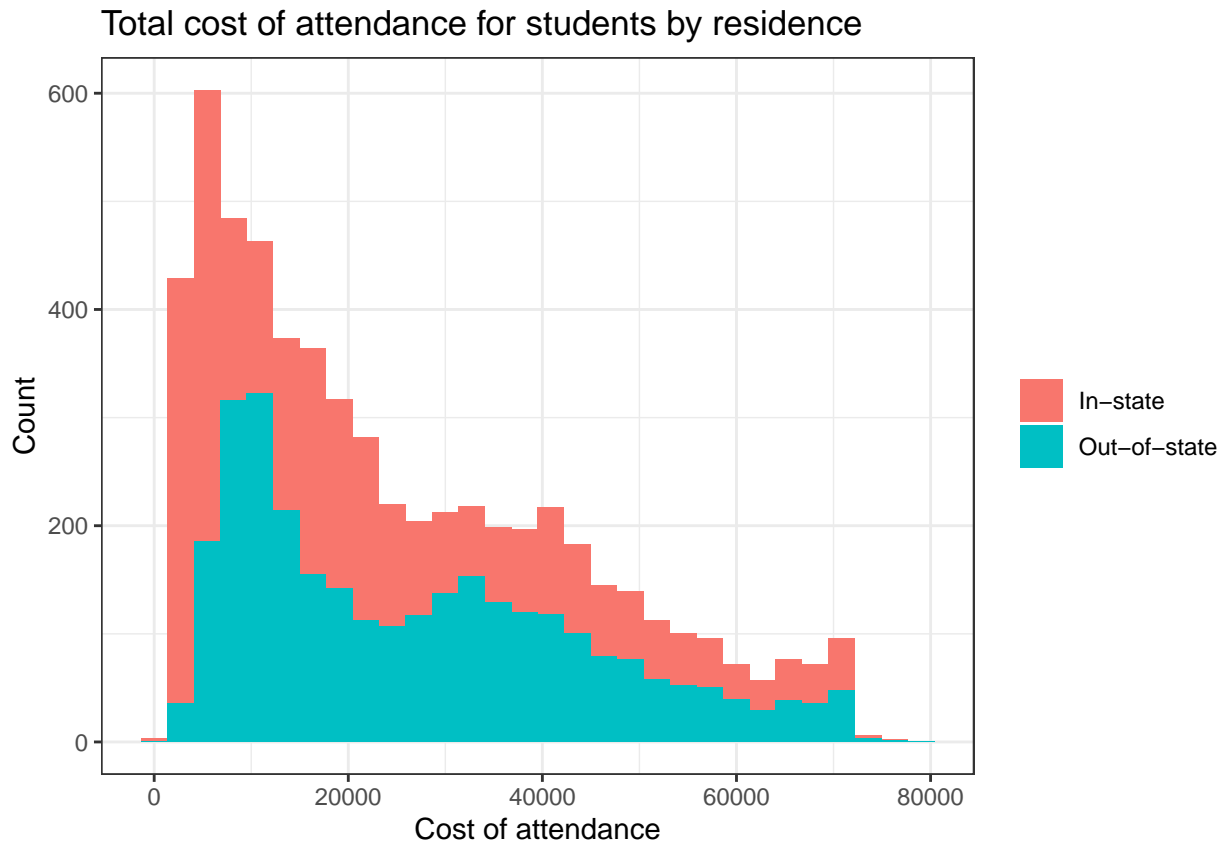


Total cost of attendance for out-of-state students



```
ggplot(gatheredtc, aes(x=totalCost,fill=in_out))+geom_histogram()+expand_limits(x=80000,y=430) +
  ggtitle("Total cost of attendance for students by residence")+ # for the main title
  xlab("Cost of attendance")+ # for the x axis label
  ylab("Count") + # for the y axis label
  theme_bw()+theme(
    legend.title = element_blank(),
  ) + scale_fill_discrete(name = "Student Residence", labels = c("In-state", "Out-of-state"))

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

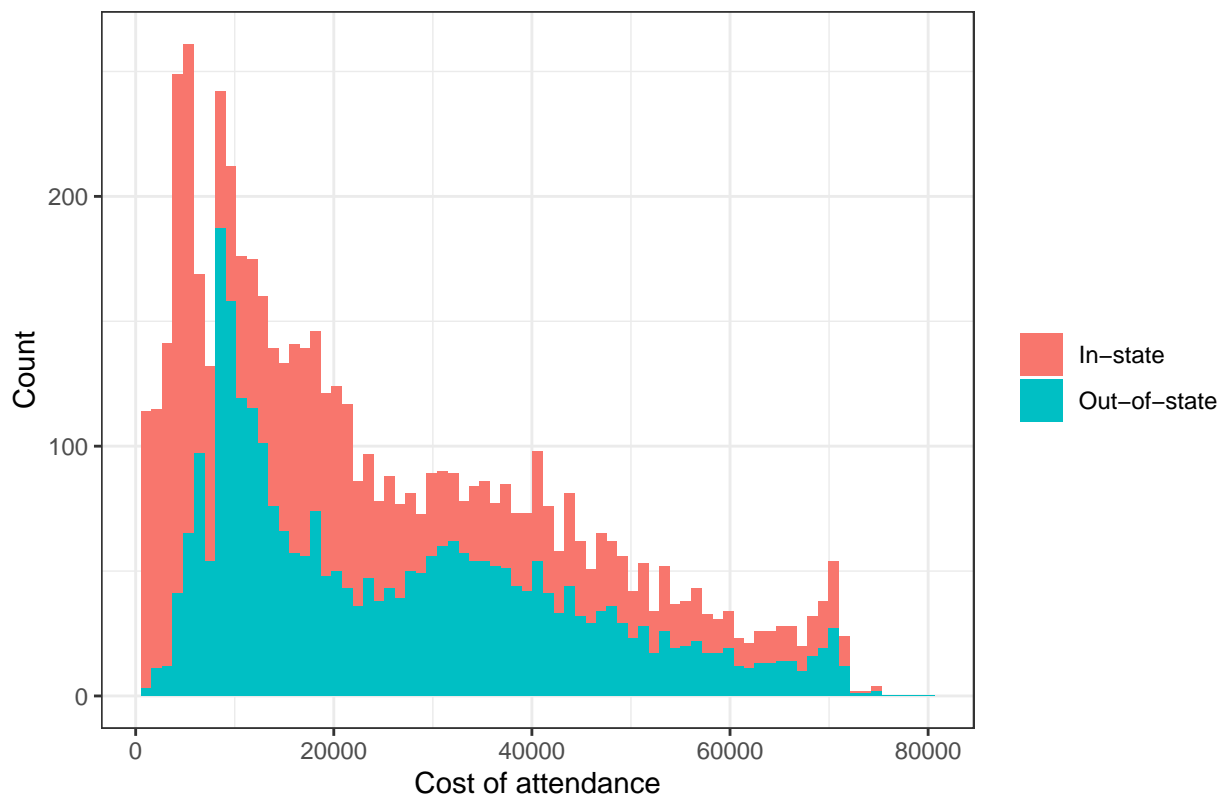


```
#ggtitle(label) # for the main title
#xlab(label) # for the x axis label
#ylab(label) # for the y axis label
#labs(...) # for the main title, axis labels and legend titles
```

As the above plots show, it's clear that the distributions are skewed to the right which means that expensive schools are generally less common. It's interesting to see that both of these seem to have similar shapes, and a hint of evidence for a slight bimodal distribution.

```
ggplot(gatheredtc, aes(x=totalCost,fill=in_out))+geom_histogram(bins=75)+expand_limits(x=80000) +
  ggtitle("Total cost of attendance for students by residence")+ # for the main title
  xlab("Cost of attendance")+ # for the x axis label
  ylab("Count") + # for the y axis label
  theme_bw()+theme(
    legend.title = element_blank(),
  ) + scale_fill_discrete(name = "Student Residence", labels = c("In-state", "Out-of-state"))
```

## Total cost of attendance for students by residence



Upon further inspection by increasing the bin number, the shape becomes more distinct. The second mode is mostly just a bump for the out-of-state group, but something interesting appears in the in-state group! Is there a cause for this disruption?

```
tcInStateSummr = tcFactored %>%
  group_by(degFactor) %>%
  summarize(median(in_state_total))

tcOutStateSummr = tcFactored %>%
  group_by(degFactor) %>%
  summarize(median(out_of_state_total))

tcInStateSummr
```

```
## # A tibble: 3 x 2
##   degFactor `median(in_state_total)`
##   <fct>          <dbl>
## 1 2 Year          4972.
## 2 4 Year        28287
## 3 Other          8448
```

```
tcOutStateSummr
```

```
## # A tibble: 3 x 2
##   degFactor `median(out_of_state_total)`
##   <fct>          <dbl>
## 1 2 Year        10291
## 2 4 Year       34888
## 3 Other       14640
```

This is a simple calculation of the median for 2-year and 4-year schools for total cost to out-of-state students.

```
tcFours = tcFactored %>%
  filter(degFactor=="4 Year")
tcFours

## # A tibble: 1,852 x 11
##   name      state state~1 type  degre~2 room_~3 in_st~4 in_st~5 out_o~6 out_o~7
##   <chr>    <chr> <chr>  <chr> <chr>    <dbl>  <dbl>  <dbl>  <dbl>  <dbl>
## 1 Abilene ~ Texas TX      Priv~ 4 Year    10350   34850   45200   34850   45200
## 2 Academy ~ Cali~ CA      For~ 4 Year    16648   27810   44458   27810   44458
## 3 Adams St~ Colo~ CO      Publ~ 4 Year     8782    9440   18222   20456   29238
## 4 Adelphi ~ New ~ NY      Priv~ 4 Year    16030   38660   54690   38660   54690
## 5 Adrian C~ Mich~ MI      Priv~ 4 Year    11318   37087   48405   37087   48405
## 6 Adventis~ Flor~ FL      Priv~ 4 Year     4200   15150   19350   15150   19350
## 7 Agnes Sc~ Geor~ GA      Priv~ 4 Year    12330   41160   53490   41160   53490
## 8 Alabama ~ Alab~ AL      Publ~ 4 Year     8379    9698   18077   17918   26297
## 9 Alabama ~ Alab~ AL      Publ~ 4 Year     5422   11068   16490   19396   24818
## 10 Alaska B~ Alas~ AK      Priv~ 4 Year     5700    9300   15000    9300   15000
## # ... with 1,842 more rows, 1 more variable: degFactor <fct>, and abbreviated
## #   variable names 1: state_code, 2: degree_length, 3: room_and_board,
## #   4: in_state_tuition, 5: in_state_total, 6: out_of_state_tuition,
## #   7: out_of_state_total

tcTwos = tcFactored %>%
  filter(degFactor=="2 Year")

tc4Y00S_Summary = tcFours%>%
  summarise(count_4Y00S=n(),
            min=min(tcFours$out_of_state_total, na.rm=TRUE),
            Q1=quantile(tcFours$out_of_state_total, prob=0.25,na.rm=TRUE),
            med=median(tcFours$out_of_state_total, na.rm=TRUE), #or quantile(AQI,prob=0.5,na.rm=TRUE)
            Q3=quantile(tcFours$out_of_state_total, prob=0.75,na.rm=TRUE),
            max=max(tcFours$out_of_state_total, na.rm=TRUE))

tc4YIS_Summary = tcFours%>%
  summarise(count_4YIS=n(),
            min=min(tcFours$in_state_total, na.rm=TRUE),
            Q1=quantile(tcFours$in_state_total, prob=0.25,na.rm=TRUE),
            med=median(tcFours$in_state_total, na.rm=TRUE), #or quantile(AQI,prob=0.5,na.rm=TRUE)
            Q3=quantile(tcFours$in_state_total, prob=0.75,na.rm=TRUE),
            max=max(tcFours$in_state_total, na.rm=TRUE))

tc2Y00S_Summary = tcTwos%>%
  summarise(count_2Y00S=n(),
            min=min(tcTwos$out_of_state_total, na.rm=TRUE),
            Q1=quantile(tcTwos$out_of_state_total, prob=0.25,na.rm=TRUE),
            med=median(tcTwos$out_of_state_total, na.rm=TRUE), #or quantile(AQI,prob=0.5,na.rm=TRUE)
            Q3=quantile(tcTwos$out_of_state_total, prob=0.75,na.rm=TRUE),
            max=max(tcTwos$out_of_state_total, na.rm=TRUE))

tc2YIS_Summary = tcTwos%>%
  summarise(count_2YIS=n(),
            min=min(tcTwos$in_state_total, na.rm=TRUE),
            Q1=quantile(tcTwos$in_state_total, prob=0.25,na.rm=TRUE),
```

```

med=median(tcTwos$in_state_total, na.rm=TRUE), #or quantile(AQI,prob=0.5,na.rm=TRUE)
Q3=quantile(tcTwos$in_state_total, prob=0.75,na.rm=TRUE),
max=max(tcTwos$in_state_total, na.rm=TRUE))

```

```
tc4Y00S_Summary
```

```

## # A tibble: 1 x 6
##   count_4Y00S   min    Q1   med    Q3   max
##         <int> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1         1852  1430 24951 34888 46670 75003

```

```
tc4YIS_Summary
```

```

## # A tibble: 1 x 6
##   count_4YIS   min    Q1   med    Q3   max
##         <int> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1         1852  1430 18199 28287 44846. 75003

```

```
tc2Y00S_Summary
```

```

## # A tibble: 1 x 6
##   count_2Y00S   min    Q1   med    Q3   max
##         <int> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1         1120  1376 8196. 10291 13598 68640

```

```
tc2YIS_Summary
```

```

## # A tibble: 1 x 6
##   count_2YIS   min    Q1   med    Q3   max
##         <int> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1         1120   962 3364. 4972.  8946 68640

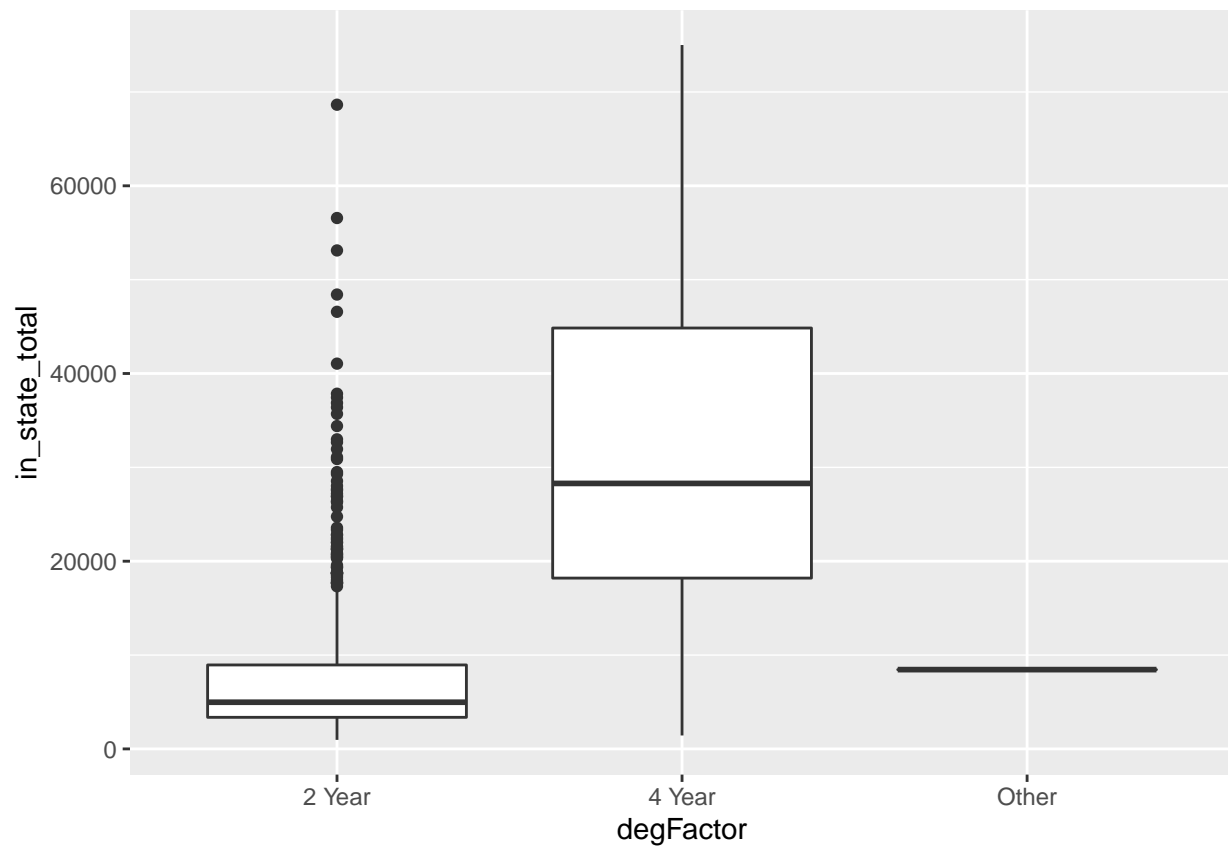
```

These are the 5-number summaries for each of the categorical variables of interest.

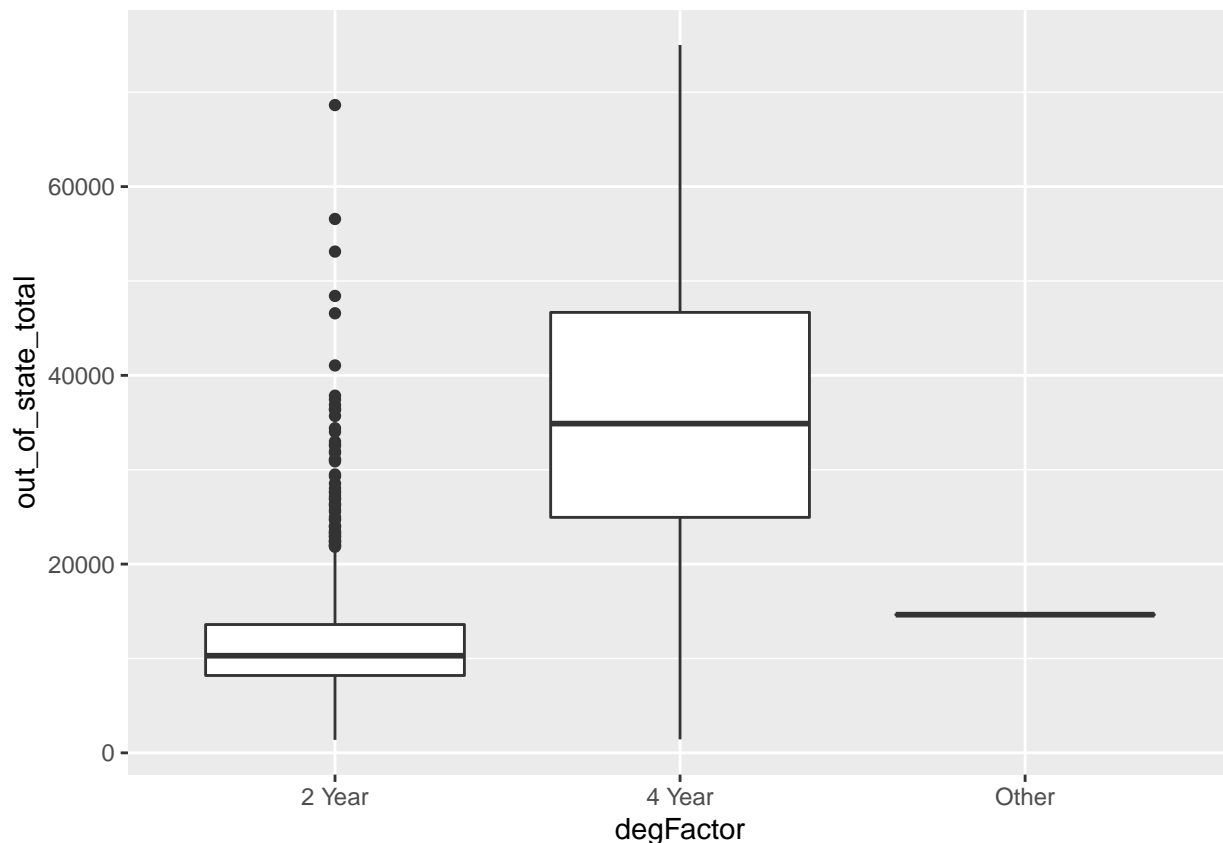
```

ggplot(tcFactored, aes(x = degFactor, y = in_state_total)) + # ggplot function
  geom_boxplot()

```



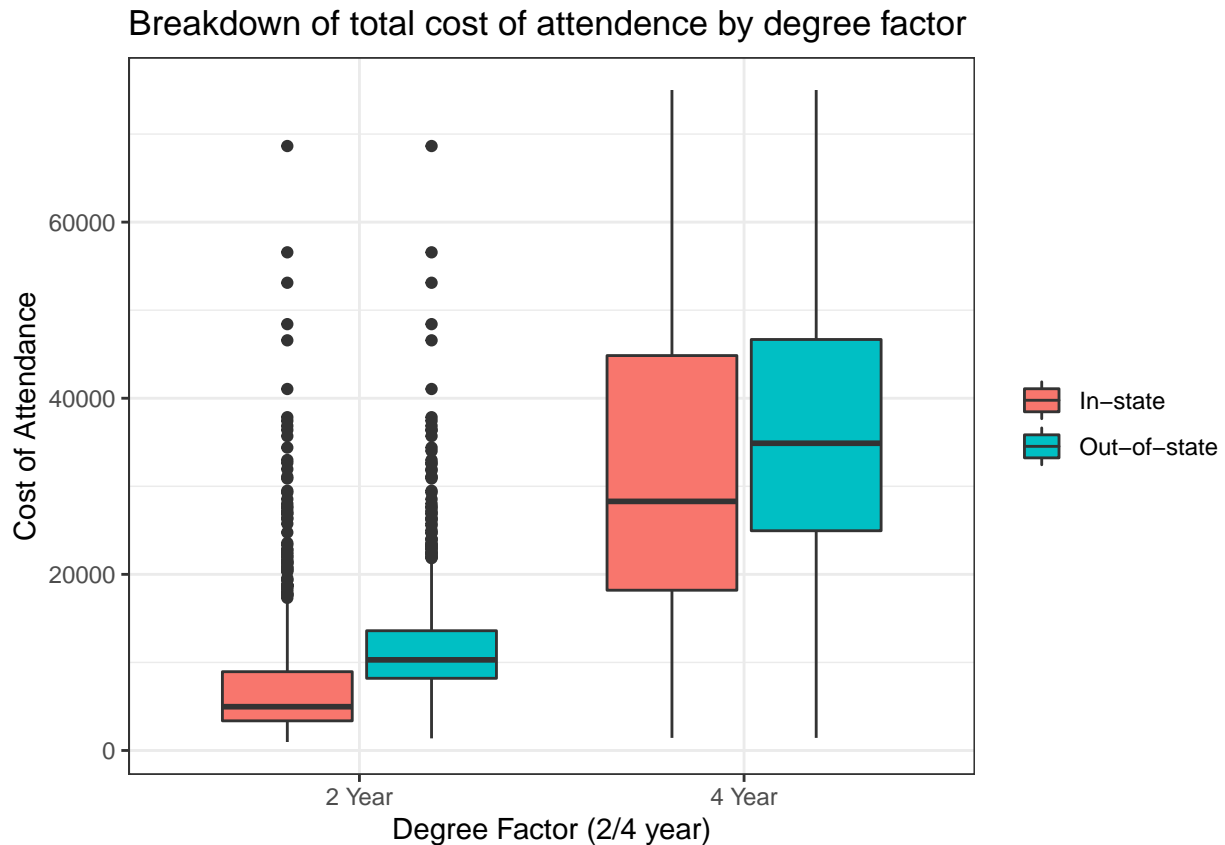
```
ggplot(tcFactored, aes(x = degFactor, y = out_of_state_total)) + # ggplot function  
  geom_boxplot()
```



These box plots (couldn't figure out how to make an overlaid boxplot with both in/out of state variables) show a clear difference in the general cost between 2-year and 4-year institutions, and that out-of-state students generally pay more.

```
#ggplot(tcFactored, aes(x=tcInStateSummr$degFactor, fill=tcInStateSummr$in_state_total)) +
# geom_histogram( color="#e9ecef", alpha=0.6, position = 'identity') +
# scale_fill_manual(values=c("#69b3a2", "#404080"))

ggplot(gatheredtc, aes(x = degFactor, y = totalCost, fill=in_out)) + # ggplot function
  geom_boxplot()+
  ggtitle("Breakdown of total cost of attendance by degree factor")+ # for the main title
  xlab("Degree Factor (2/4 year)")+ # for the x axis label
  ylab("Cost of Attendance")+ # for the y axis label
  theme_bw()+theme(
    legend.title = element_blank(),
  ) + scale_fill_discrete(name = "Student Residence", labels = c("In-state", "Out-of-state"))
```



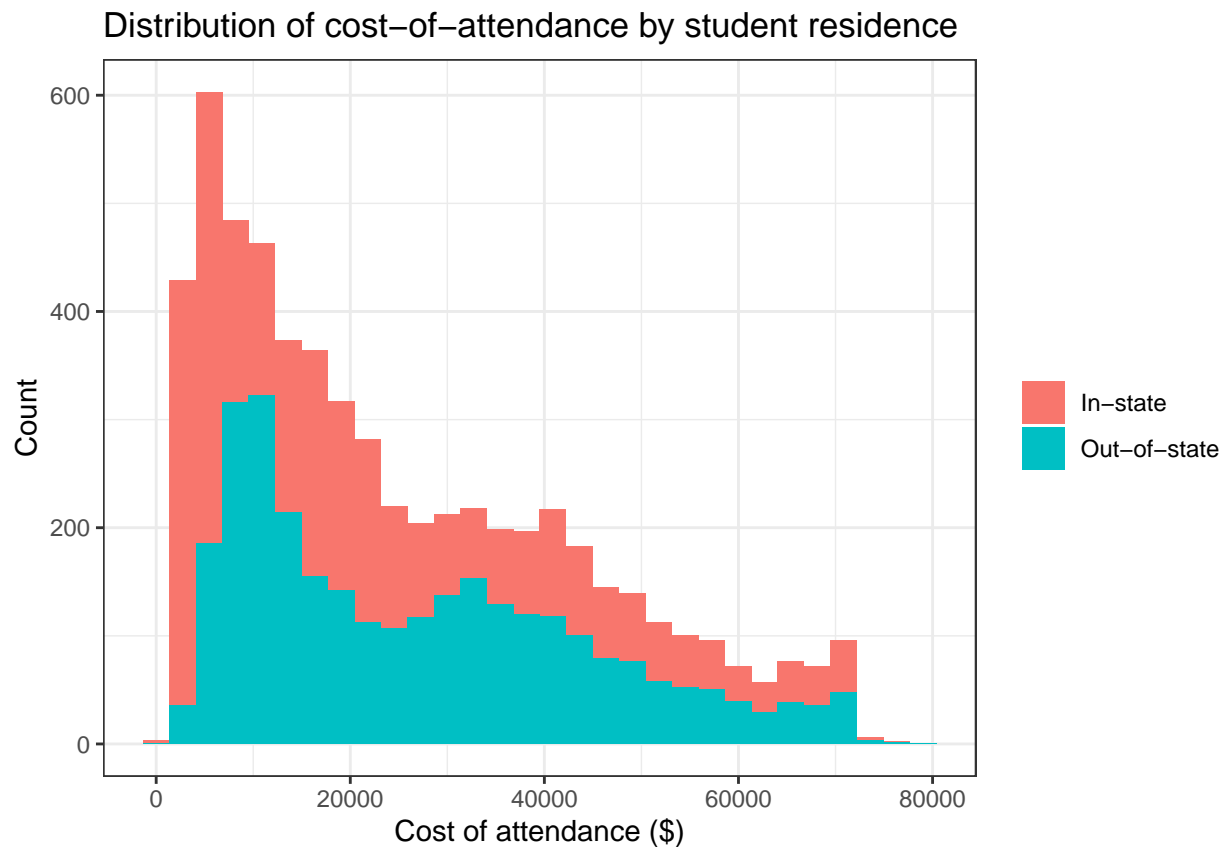
There is clearly a difference here between how much students should expect to pay given their residency status, but it isn't as absurdly significant as we were anticipating given that we hear from high school guidance counselors, specifically about 4-year institutions. Therefore, we should look for another potential explanation for the contribution to higher costs of attendance for some students.

### Total Cost of Attendance by Student Residence and College Type

```
ggplot(gatheredtc, aes(x=totalCost, fill=in_out)) +
  geom_histogram() +
  expand_limits(x=80000) +
  ggtitle("Distribution of cost-of-attendance by student residence")+
  xlab("Cost of attendance ($)") +
  ylab("Count") +
  theme_bw()+theme(
    legend.title = element_blank(),
  ) + scale_fill_discrete(labels = c("In-state", "Out-of-state"))
```

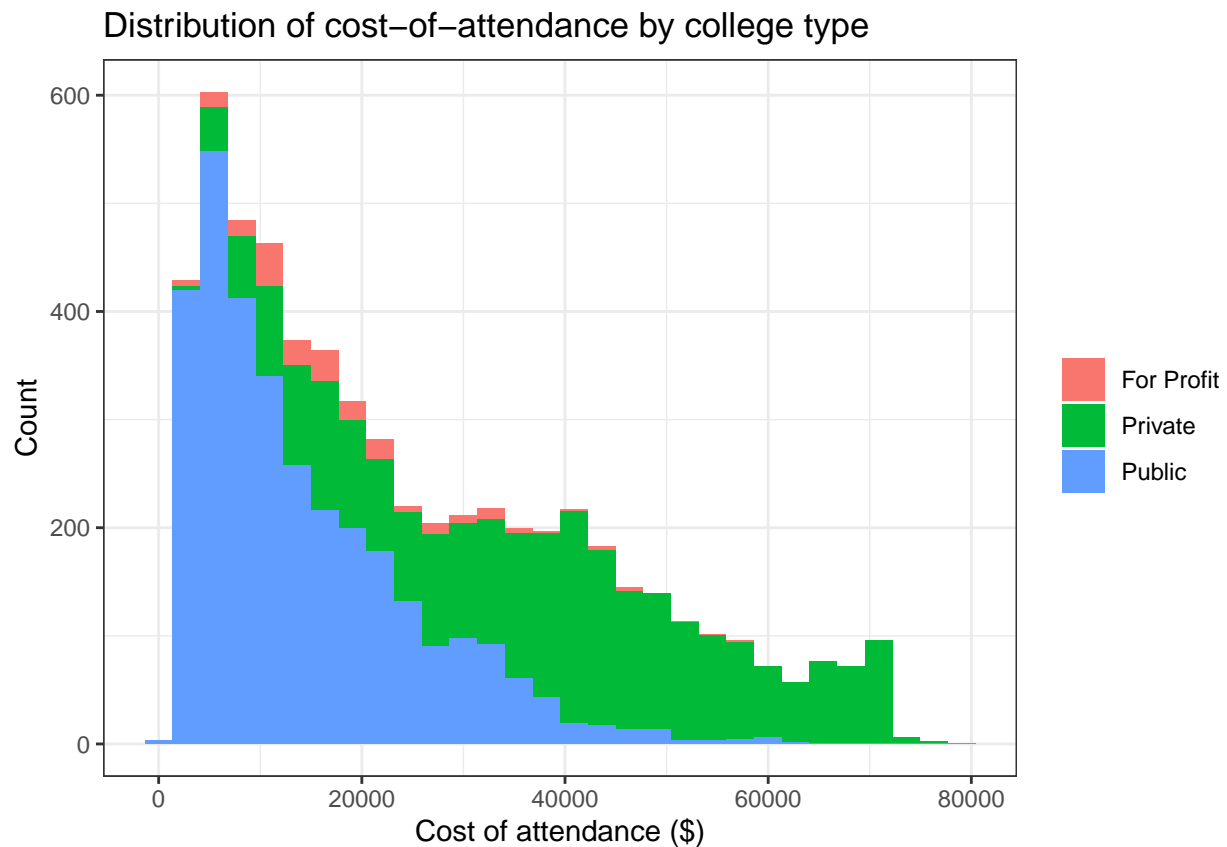
## `stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.





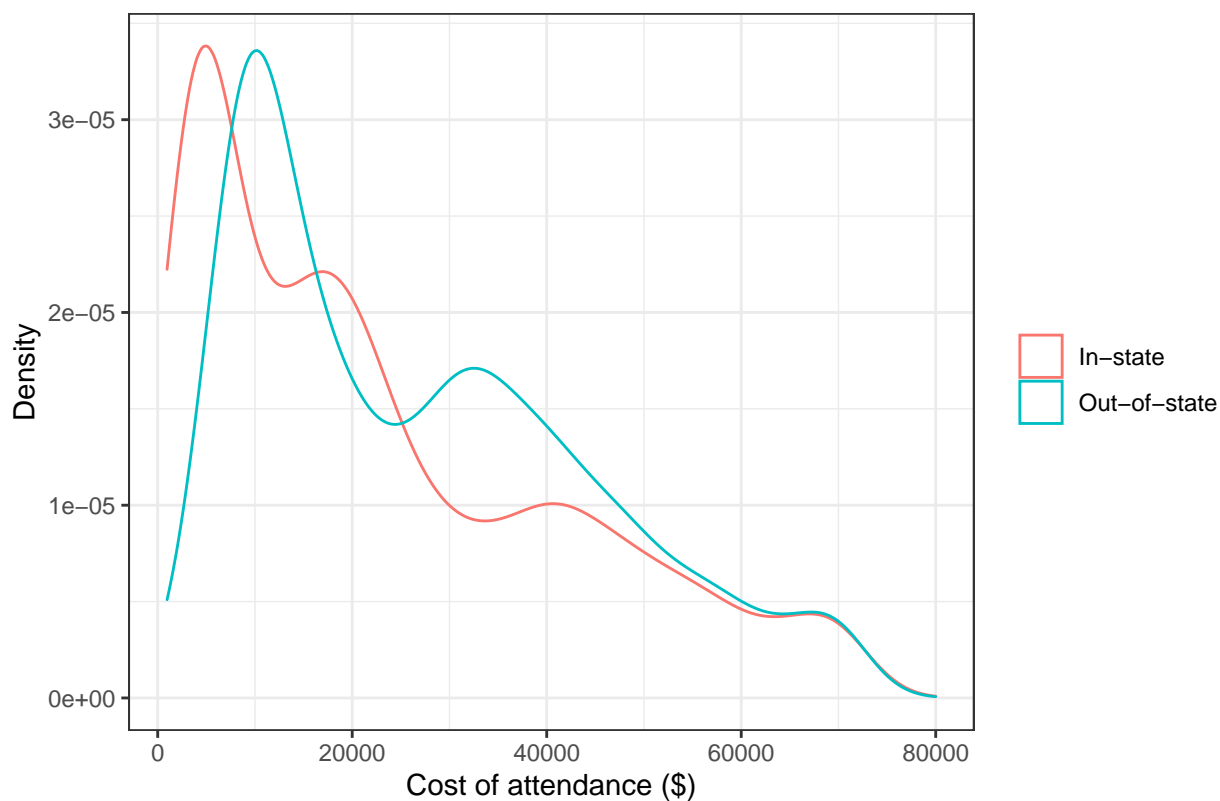
```
ggplot(gatheredtc,aes(x=totalCost, fill=type)) +
  geom_histogram() +
  expand_limits(x=80000) +
  ggtitle("Distribution of cost-of-attendance by college type")+
  xlab("Cost of attendance ($)") +
  ylab("Count") +
  theme_bw()+theme(
    legend.title = element_blank() + scale_fill_discrete(labels=c('For Profit','Private','Public'))

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



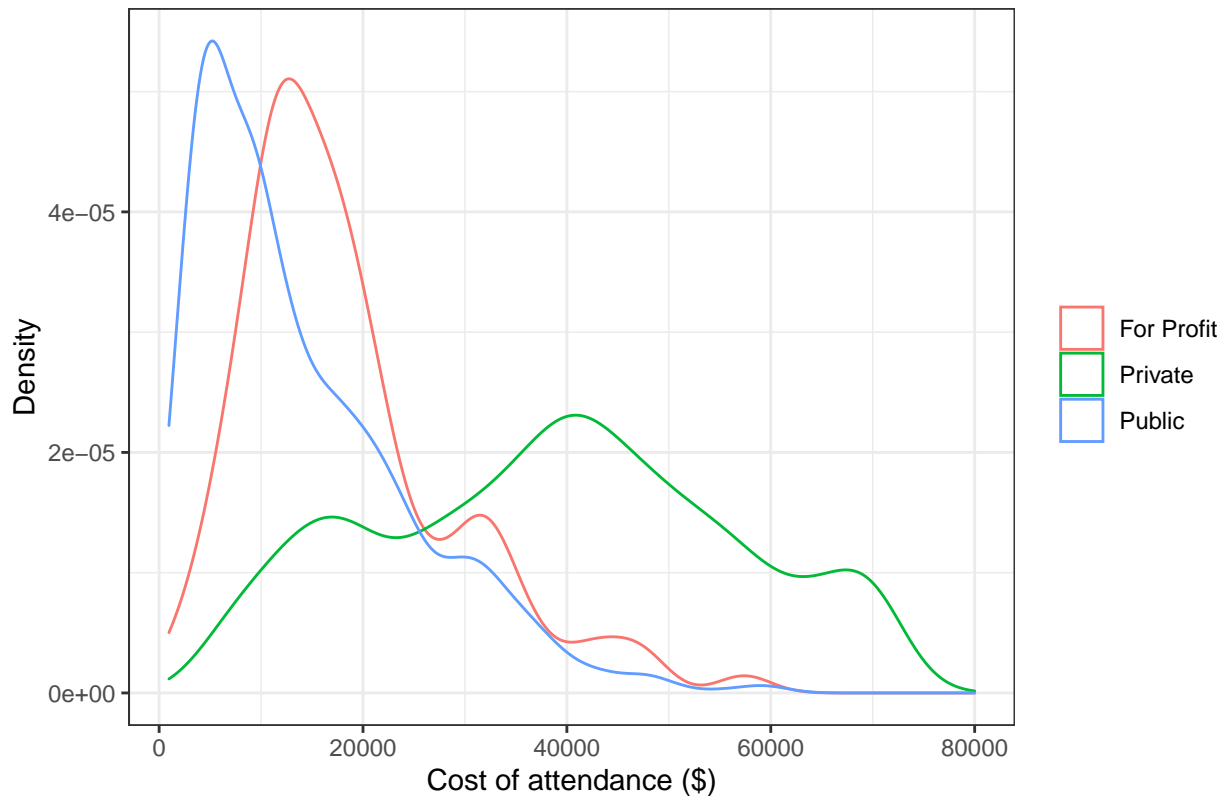
```
ggplot(gatheredtc,aes(x=totalCost, color=in_out)) +
  geom_density() +
  expand_limits(x=80000) +
  ggtitle("Distribution of cost-of-attendance by student residence")+
  xlab("Cost of attendance ($)") +
  ylab("Density") +
  theme_bw()+theme(
    legend.title = element_blank(),
  ) + scale_color_discrete(labels = c("In-state", "Out-of-state"))
```

Distribution of cost-of-attendance by student residence



```
ggplot(gatheredtc,aes(x=totalCost, color=type)) +
  geom_density() +
  expand_limits(x=80000) +
  ggtitle("Distribution of cost-of-attendance by college type")+
  xlab("Cost of attendance ($)") +
  ylab("Density") +
  theme_bw()+theme(
    legend.title = element_blank()) + scale_color_discrete(labels=c('For Profit','Private','Public'))
```

Distribution of cost-of-attendance by college type



```
# ggplot(tcFactored, aes(x=in_state_total))+geom_histogram()+expand_limits(x=80000,y=430) +
# ggtitle("Total cost of attendance for in-state students")+ # for the main title
# xlab("Cost of attendance")+ # for the x axis label
# ylab("Count") # for the y axis label
#
#
# ggplot(tcFactored, aes(x=out_of_state_total))+geom_histogram()+expand_limits(x=80000,y=430) +
# ggtitle("Total cost of attendance for out-of-state students")+ # for the main title
# xlab("Cost of attendance")+ # for the x axis label
# ylab("Count") # for the y axis label

#ggtitle(label) # for the main title
#xlab(label) # for the x axis label
#ylab(label) # for the y axis label
#labs(...) # for the main title, axis labels and legend titles
```

This is a density plot that shows how high the cost of attendance is for schools across the country relative to each other given institution type.

```
# Time to explore the data!

# Commenting out ggplot stuff to do dplyr first
#ggplot(ti,aes(x=year, y=total_price)) + geom_point()

#this is the median cost of attendance for instate/outstate

median_IN_COA <- tc %>%
```

```

filter(degree_length=='4 Year') %>%
group_by(state_code)%>%
summarize(median_instate_COA = median(in_state_total))

```

```
median_IN_COA
```

```

## # A tibble: 53 x 2
##   state_code median_instate_COA
##   <chr>          <dbl>
## 1 AK              17017
## 2 AL              18646
## 3 AR              19023
## 4 AZ              25037
## 5 CA              30416
## 6 CO              20976.
## 7 CT              46455
## 8 DC              50702.
## 9 DE              26542
## 10 FL             23352
## # ... with 43 more rows

```

```

median_OUT_COA <- tc %>%
  filter(degree_length=='4 Year') %>%
  group_by(state_code)%>%
  summarize(median_outstate_COA = median(out_of_state_total))

```

```
median_OUT_COA
```

```

## # A tibble: 53 x 2
##   state_code median_outstate_COA
##   <chr>          <dbl>
## 1 AK              28604
## 2 AL              27880
## 3 AR              23709
## 4 AZ              37190
## 5 CA              36103
## 6 CO              36096
## 7 CT              48656.
## 8 DC              50702.
## 9 DE              30700
## 10 FL             32000
## # ... with 43 more rows

```

```

# mutate(mean_instate_COA=mean(in_state_tuition)) %>%
# mutate(mean_outofstate_COA=mean(out_of_state_tuition))%>%

```

*#In the following graph, I want to find out whether colleges with higher STEM enrollment tend to cost more*

```

jointisp = ti %>%
  left_join(sp) %>%
  group_by(stem_percent)%>%
  summarize(medianNet=median(net_cost))

```

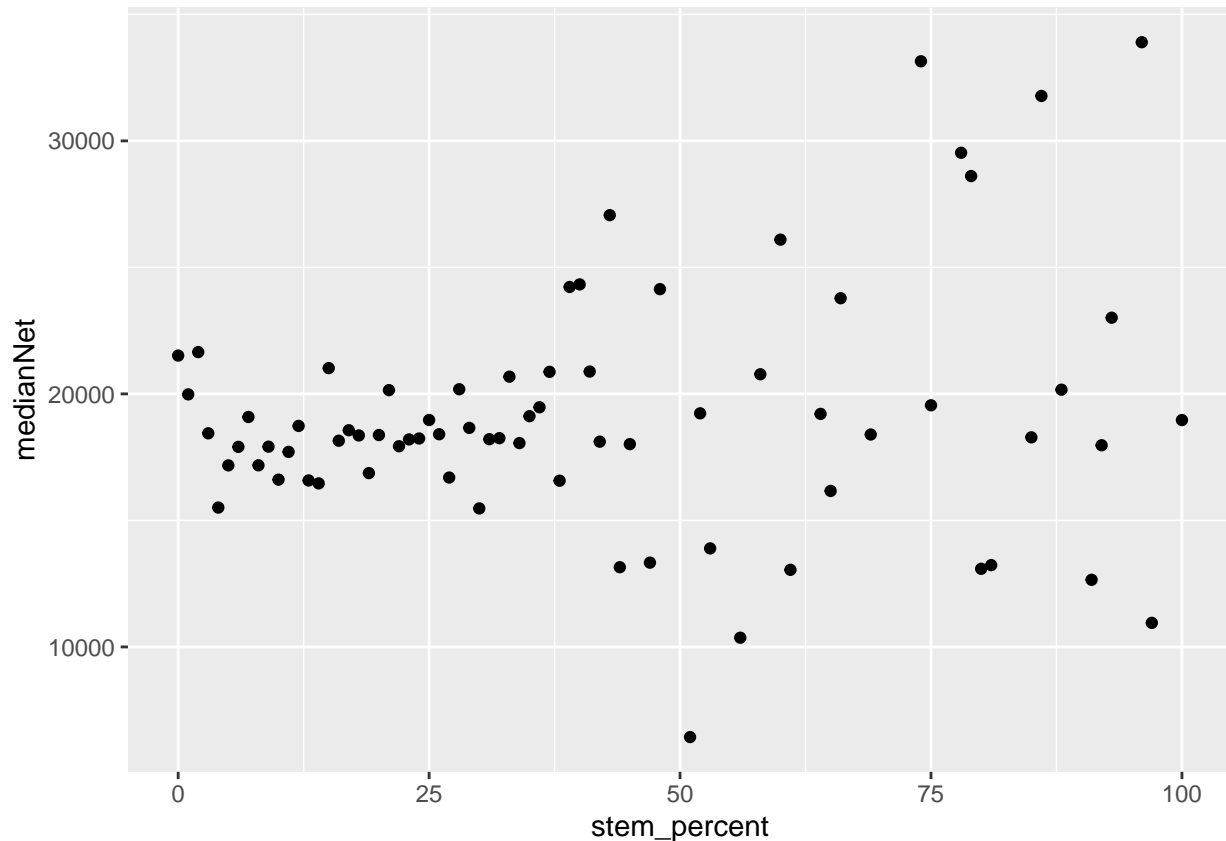
```
## Joining, by = "name"
```

```
jointisp
```

```
## # A tibble: 75 x 2
##   stem_percent medianNet
##   <dbl>         <dbl>
## 1         0     21516.
## 2         1     19981.
## 3         2     21653.
## 4         3     18443.
## 5         4     15509.
## 6         5     17175.
## 7         6     17907.
## 8         7     19088.
## 9         8     17178.
## 10        9     17915
## # ... with 65 more rows
```

```
ggplot(jointisp, aes(stem_percent, medianNet)) + geom_point()
```

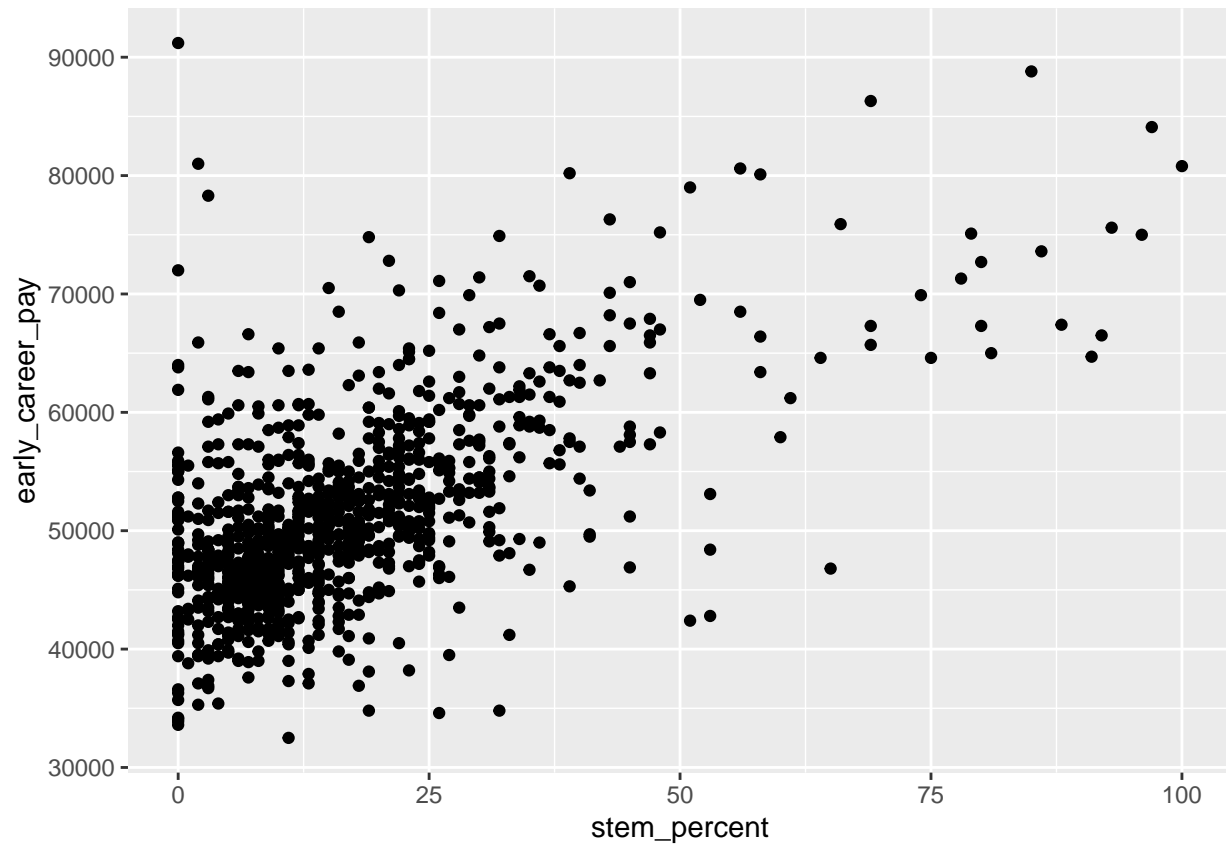
```
## Warning: Removed 1 rows containing missing values (geom_point).
```



*#My conclusion is that there is no association between higher STEM enrollment and median net cost.*

In this graph I want to see whether a higher STEM enrollment has a high association with early career pay. In a later graphic, I will want to see whether the trend keeps for mid-career pay.

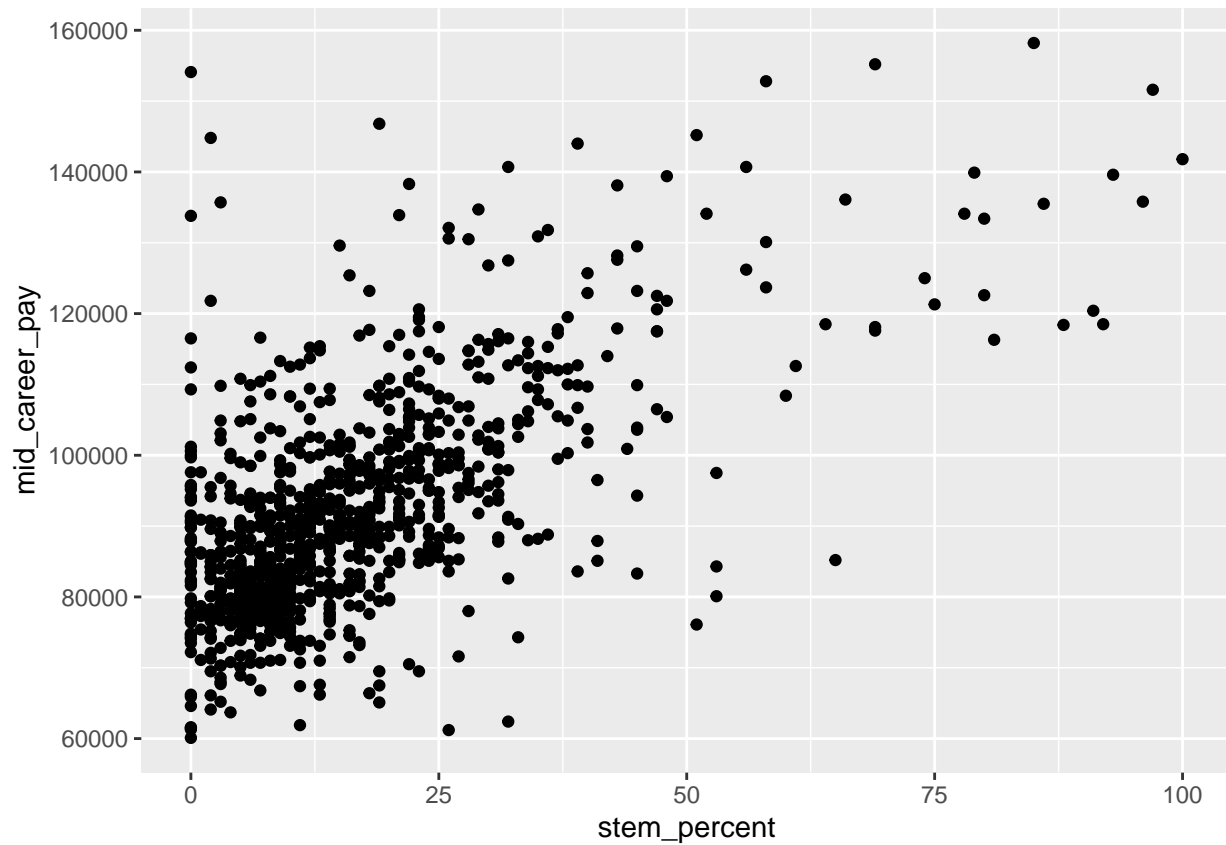
```
ggplot(sp, aes(stem_percent, early_career_pay)) + geom_point()
```



My conclusion is that there seems to be a weak positive correlation between these two variables.

*#In this graphic, perhaps the trend keeps?*

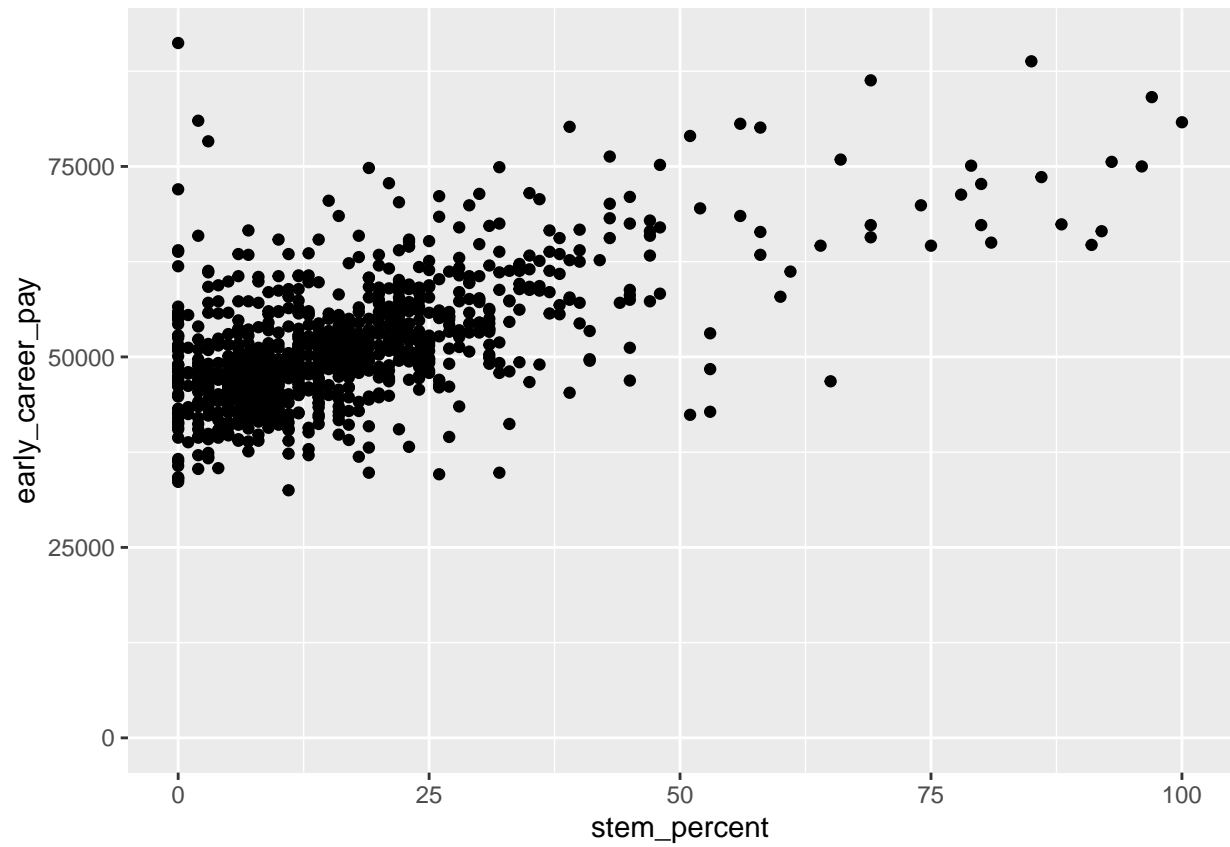
```
ggplot(sp, aes(stem_percent,mid_career_pay)) + geom_point()
```



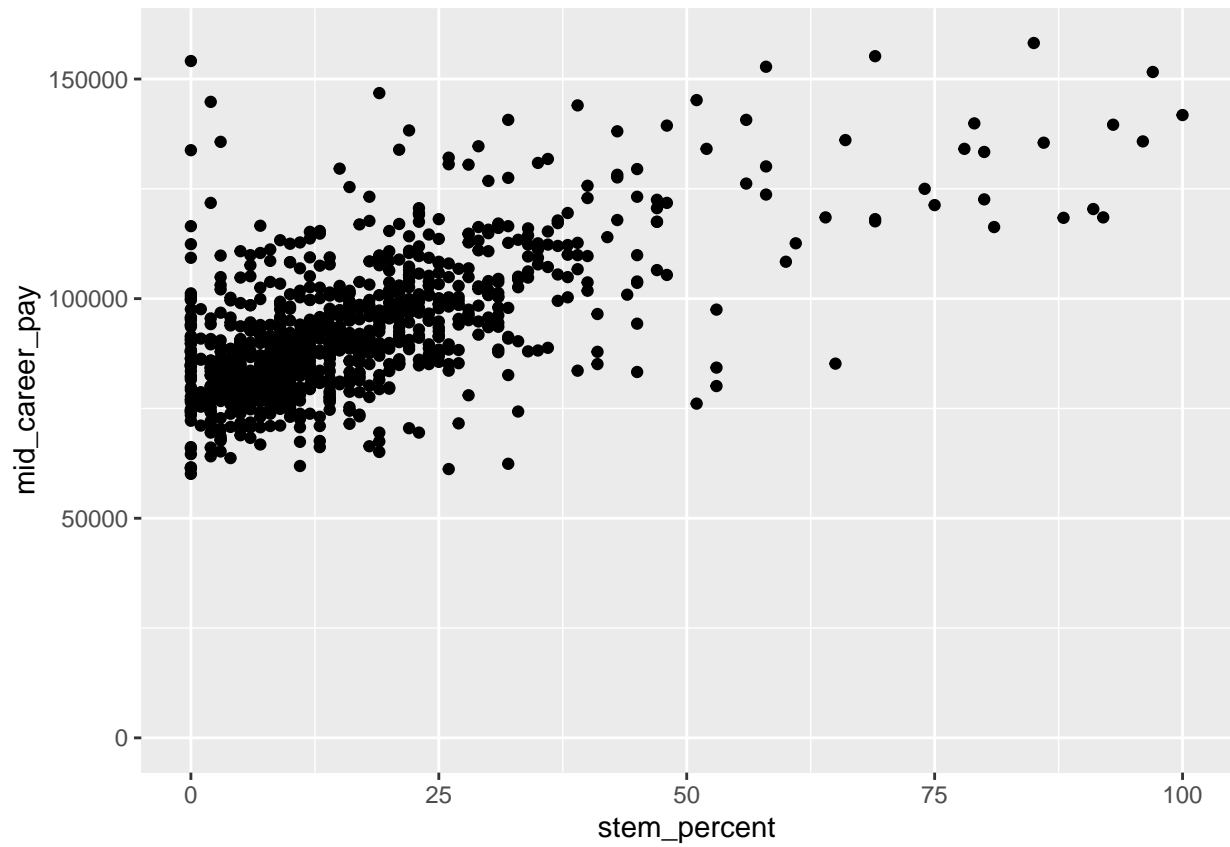
*#attempting to make the graphics easier to differentiate. I'm not sure what the difference is.*

```
ggplot(sp, aes(x=stem_percent,y=early_career_pay)) + geom_point() + expand_limits(x=0,y=0)
```

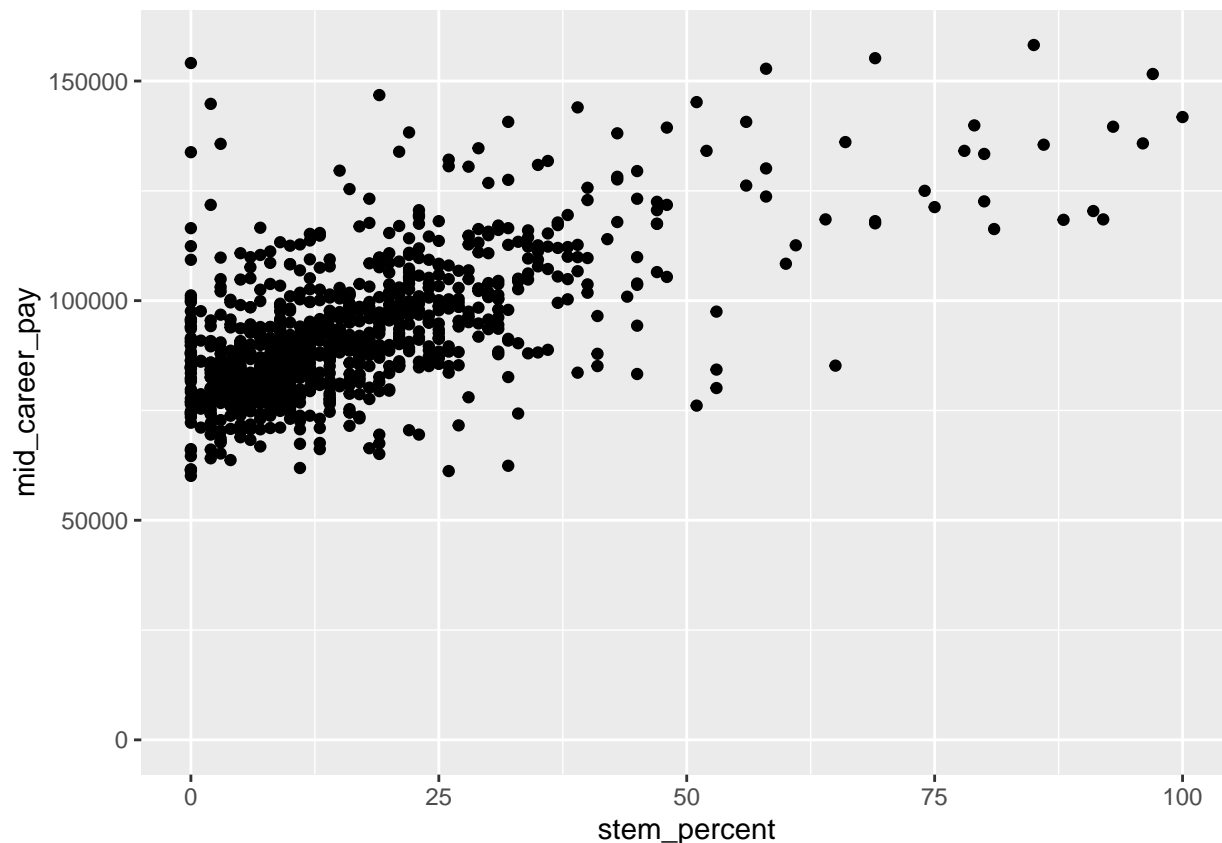




```
ggplot(sp, aes(x=stem_percent,y=mid_career_pay)) + geom_point() + expand_limits(x=0,y=0)
```



```
ggplot(sp, aes(x=stem_percent,y=mid_career_pay)) + geom_point() + expand_limits(x=0,y=0)
```



```
income = ti %>%
  group_by(income_lvl) %>%
  summarize(Count=n()) %>%
  mutate(Percent = round((Count/sum(Count)*100))) %>%
  arrange(desc(Count))
income
```

```
## # A tibble: 5 x 3
##   income_lvl      Count Percent
##   <chr>          <int>   <dbl>
## 1 0 to 30,000     44969     22
## 2 30,001 to 48,000 43384     21
## 3 48,001 to 75,000 42600     20
## 4 75,001 to 110,000 40403     19
## 5 Over 110,000    37656     18
```

```
incomeByState = ti %>%
  group_by(income_lvl,state) %>%
  summarize(Count=n()) %>%
  mutate(Percent = round((Count/sum(Count)*100))) %>%
  arrange(desc(Count))
```

```
## `summarise()` has grouped output by 'income_lvl'. You can override using the
## `.groups` argument.
```

```
incomeByState
```

```
## # A tibble: 255 x 4
## # Groups:   income_lvl [5]
```

```
## income_lvl state Count Percent
## <chr> <chr> <int> <dbl>
## 1 0 to 30,000 NY 3460 8
## 2 30,001 to 48,000 NY 3357 8
## 3 48_001 to 75,000 NY 3333 8
## 4 0 to 30,000 CA 3290 7
## 5 75,001 to 110,000 NY 3125 8
## 6 30,001 to 48,000 CA 2909 7
## 7 Over 110,000 NY 2877 8
## 8 48_001 to 75,000 CA 2841 7
## 9 0 to 30,000 PA 2776 6
## 10 30,001 to 48,000 PA 2736 6
## # ... with 245 more rows
```

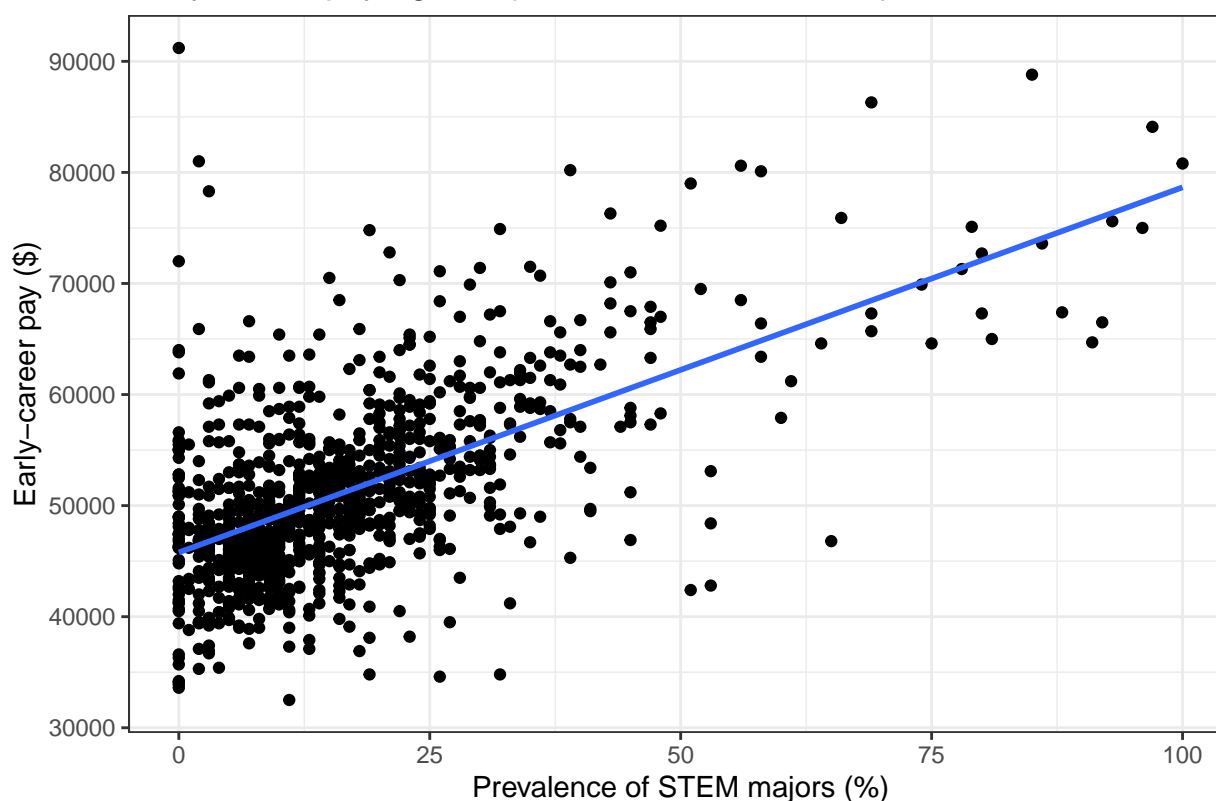
```
tcFacJoinSp = tcFactored %>%
  filter(tcFactored$type!='For Profit') %>%
  inner_join(sp, by=c("name"="name"))
tcFacJoinSp
```

```
## # A tibble: 727 x 17
## name state state-1 type degree-2 room_-3 in_st-4 in_st-5 out_o-6 out_o-7
## <chr> <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 Adams St~ Colo~ CO Publ~ 4 Year 8782 9440 18222 20456 29238
## 2 Adventis~ Flor~ FL Priv~ 4 Year 4200 15150 19350 15150 19350
## 3 Agnes Sc~ Geor~ GA Priv~ 4 Year 12330 41160 53490 41160 53490
## 4 Alabama ~ Alab~ AL Publ~ 4 Year 5422 11068 16490 19396 24818
## 5 Alaska P~ Alas~ AK Priv~ 4 Year 7300 20830 28130 20830 28130
## 6 Albany C~ New ~ NY Priv~ 4 Year 10920 35105 46025 35105 46025
## 7 Albertus~ Conn~ CT Priv~ 4 Year 13200 32060 45260 32060 45260
## 8 Albion C~ Mich~ MI Priv~ 4 Year 12380 45775 58155 45775 58155
## 9 Alcorn S~ Miss~ MS Publ~ 4 Year 9608 7144 16752 7144 16752
## 10 Allen Co~ Iowa IA Priv~ 4 Year 7282 19970 27252 19970 27252
## # ... with 717 more rows, 7 more variables: degFactor <fct>, rank <dbl>,
## # state_name <chr>, early_career_pay <dbl>, mid_career_pay <dbl>,
## # make_world_better_percent <dbl>, stem_percent <dbl>, and abbreviated
## # variable names 1: state_code, 2: degree_length, 3: room_and_board,
## # 4: in_state_tuition, 5: in_state_total, 6: out_of_state_tuition,
## # 7: out_of_state_total
```

```
ggplot(sp, aes(stem_percent,early_career_pay)) + geom_point() +
  geom_smooth(method="lm",se=FALSE)+
  ggtitle("Early career pay against prevalence of STEM majors in a school")+
  xlab("Prevalence of STEM majors (%)")+
  ylab("Early-career pay ($)")+
  theme_bw()
```

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

Early career pay against prevalence of STEM majors in a school



```
cor(sp$stem_percent,sp$early_career_pay)
```

```
## [1] 0.6050609
```

There seems to be a moderately strong correlation between the prevalence of STEM majors and how much graduates tend to

```
ECSPmodel = lm(early_career_pay~stem_percent,data=tcFacJoinSp)
summary(ECSPmodel)
```

```
##
## Call:
## lm(formula = early_career_pay ~ stem_percent, data = tcFacJoinSp)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21134  -4041   -624    3056   34761
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  45592.77     353.98   128.80  <2e-16 ***
## stem_percent    323.16       15.46    20.91  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6536 on 725 degrees of freedom
## Multiple R-squared:  0.3762, Adjusted R-squared:  0.3753
## F-statistic: 437.2 on 1 and 725 DF, p-value: < 2.2e-16
```

Slope: 323.30 Y-intercept: 45584.50

```
cor(x=sp$stem_percent,y=sp$early_career_pay)
```

```
## [1] 0.6050609
```

```
cor(x=sp$stem_percent,y=sp$mid_career_pay)
```

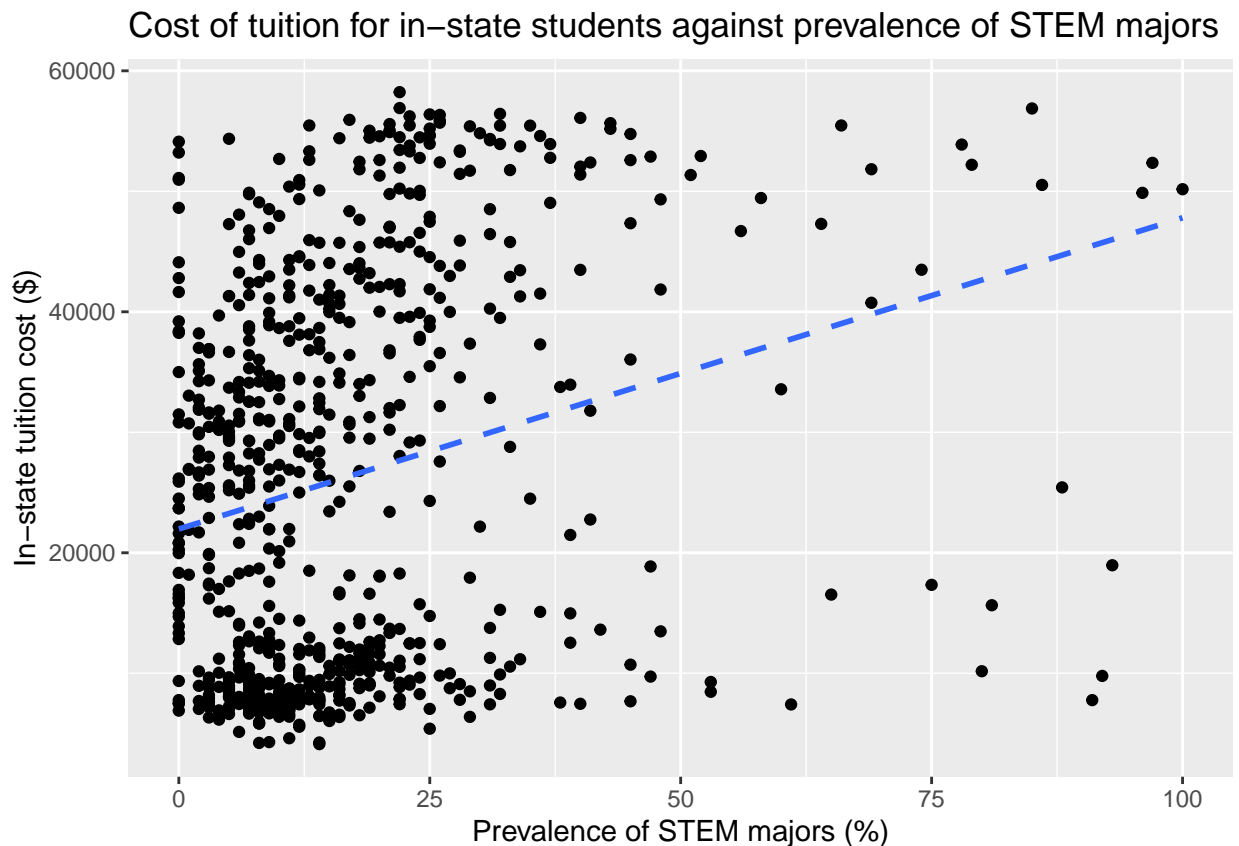
```
## [1] 0.6212143
```

Moderately strong positive association between prevalence of STEM majors at a school and general alumni early-career earnings.

Boring. STEM jobs tend to pay really well. Let's do something fun. Hear me out...

```
ggplot(tcFacJoinSp, aes(x=stem_percent,y=in_state_tuition)) +  
  geom_point() +  
  geom_smooth(method="lm",se=FALSE,lty=2) +  
  ggtitle("Cost of tuition for in-state students against prevalence of STEM majors")+  
  xlab("Prevalence of STEM majors (%)")+  
  ylab("In-state tuition cost ($)")
```

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



```
cor(x=tcFacJoinSp$stem_percent,y=tcFacJoinSp$in_state_tuition)
```

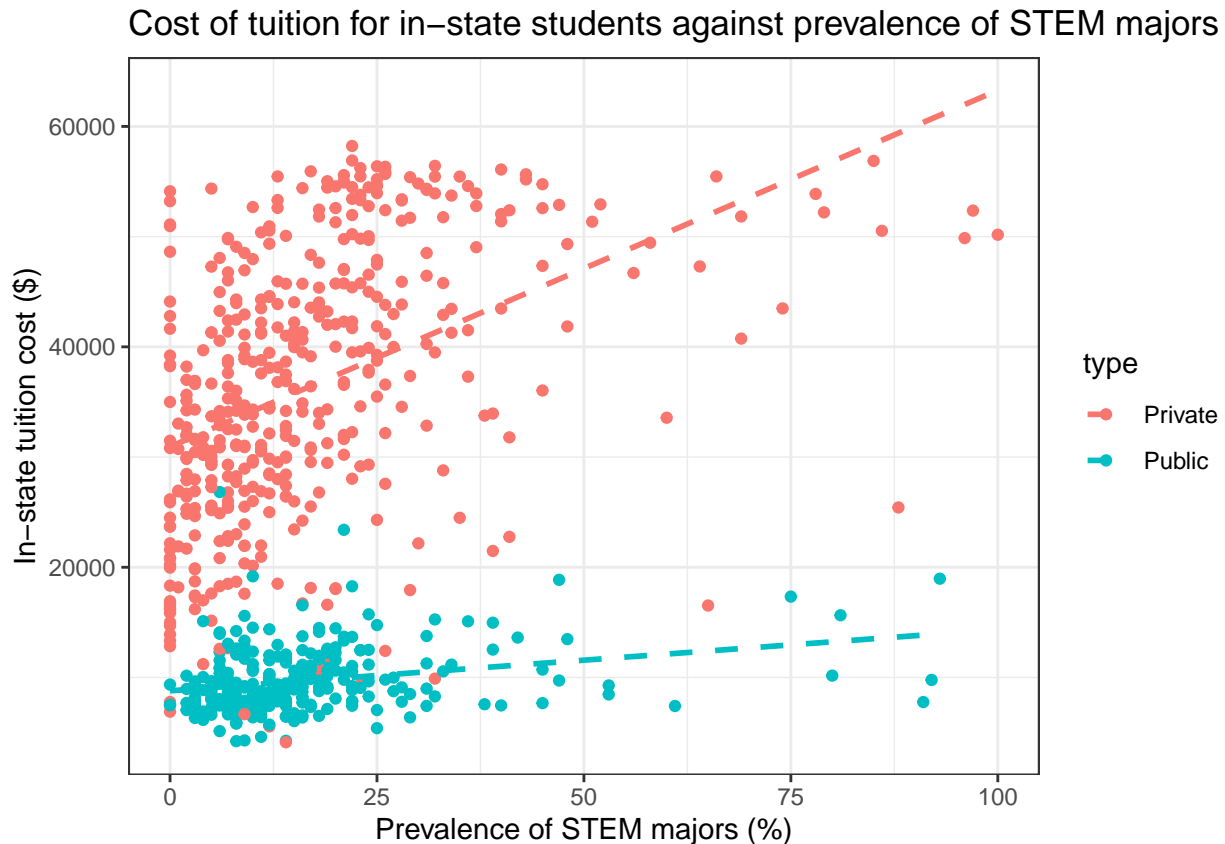
```
## [1] 0.2487816
```

Terrible fit. Couldn't predict the broad side of a barn!

```
ggplot(tcFacJoinSp, aes(x=stem_percent,y=in_state_tuition,color=type)) +  
  geom_point() +
```

```
geom_smooth(method="lm",se=FALSE,lty=2) +
ggtitle("Cost of tuition for in-state students against prevalence of STEM majors")+
xlab("Prevalence of STEM majors (%"))+
ylab("In-state tuition cost ($)")+
theme_bw()
```

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



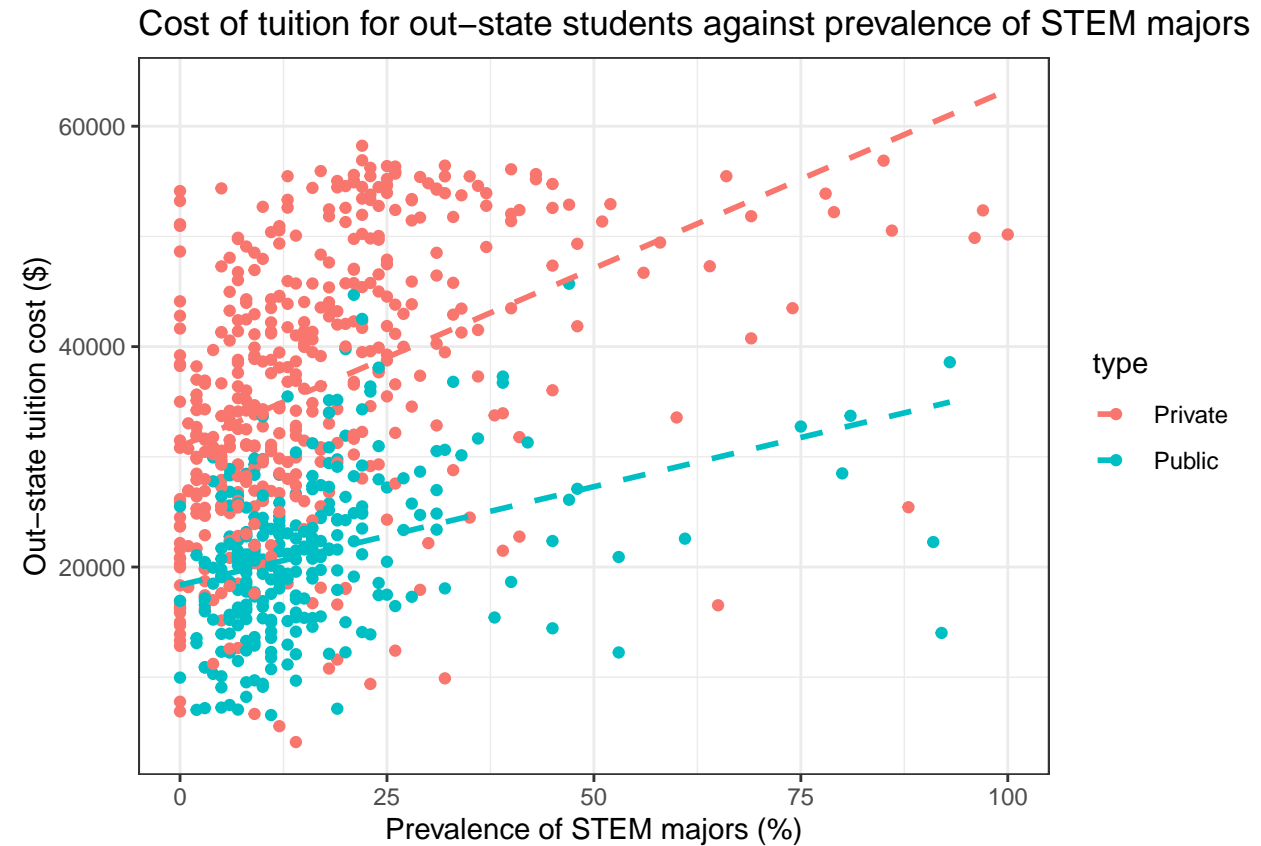
```
correlationsIS <- tcFacJoinSp %>%
  group_by(type) %>%
  summarise(r = cor(stem_percent, in_state_tuition))
correlationsIS
```

```
## # A tibble: 2 x 2
##   type      r
##   <chr>  <dbl>
## 1 Private 0.433
## 2 Public  0.265
```

Moderately weak/moderate correlation between variables given institution type.

```
ggplot(tcFacJoinSp, aes(x=stem_percent,y=out_of_state_tuition,color=type)) +
  geom_point() +
  geom_smooth(method="lm",se=FALSE,lty=2) +
  ggtitle("Cost of tuition for out-state students against prevalence of STEM majors")+
  xlab("Prevalence of STEM majors (%)")+
  ylab("Out-state tuition cost ($)")+
  theme_bw()
```

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



```
correlationsOOS <- tcFacJoinSp %>%
  group_by(type) %>%
  summarise(r = cor(stem_percent, out_of_state_tuition))
correlationsOOS
```

```
## # A tibble: 2 x 2
##   type      r
##   <chr>  <dbl>
## 1 Private 0.433
## 2 Public  0.356
```

Correlations show that there is a moderate correlation between the two variables given type.

These two graphs support the idea that tuition tends to be more expensive for schools that see greater proportions of STEM enrollment. Possibly due to the expensive equipment that generally comes with academic amenities like labs and associated equipment.

```
ISSPmodel=lm(in_state_tuition~stem_percent,data=tcFacJoinSp)
OSSPmodel=lm(out_of_state_tuition~stem_percent,data=tcFacJoinSp)

summary(ISSPmodel)
```

```
##
## Call:
## lm(formula = in_state_tuition ~ stem_percent, data = tcFacJoinSp)
##
## Residuals:
```



```

##      Min      1Q Median      3Q      Max
## -37709 -15280   1204  13279  32147
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  21970.98     855.47  25.683 < 2e-16 ***
## stem_percent   258.33       37.35   6.916 1.02e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 15790 on 725 degrees of freedom
## Multiple R-squared:  0.06189, Adjusted R-squared:  0.0606
## F-statistic: 47.83 on 1 and 725 DF, p-value: 1.02e-11
summary(OSSPmodel)

##
## Call:
## lm(formula = out_of_state_tuition ~ stem_percent, data = tcFacJoinSp)
##
## Residuals:
##      Min      1Q Median      3Q      Max
## -38392  -8930  -1347   9181  28263
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  25855.11     657.14   39.34 <2e-16 ***
## stem_percent   288.67       28.69   10.06 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12130 on 725 degrees of freedom
## Multiple R-squared:  0.1225, Adjusted R-squared:  0.1213
## F-statistic: 101.2 on 1 and 725 DF, p-value: < 2.2e-16

```