Homework 1C - DATA-312

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Abstract

This writeup explores the dataset, FirstYearGPA, from the R library, Stat2Data. Categorical variables in this dataset utilize boolean values for identification. These variables are as follows: Male, FirstGen, White, CollegeBound. Numerical variables are as follows: GPA, HSGPA, SATV, SATM, HU, SS.

Accessible as a library in R, this dataset comprises information from "a sample of 2019 first year students at a midwestern college", with the original intention of constructing an informed prediction of their first year GPA using various categorical and numerical variables.

NUMERICAL VARIABLES

`GPA`: Represents the grade point average of any given student in their first year of college.

`HSGPA`: Represents the grade point average of any given student in high school.

`SATV`: Represents the SAT score of any given student with respect to the Verbal/Literacy portion.

`SATM`: Represents the SAT score of any given student with respect to the Mathematics portion.

`HU`: Representative of how many credit hours any given student has earned in high school humanities courses.

`SS`: Representative of how many credit hours any given student has earned in high school social science courses.

CATEGORICAL VARIABLES

`FirstGen`: Boolean variable (0/1) representative of whether student expresses that they are the first in their family to attend college.

`White`: Boolean variable (0/1) representative of whether student identifies as White.

`CollegeBound`: Boolean variable (0/1) representative of whether student attended a high school where 50% of the student body (or greater) indicates intention to attend college.

```
head(FirstYearGPA)
```

```
##    GPA HSGPA SATV SATM Male   HU   SS FirstGen White CollegeBound
## 1 3.06  3.83  680  770    1  3.0  9.0        1     1            1
## 2 4.15  4.00  740  720    0  9.0  3.0        0     1            1
## 3 3.41  3.70  640  570    0 16.0 13.0        0     0            1
## 4 3.21  3.51  740  700    0 22.0  0.0        0     1            1
## 5 3.48  3.83  610  610    0 30.5  1.5        0     1            1
## 6 2.95  3.25  600  570    0 18.0  3.0        0     1            1
```

```
summary(FirstYearGPA)
```

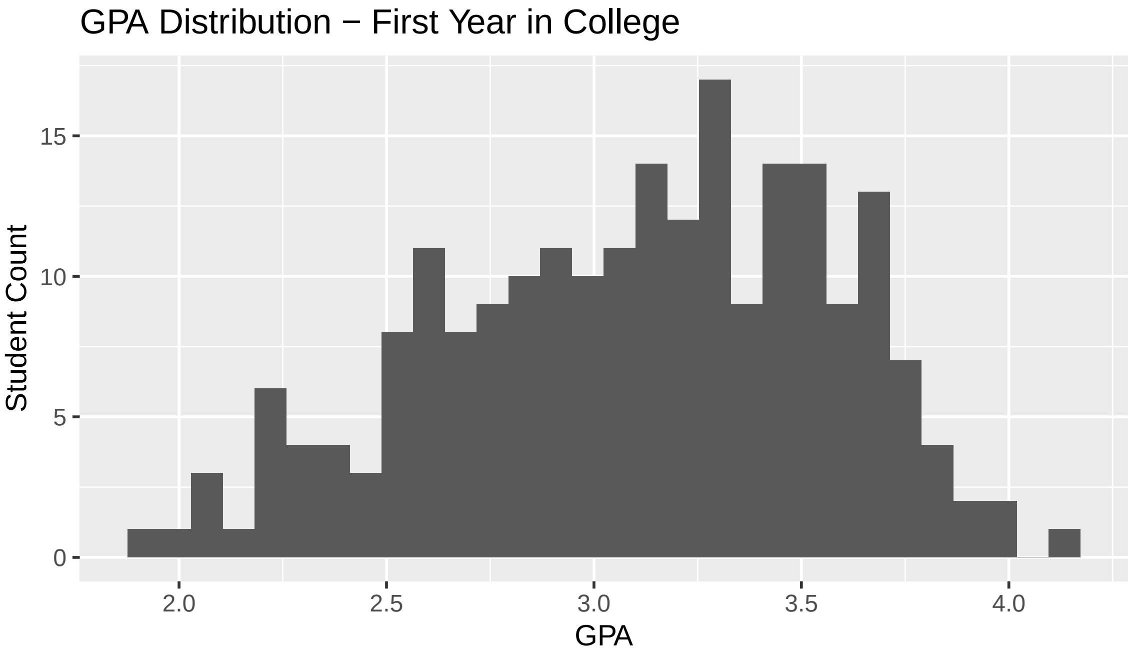
```
##       GPA            HSGPA            SATV            SATM
##  Min.   :1.930   Min.   :2.340   Min.   :260.0   Min.   :430.0
##  1st Qu.:2.745   1st Qu.:3.170   1st Qu.:565.0   1st Qu.:580.0
##  Median :3.150   Median :3.500   Median :610.0   Median :640.0
##  Mean   :3.096   Mean   :3.453   Mean   :605.1   Mean   :634.3
##  3rd Qu.:3.480   3rd Qu.:3.760   3rd Qu.:670.0   3rd Qu.:690.0
##  Max.   :4.150   Max.   :4.000   Max.   :740.0   Max.   :800.0
##       Male              HU              SS            FirstGen
##  Min.   :0.0000   Min.   : 0.00   Min.   : 0.000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.: 8.00   1st Qu.: 3.000   1st Qu.:0.0000
##  Median :0.0000   Median :13.00   Median : 6.000   Median :0.0000
##  Mean   :0.4658   Mean   :13.11   Mean   : 7.249   Mean   :0.1142
##  3rd Qu.:1.0000   3rd Qu.:17.00   3rd Qu.:11.000   3rd Qu.:0.0000
##  Max.   :1.0000   Max.   :40.00   Max.   :21.000   Max.   :1.0000
##      White       CollegeBound
##  Min.   :0.00   Min.   :0.0000
##  1st Qu.:1.00   1st Qu.:1.0000
##  Median :1.00   Median :1.0000
##  Mean   :0.79   Mean   :0.9224
##  3rd Qu.:1.00   3rd Qu.:1.0000
##  Max.   :1.00   Max.   :1.0000
```

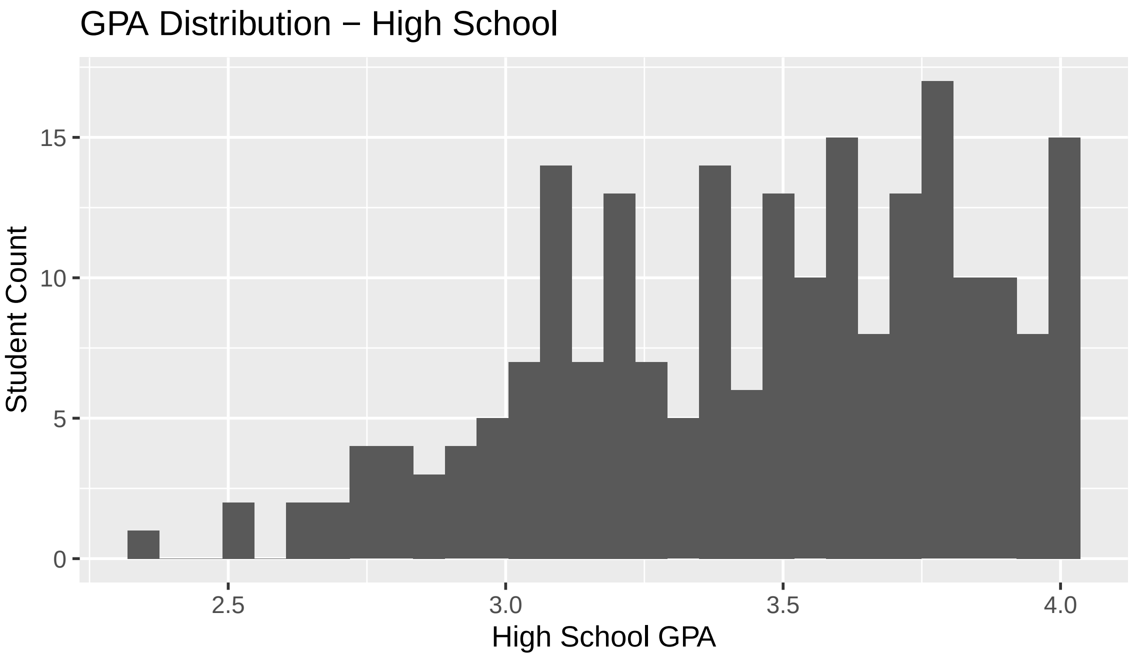
```
sapply(FirstYearGPA, class)
```

```
##          GPA        HSGPA         SATV         SATM         Male           HU
##    "numeric"    "numeric"    "integer"    "integer"    "integer"    "numeric"
##           SS     FirstGen        White CollegeBound
##    "numeric"    "integer"    "integer"    "integer"
```

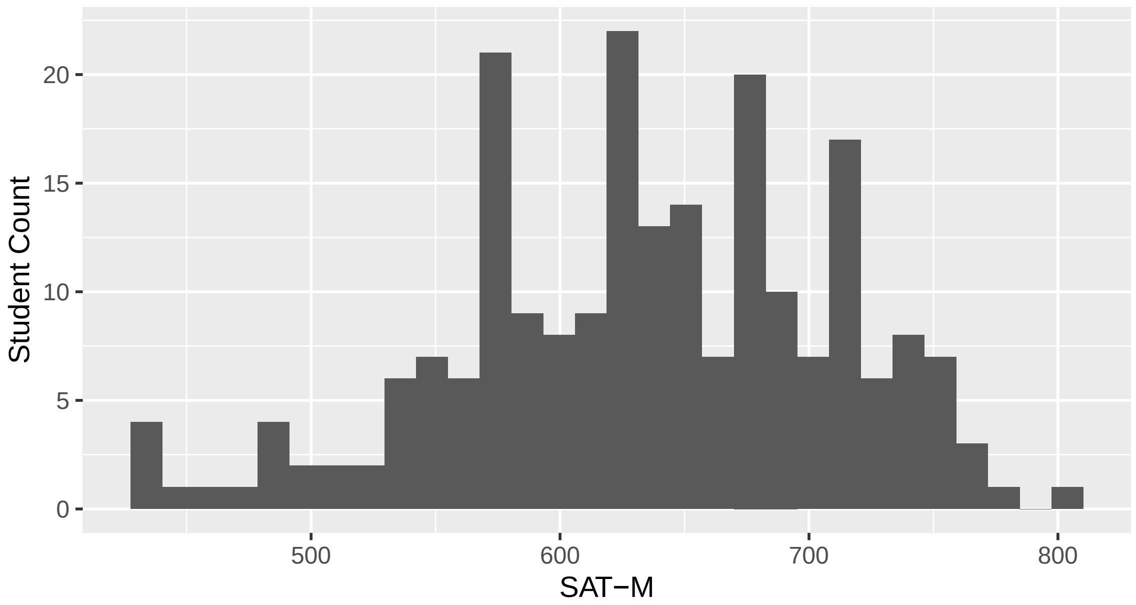
NUMERICAL VARIABLES

The following provides visual representation of the distributions of the variables in the dataset that are classified as numerical. These distributions permit further conceptualization of the standings of students at the closure of their high school careers with respect to their GPA, SAT scores, and the numbers of credit hours they have earned for various types of classes.

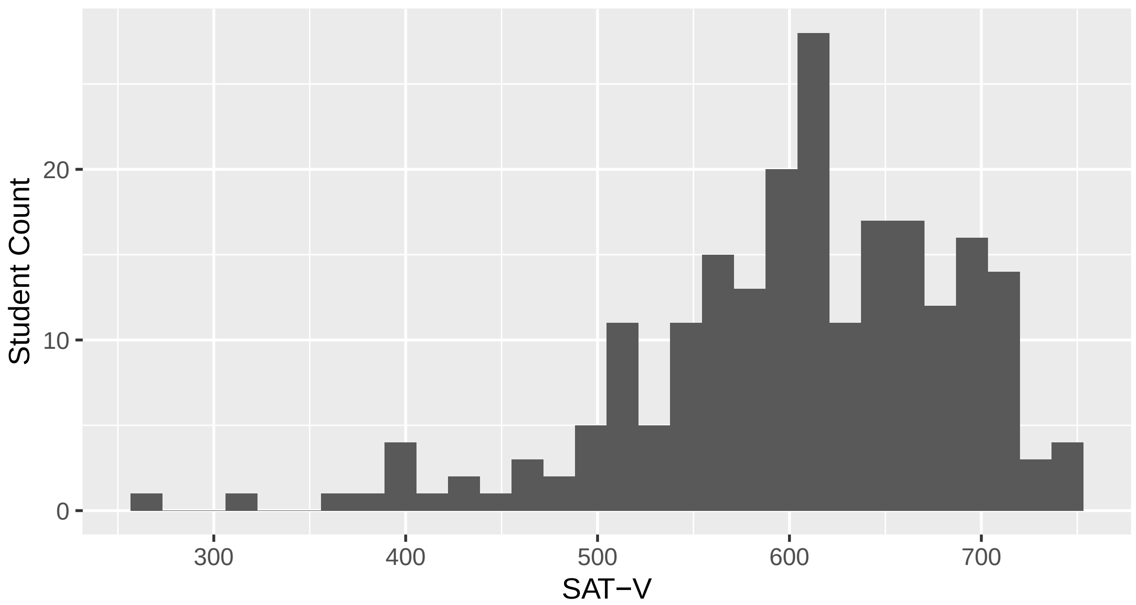


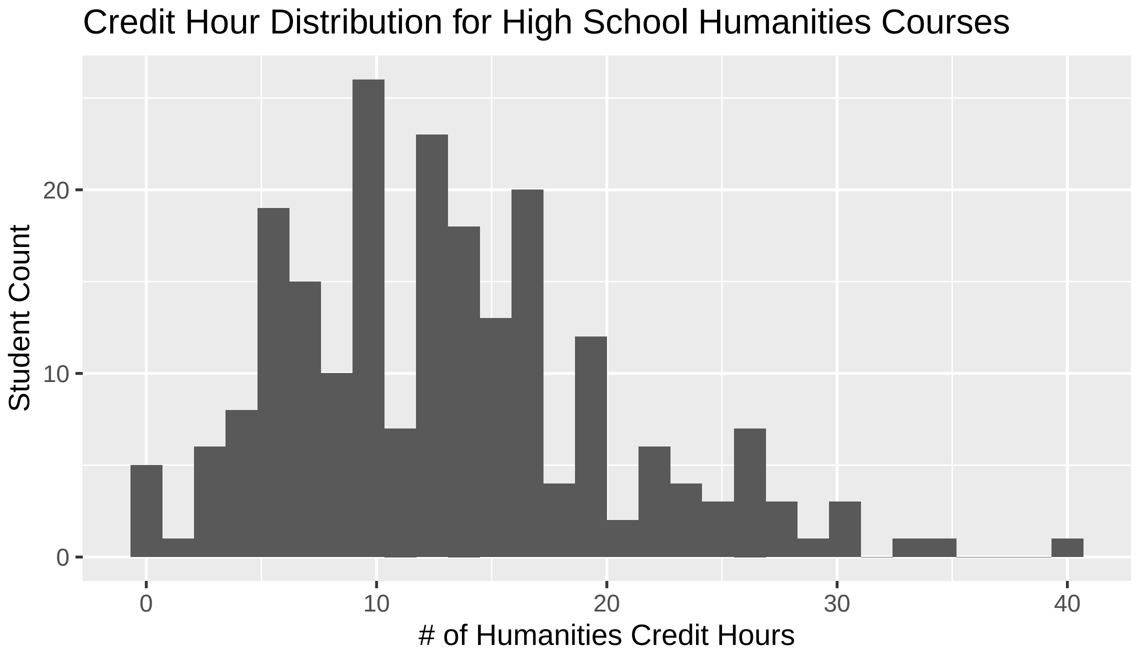


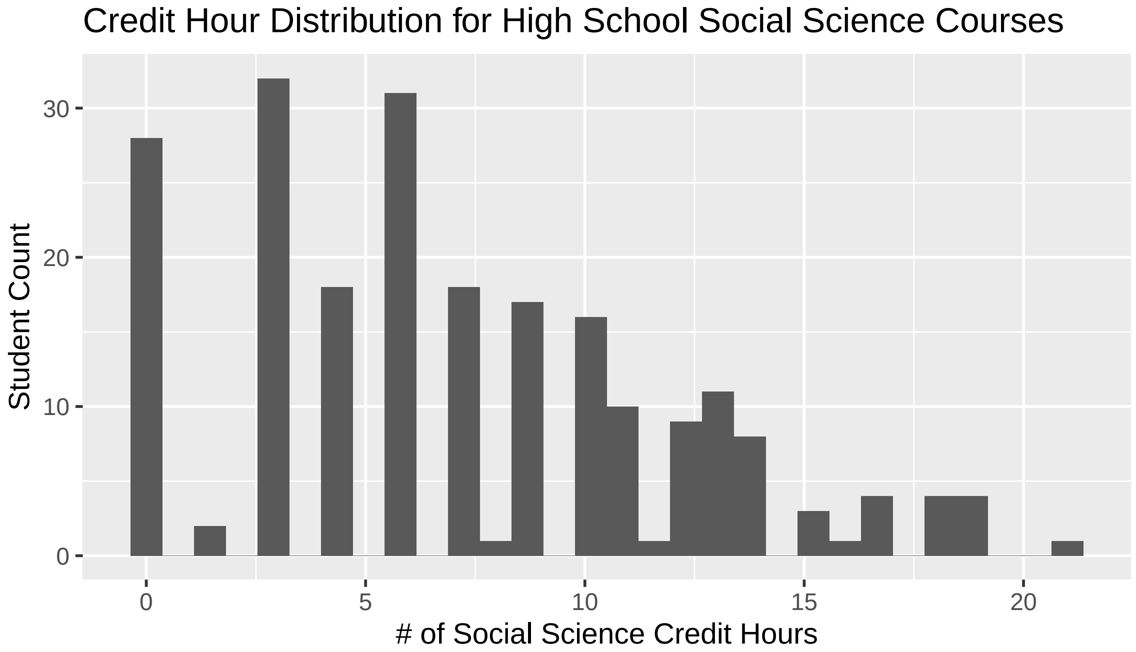
SAT: Mathematics Score Distribution



SAT: Verbal/Literacy Score Distribution

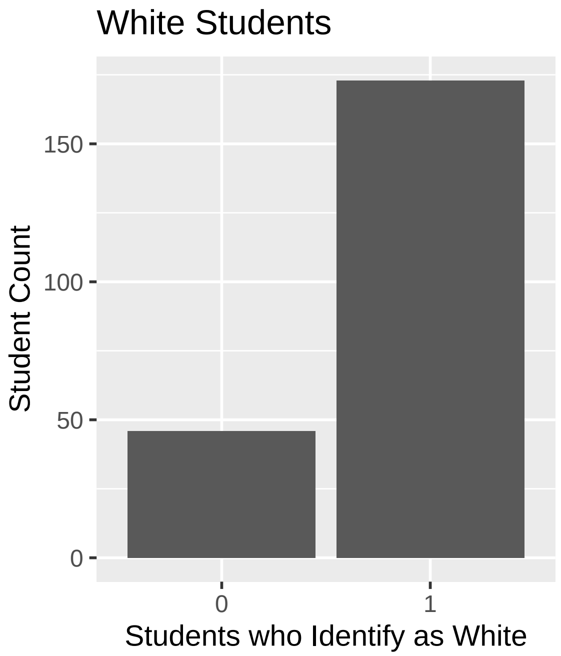


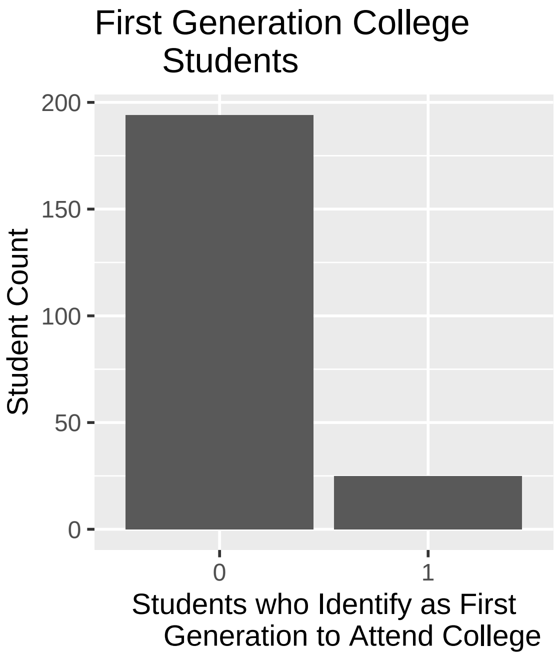

Credit Hour Distribution for High School Humanities Courses
Student Count
0
10
20
0
10
20
30
40
# of Humanities Credit Hours

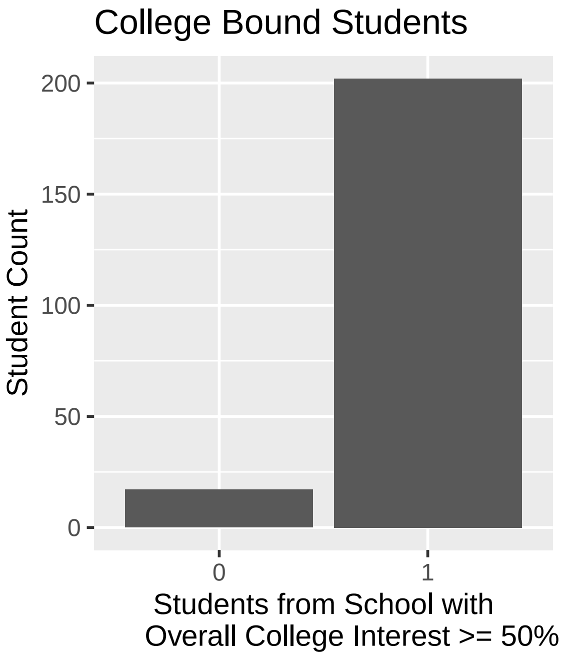

Credit Hour Distribution for High School Social Science Courses
Student Count
0
10
20
30
0
5
10
15
20
# of Social Science Credit Hours

CATEGORICAL VARIABLES

The following provides appropriate visual representation of the distributions of categorical variables identified in the dataset. As previously stated, these categorical variables consist strictly of boolean values, with 0 indicating falsity of a certain identity/status of a student, and 1 indicating that a student identifies with a given condition.

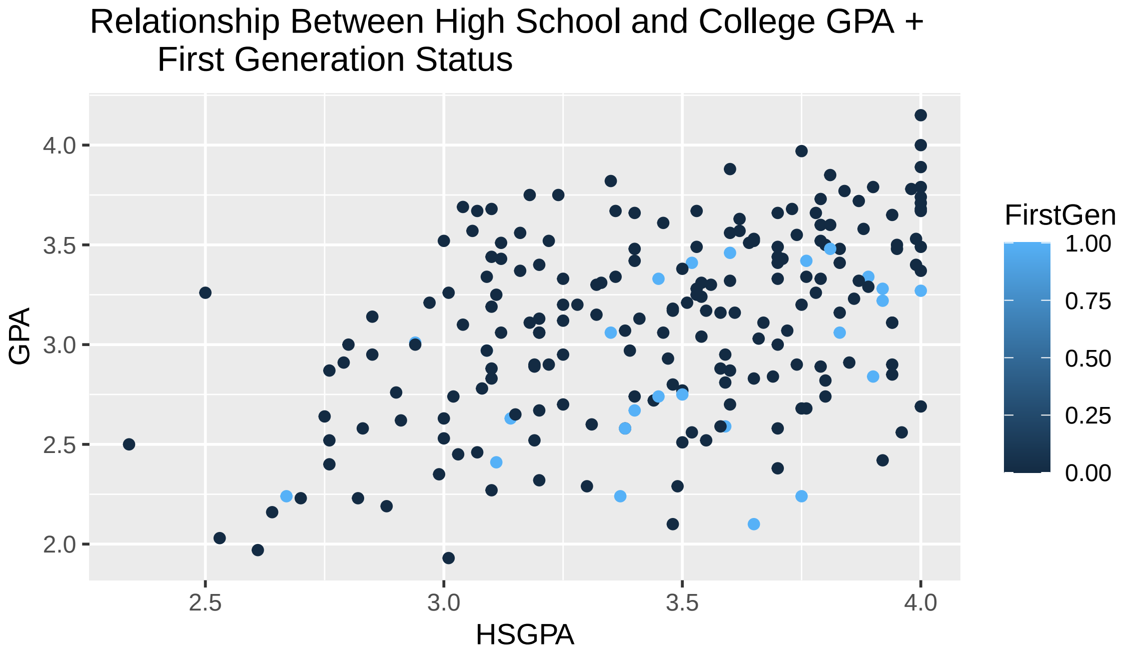


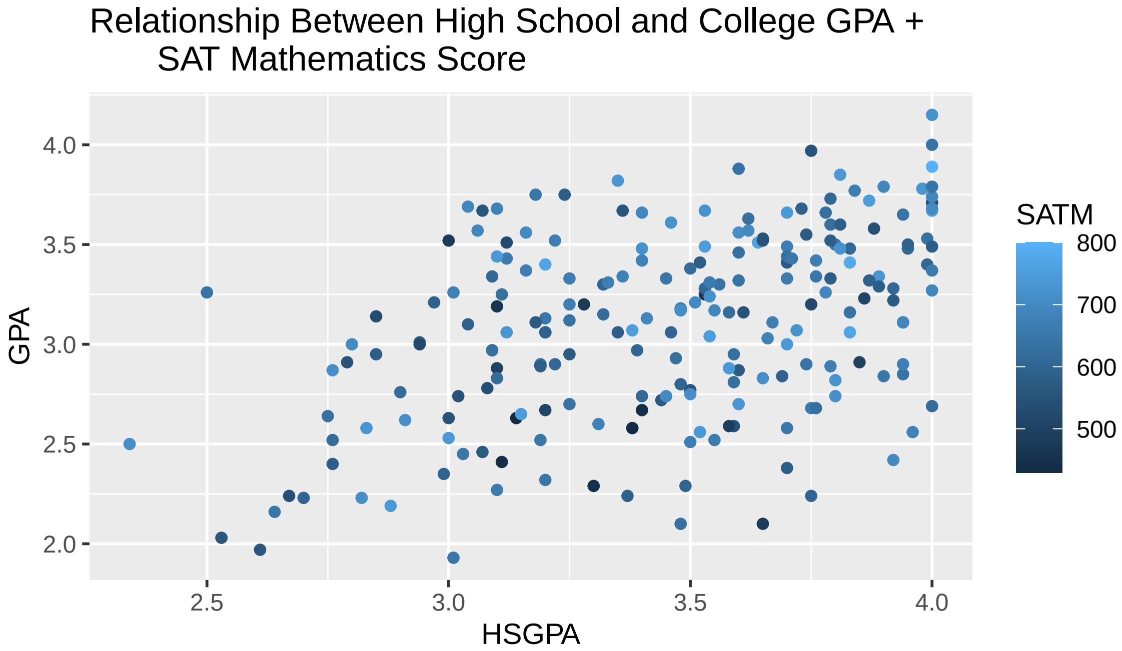


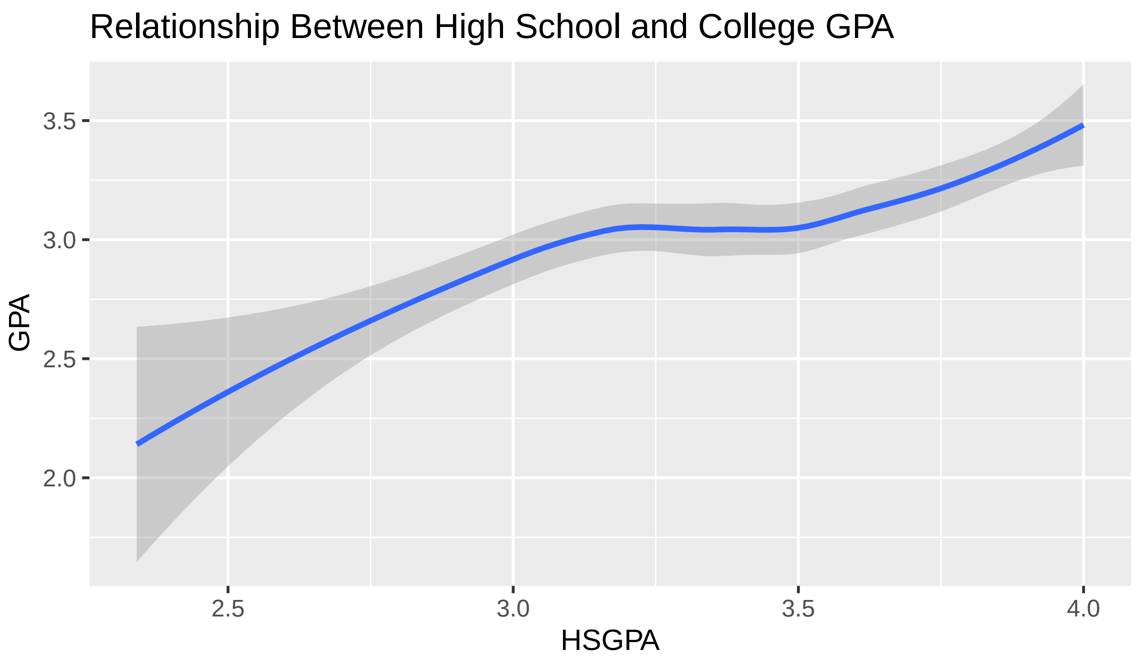


ANALYSIS OF RELATIONSHIP BETWEEN HIGH SCHOOL GPA AND COLLEGE GPA

The following analyses surrounds the possibility of a relationship between a student's GPA in high school and their GPA in their first year of college. Such an analysis seeks to determine consistency in a student's academic performance in high school versus in college, with particular respect to their GPA. A strong correlation between the `HSGPA` and `GPA` can tell us this. Several variables, such as the student's identification as a first-generation college student, and their score on a particular portion of SAT, are integrated into the following graphical analyses.







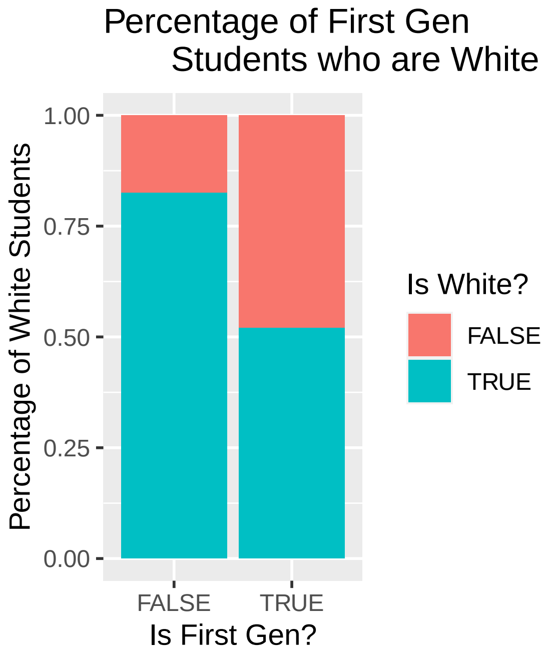
Line of Best Fit: Relationship Scatterplots for High School and College GPA

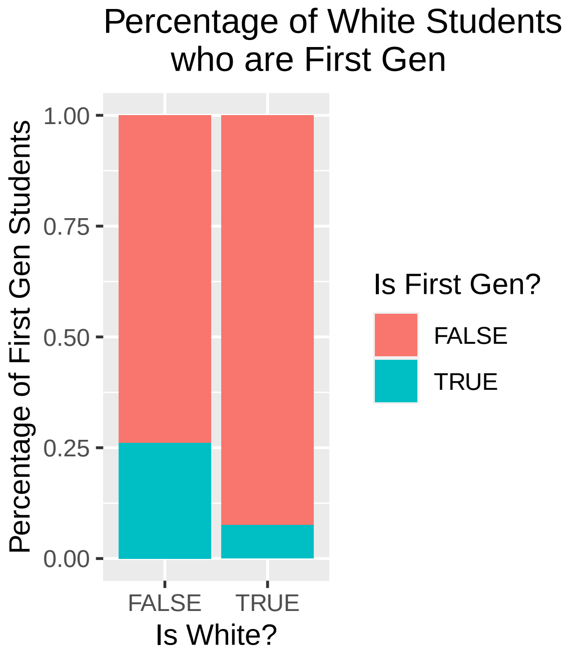
```
##
## Call:
## lm(formula = FirstYearGPA$GPA ~ FirstYearGPA$HSGPA)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.10565 -0.31329  0.05871  0.29485  0.82291
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         1.17985    0.26194   4.504 1.09e-05 ***
## FirstYearGPA$HSGPA  0.55501    0.07542   7.359 3.78e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4174 on 217 degrees of freedom
## Multiple R-squared:  0.1997, Adjusted R-squared:  0.196
## F-statistic: 54.15 on 1 and 217 DF,  p-value: 3.783e-12
```

```
##        (Intercept) FirstYearGPA$HSGPA
##          1.1798507          0.5550125
```

ANALYSIS OF RELATIONSHIP BETWEEN FIRST GENERATION STATUS AND IDENTIFICATION AS WHITE/NON-WHITE

The following evaluates whether there exists a relationship between a student's identification as being the first in their family to attend college with their racial identification as White. The potential conclusions relate to whether trends with first-gen statuses exist in white and non-white students. Are there more first-gens among non-white populations? White populations? The following analyses seek such answers in this dataset.





Chi-Squared Test: Expected vs. Actual Relationship Between First Gen Status and Identification as White

```
##
##       0   1
##   0  34 160
##   1  12  13
```

```
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  newtable
## X-squared = 10.626, df = 1, p-value = 0.001115
```

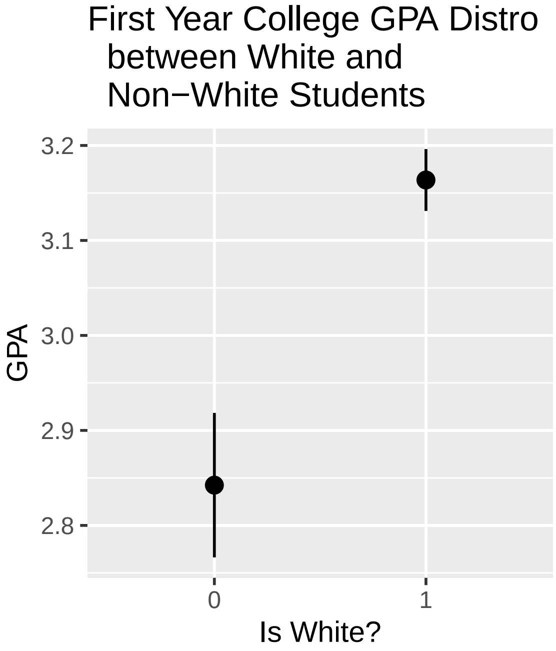
```
##
##       0   1
##   0  34 160
##   1  12  13
```

```
##
##             0         1
##   0 40.748858 153.25114
##   1  5.251142  19.74886
```

```
##
##          0      1
##   0 40.75 153.25
##   1  5.25  19.75
```

ANALYSIS OF RELATIONSHIP BETWEEN GPA AND IDENTIFICATION AS WHITE/NON-WHITE

The following table represents the distribution of first-year college GPAs among students, adjusted to also reflect the population of white/non-white students. It seeks to determine if there is a trend in lower/higher GPAs in students depending on their identification as white or non-white.



KEY FINDINGS & CONCLUSION

Of the three analyses conducted - the first dealing with the correlation between a student's high school GPA and their GPA in their first year of college, the second dealing with the relationship between first gen status and identification as white/non-white, and the third dealing with the relationship between a student's white/non-white identification and GPA trends - several important findings came to fruition. Firstly, there is a rather strong correlation between high school GPA and college GPA with several outliers. Overall, it is predictable that given GPA data, students are likely to perform similarly in college to what was typical of their academic performance in high school. Their GPA is likely to be similar to what they earned in high school. Secondly, it is evident that there is significant relationship at the 95% confidence interval that a student's identification as a first-gen college student is likely to be contingent on whether they identify as white/non-white. Particularly, it is evident that students who identify as White are less likely to be first-gen college students. Lastly, it is evident that higher first-year college GPAs trend in students who identify as White, concentrating narrowly between 3.1 and 3.2.