empirical_proj_2

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Question 1

The fundamental problem of causal inference is that you cannot see the outcome for a child who both was in a small class and not in a small class. In other words, it is impossible to measure the dual outcomes when a child both is in a small class and not in a small class, because the child can only either be in a small class or not in a small class.

Question 2

The following variables have missing values:

- towncode: 318 missing
- math: 58 missing
- verb: 466 missing
- ses_index: 318 missing
- boy: 1037 missing

```
##    student_id       towncode        schlcode        class_id
##  Min.   :    1   Min.   :  166   Min.   :11005   Min.   :110051
##  1st Qu.:13600   1st Qu.:26104   1st Qu.:31049   1st Qu.:310491
##  Median :27412   Median :62000   Median :41284   Median :412841
##  Mean   :27395   Mean   :50434   Mean   :39776   Mean   :397762
##  3rd Qu.:41158   3rd Qu.:79004   3rd Qu.:51247   3rd Qu.:512471
##  Max.   :54860   Max.   :98004   Max.   :61365   Max.   :613651
##                  NA's   :318
##  school_enrollment   class_size         math           verb
##  Min.   :  9.00    Min.   : 7.00   Min.   : 1.0   Min.   : 1.00
##  1st Qu.: 57.00    1st Qu.:28.00   1st Qu.:23.0   1st Qu.:25.00
##  Median : 75.00    Median :32.00   Median :27.0   Median :27.00
##  Mean   : 80.41    Mean   :31.58   Mean   :25.3   Mean   :25.97
##  3rd Qu.:105.00    3rd Qu.:36.00   3rd Qu.:29.0   3rd Qu.:29.00
##  Max.   :188.00    Max.   :44.00   Max.   :30.0   Max.   :30.00
##                                    NA's   :58     NA's   :466
##    ses_index          boy           born_isr        religious
##  Min.   : 0.00   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.: 4.00   1st Qu.:0.0000   1st Qu.:1.0000   1st Qu.:0.0000
##  Median : 9.00   Median :1.0000   Median :1.0000   Median :0.0000
##  Mean   :13.17   Mean   :0.5078   Mean   :0.9608   Mean   :0.2242
##  3rd Qu.:18.00   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:0.0000
##  Max.   :76.00   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
##  NA's   :318     NA's   :1037
```

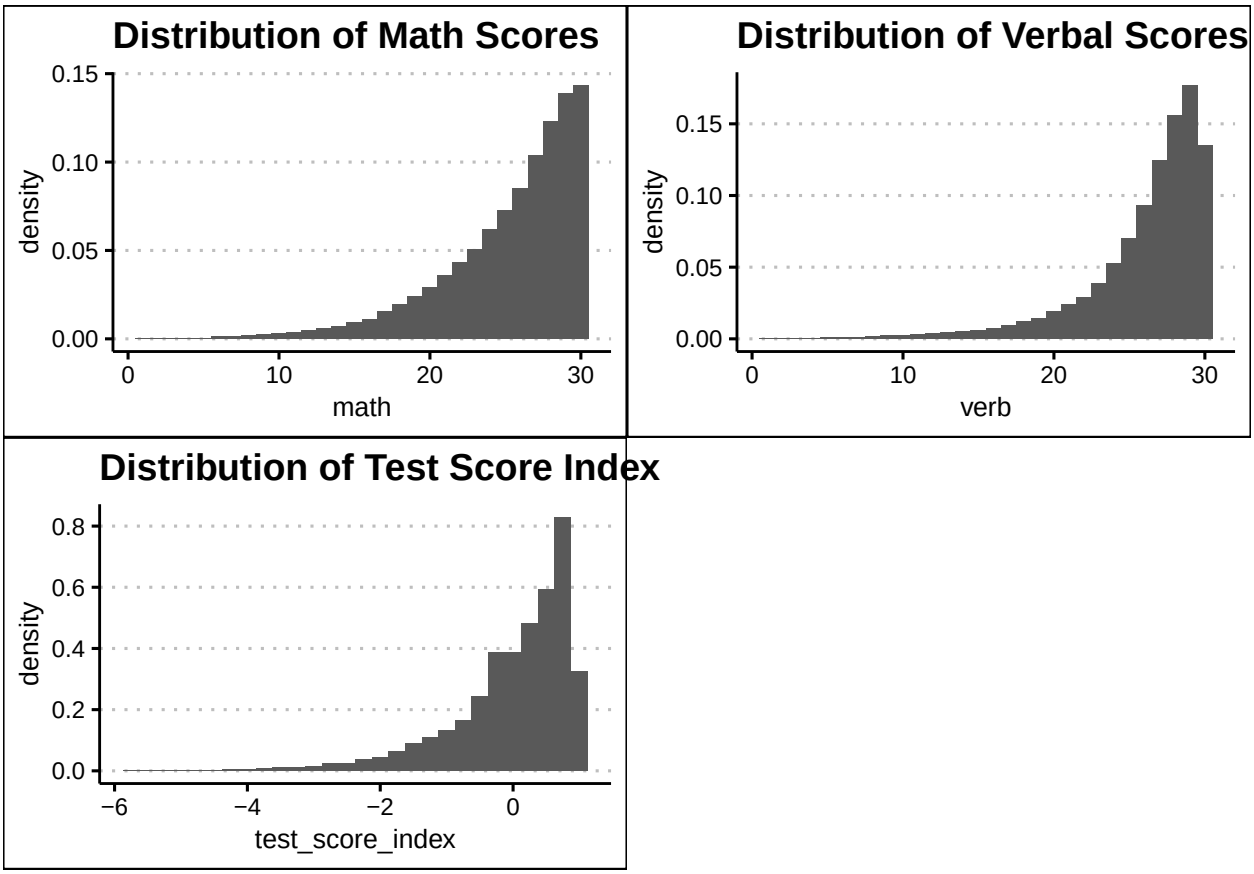
Questions 3 and 4

Table 1: Summary Statistics

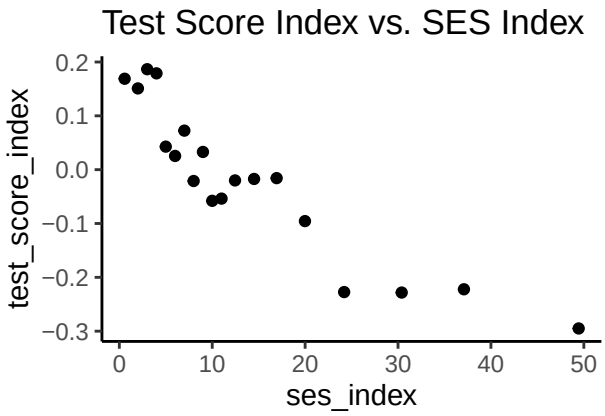
Variable	Mean	Sd	Min	Max
math	25.3	4.527	1	30
verb	26	4.279	1	30
test_score_index	0	0.903	-5.835	1.038

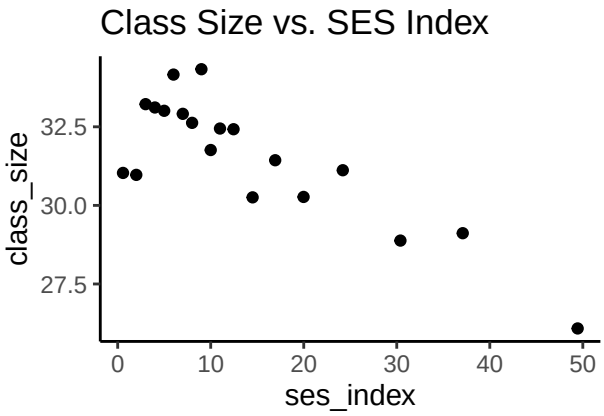
Question 5

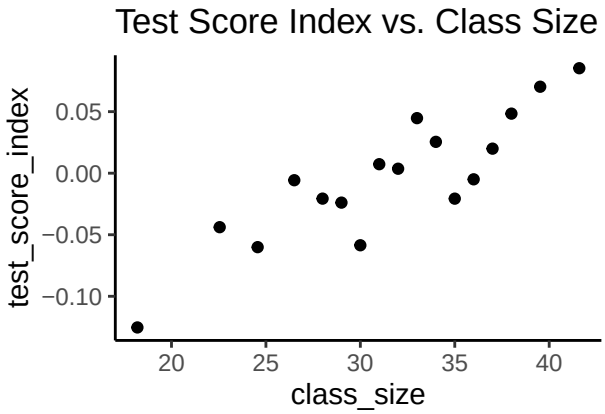
All of the histograms appear to not by symmetrical and all of them have a long left tail.



Question 6







Question 7

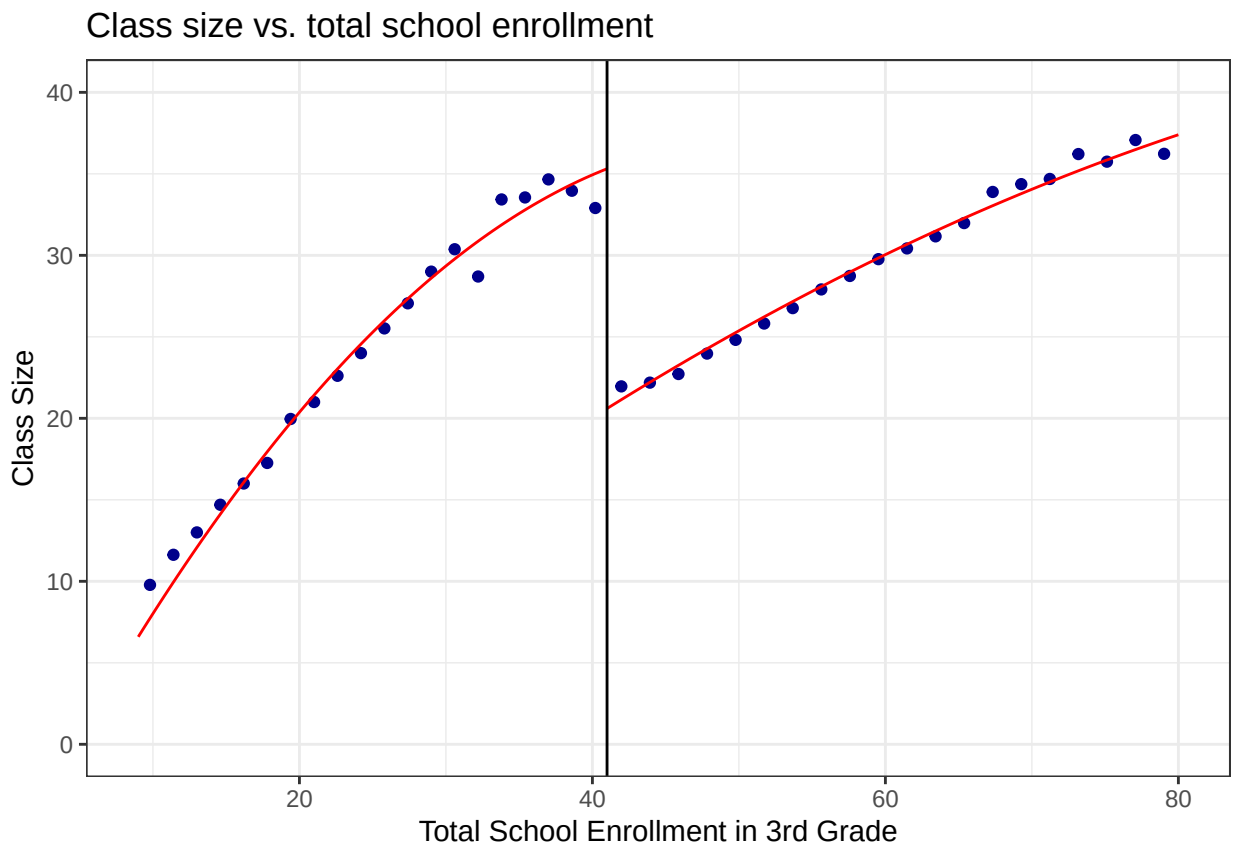
As we can see from the binned scatter plots above, the socio economic index variable is correlated with both class size and test score index. As such, it is a counfounding variable and mean we cannot interpret the relationship between class size and test scores causally because it is likely that a student's socioeconomic status influences both outcomes, meaning that we don't know how greatly class size affects test scores versus ses affects test scores.

Question 8

Part a

I chose a quadratic model it seems to fit the data better than a linear model, especiaally for the data to the left of the break

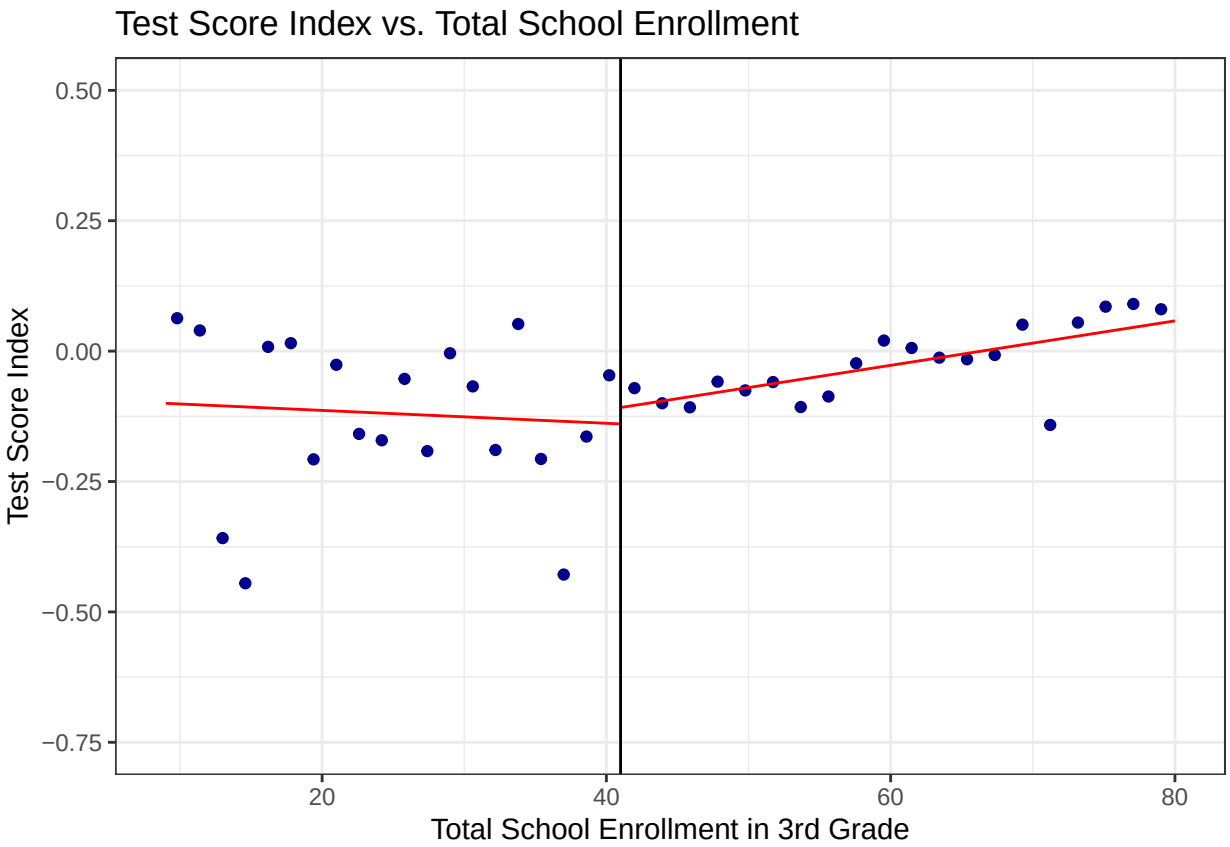
```
## [1] "Mass points detected in the running variable."
```



Part b

I chose to use a linear model because it seems to fit the data better than a quadrtatic model. When I chose a quadrataic model, it seemed like residuals on the right side of the break were much more in the positive than the negative, which would be bad. Looking at the graph, it doesn't seem like there is a wide gap in schools with 40 kids and schools with 41 kids enrolled.

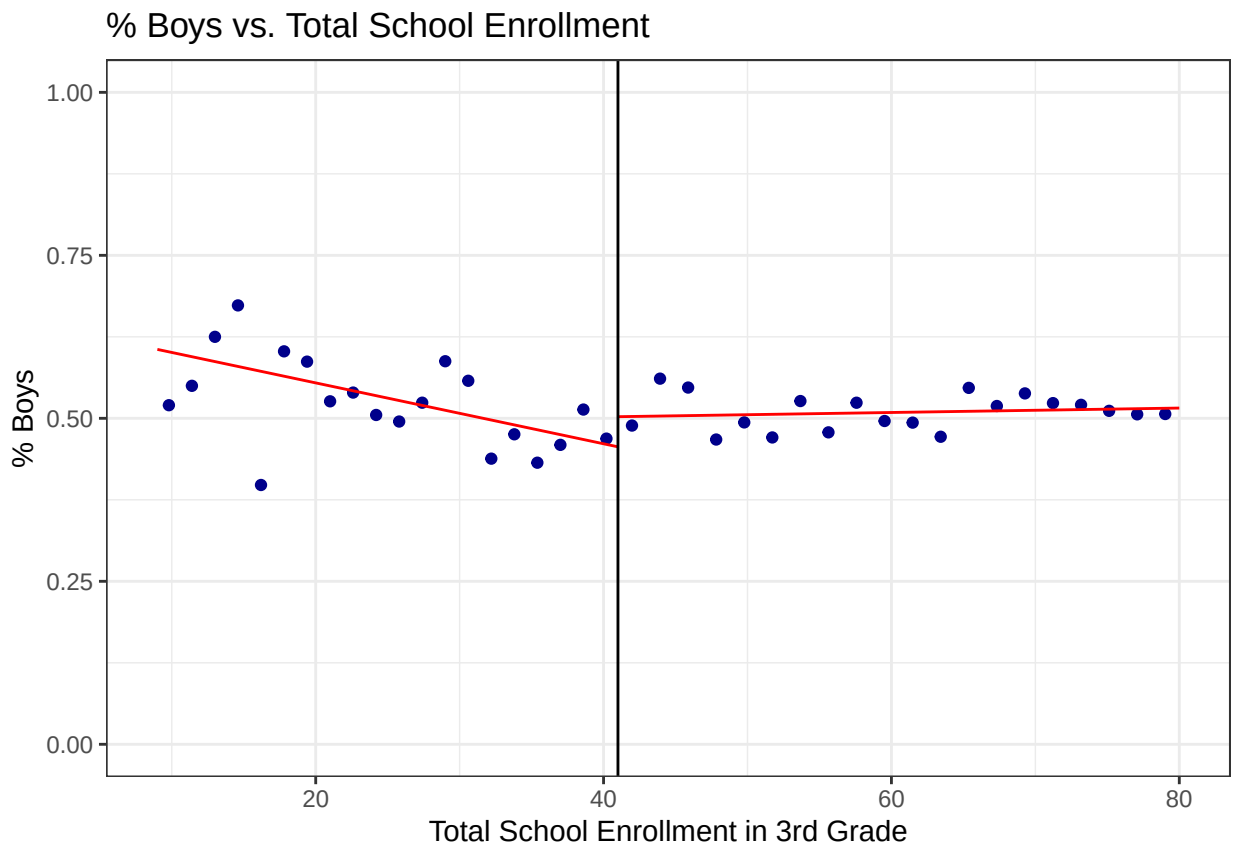
```
## [1] "Mass points detected in the running variable."
```



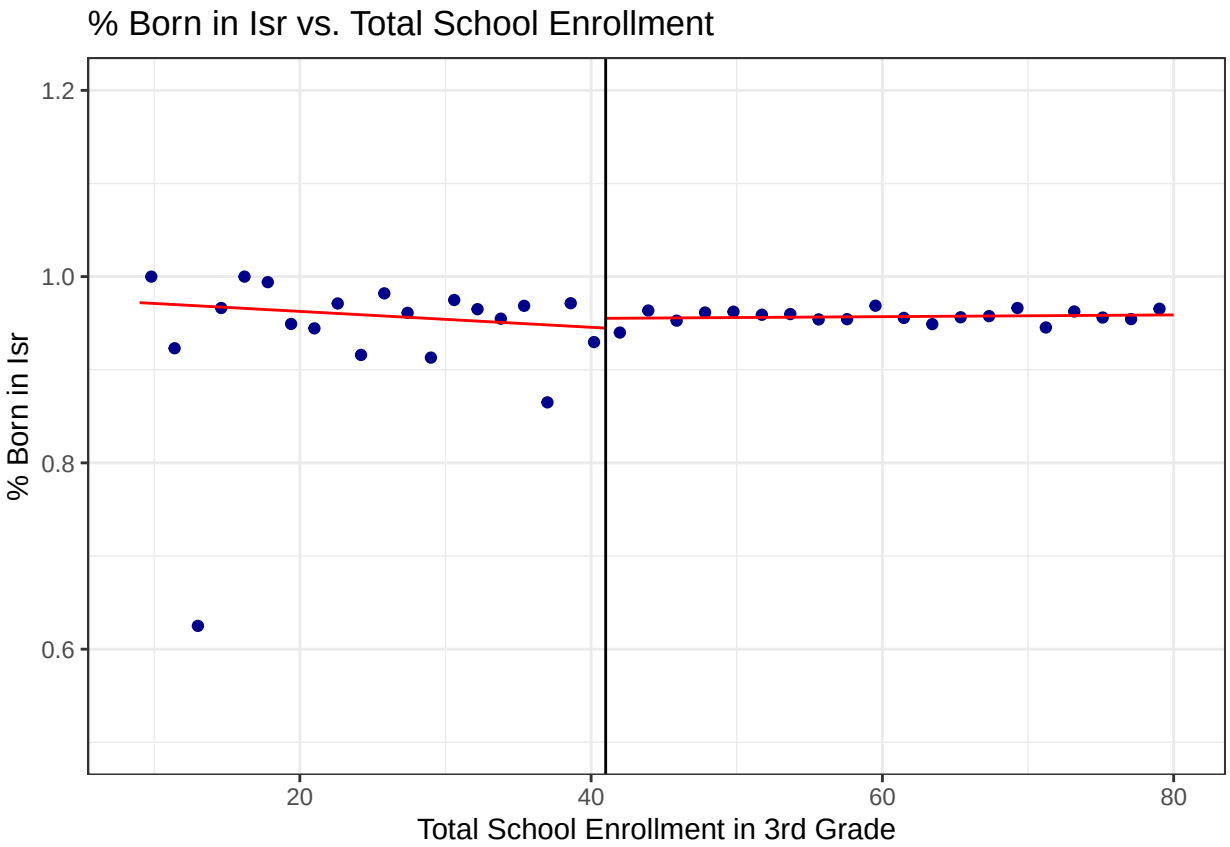
Question 9

Part a

```
## [1] "Mass points detected in the running variable."
```




```
## [1] "Mass points detected in the running variable."
```



Part b

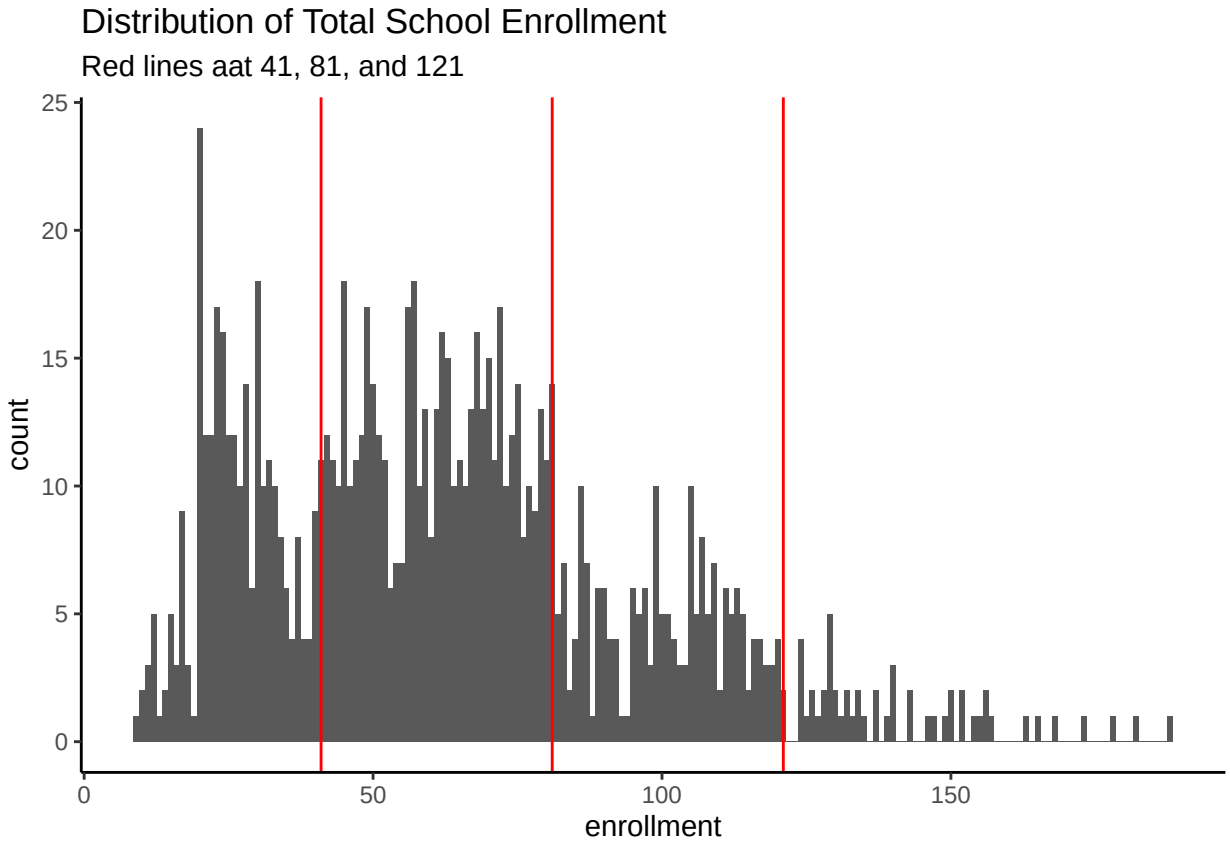
The identification assumption for the regression discontinuity design is that schools on either side of the cutoff are similar in all ways and as such the fact that they have school enrollment over or under the cutoff is as if random. The graphs from part a above are consistent with this identification assumption, as schools just at either side of the cutoff do not seem to have different percentages of boys or kids born in Israel enrolled.

Question 10

Part a

Manipulation of school enrollment could possibly invalidate the identification assumption because it means that schools could intentially stay right below the discontinuity cutoff, meaning that the schools on either side of the cutoff would be different in this way.

Parts b, c, and d



Looking at the histogram above, it seems like there is a spike in enrollment number right after the break at 41. However, there seems to be a drastic drop off in enrollment right at the 81 threshold line. As such, it certainly seems possible that there was manipulation in enrollment, but there are conflicting behvaviors at the two cutoffs. There doesn't appear to be any spike at the 121 line.