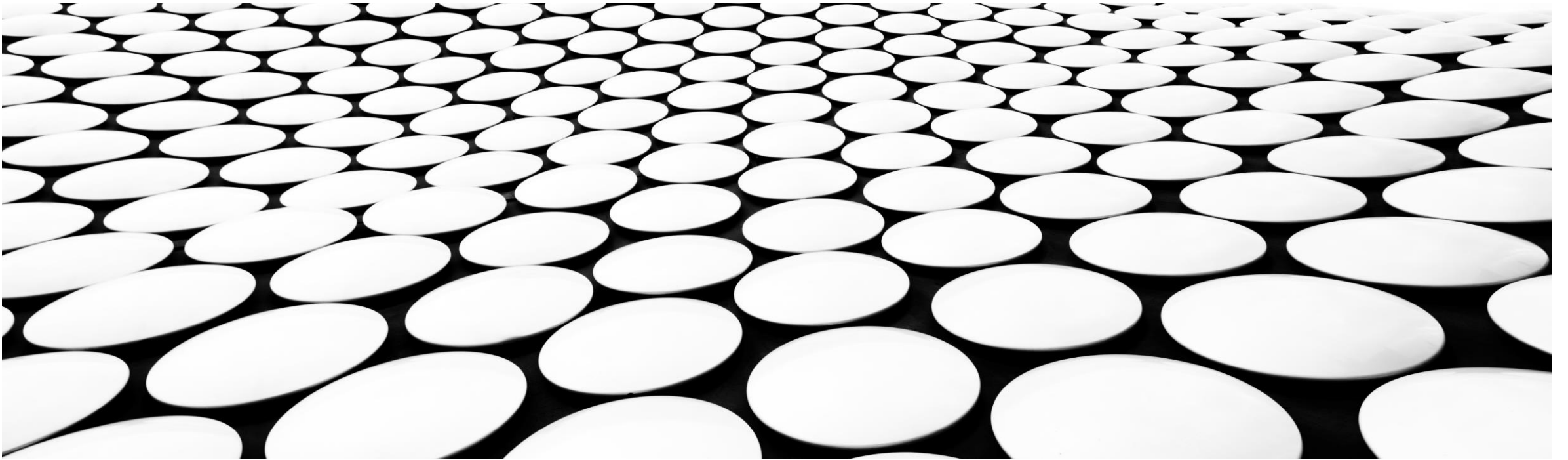

PROJECT 1 - RECOMMENDING STATES WITH LOW PARTICIPATION RATES IN SATS FOR MARKETING OPPORTUNITIES

RASHIDI



PREAMBLE

- As a marketing advisor, I wish to advise CollegeBoard, Inc. on which states to focus on for their marketing and lobbying efforts in order to increase participation rates for SATs across the US.
- Participation data for SATs across 2017 – 2019 has been compiled, cleaned, and analysed to provide recommendations to CollegeBoard, Inc.



DATA CLEANING



DATA CLEANING

- All datasets from SATs and ACTs 2017 – 2019 (total of 6) were imported into Python and cleaned.

Following are the observations seen:

1. Column 'Math' in dataset for 2017 SAT has a cell value (52) less than 400 (minimum score for SAT Math paper)
 - Value corresponds to the state of Maryland. Replaced the wrong value with the correct value from source¹ (524).
 2. Column 'Participation Rate' in dataset for 2019 SAT has dashes, '-', for cell values
 - After verifying from source that the data was not provided, replaced the cell with 'NaN' values.
 3. Column 'Science' in dataset for 2017 ACT minimum raw score is quite low (2.3) compared to the mean (21.04)
 - Value corresponds to the state of Maryland. Replaced the wrong value with the correct value from source² (23.2).
 4. All values of 'Participation Rate' in all datasets were in strings with '%'.
 - Removed the '%' and converted all to decimal floats.
 5. Column 'Composite' in dataset for 2017 ACT has one cell value with 'x' string ('20.2x')
 - Value corresponds to the state of Wyoming. Removed the extra 'x' string and converted cell value to float.
- Datasets were merged and used for further analysis.

1) Here are the Average SAT Scores by State. Source: <https://blog.collegevine.com/here-are-the-average-sat-scores-by-state>

2) 2017 - ACT Profile Report – Maryland. Source : https://www.act.org/content/dam/act/unsecured/documents/cccr2017/P_21_219999_S_S_N00_ACT-GCPR_Maryland.pdf

DATA DICTIONARY

- The following is a brief summary of the features within the compiled dataset:

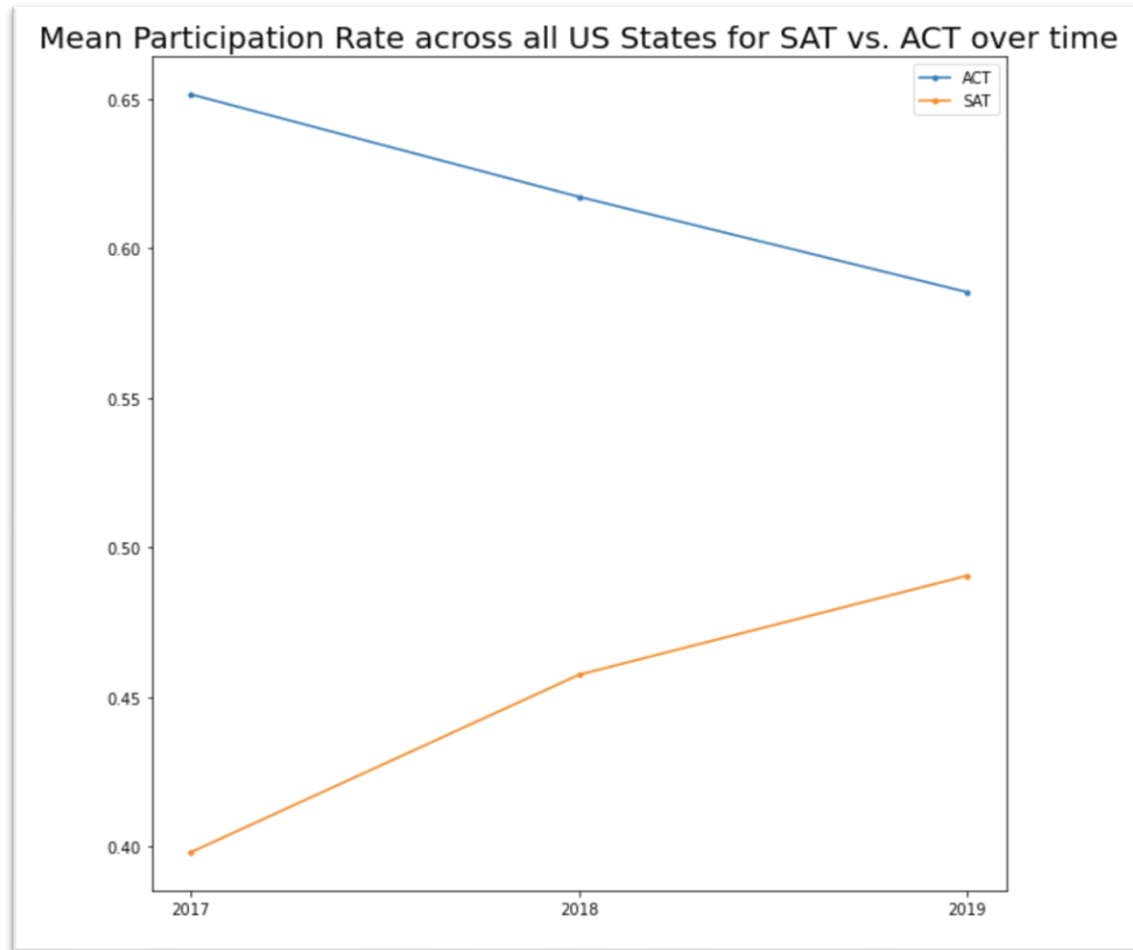
Feature	Type	Dataset	Description
state	object	SAT & ACT scores from 2017 - 2019	States with Participation in SATs/ACTs from 2017 - 2019
sat_2017_participation	float64	SAT 2017 Average Scores	Percentage of student participation per state (2 decimal places)
sat_2017_total	float64	SAT 2017 Average Scores	Average Total SAT score per state (max. of 1600, 1 decimal place)
sat_2018_participation	float64	SAT 2018 Average Scores	Percentage of student participation per state (2 decimal places)
sat_2018_total	float64	SAT 2018 Average Scores	Average Total SAT score per state (max. of 1600, 1 decimal place)
sat_2019_participation	float64	SAT 2019 Average Scores	Percentage of student participation per state (2 decimal places)
sat_2019_total	float64	SAT 2019 Average Scores	Average Total SAT score per state (max. of 1600, 1 decimal place)
act_2017_participation	float64	ACT 2017 Average Scores	Percentage of student participation per state (2 decimal places)
act_2017_composite	float64	ACT 2017 Average Scores	Average Composite ACT Score per state (1 decimal place)
act_2018_participation	float64	ACT 2018 Average Scores	Percentage of student participation per state (2 decimal places)
act_2018_composite	float64	ACT 2018 Average Scores	Average Composite ACT Score per state (1 decimal place)
act_2019_participation	float64	ACT 2019 Average Scores	Percentage of student participation per state (2 decimal places)
act_2019_composite	float64	ACT 2019 Average Scores	Average Composite ACT Score per state (1 decimal place)



EXPLORATORY DATA ANALYSIS (EDA)



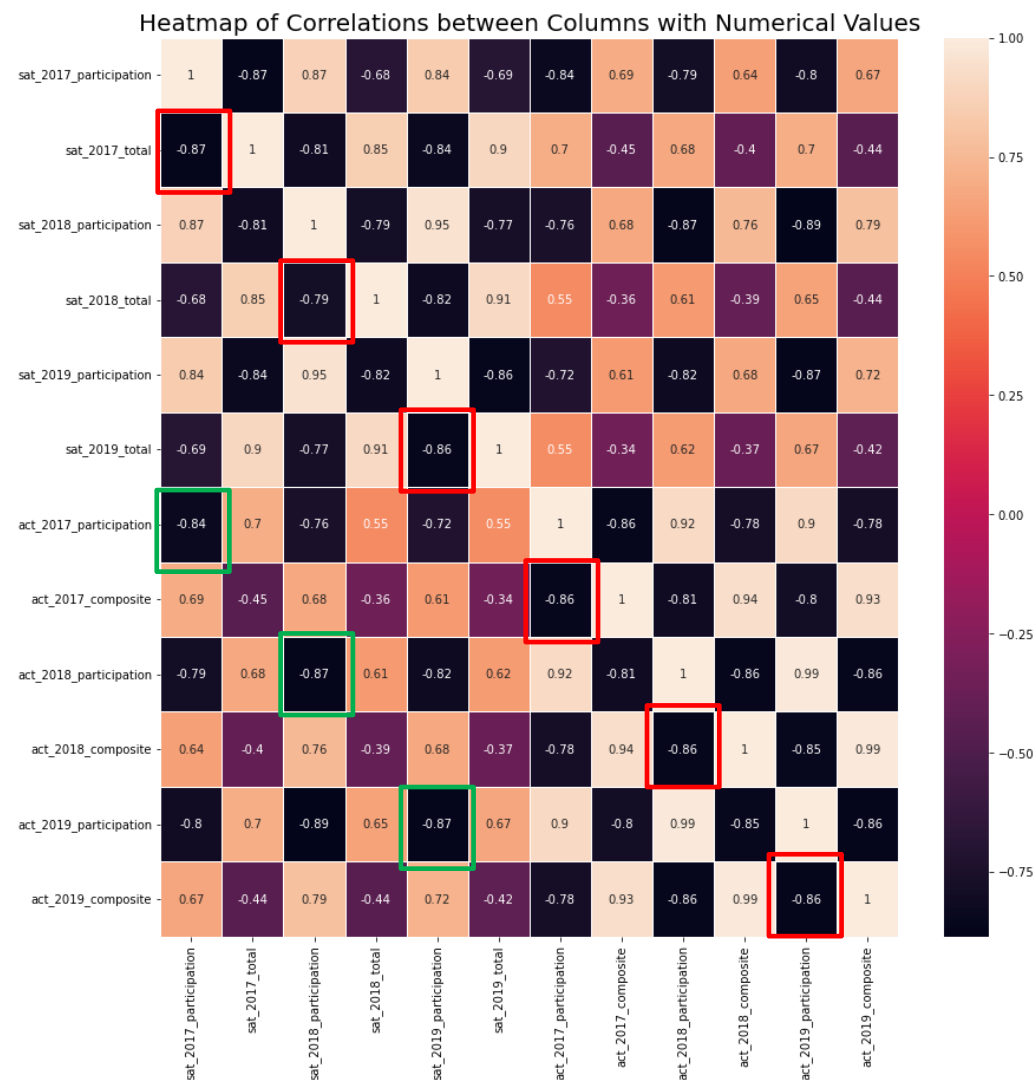
EXPLORATORY DATA ANALYSIS (EDA)



Line Plot of Mean Participation Rate across all US States for SAT vs. ACT in 2017 - 2019

- Upward trend in the mean participation rate for SAT across all US states (with ACT mean participation rate falling over the same period)
- This means that the efforts by CollegeBoard and its partners have been successful so far in getting more students and schools on board with SAT.

EXPLORATORY DATA ANALYSIS (EDA)



Heatmap of Correlations between Columns with Numerical Values in Merged Dataset

Heatmap of correlations between features with numerical values were generated to assist in finding correlations in our data.

Following findings were observed:

1. Based on the heat map, we see a strong negative correlation (value close to -1.0) between participation rates per year and the total/composite scores for both SATs and ACTs. (Marked on the plot with red boxes)
2. We also see that there's a strong negative correlation between participation between SATs vs. ACTs year-on-year which leads to the possibility that there are states which either mandate or allocate more resources to one standardize test over the other. (Marked on the plot with green boxes)

EXPLORATORY DATA ANALYSIS (EDA)

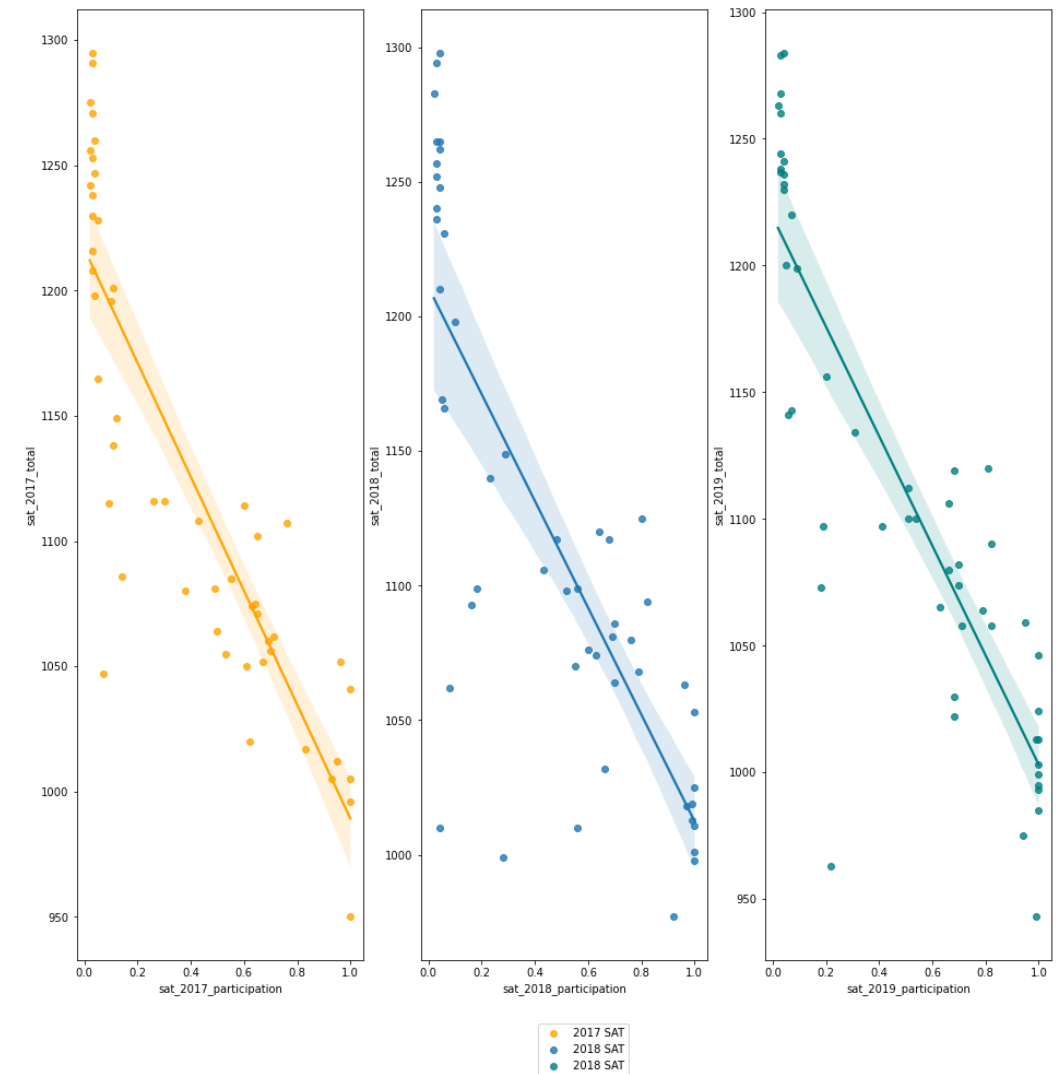
From the heatmap we observed that there's a strong negative correlation between participation rates per year and the total/composite scores for both SATs and ACTs.

The resultant scatter plot diagrams show that the relation is true and consistent year-on-year.

This is probably due to students from states reporting low participation rate are high-performers who are taking SATs additional to their state requirements.¹

1) Participation Rates Skew State Averages on SAT & ACT: <https://medium.com/@james.dargan/participation-skews-state-averages-f68969371a01>

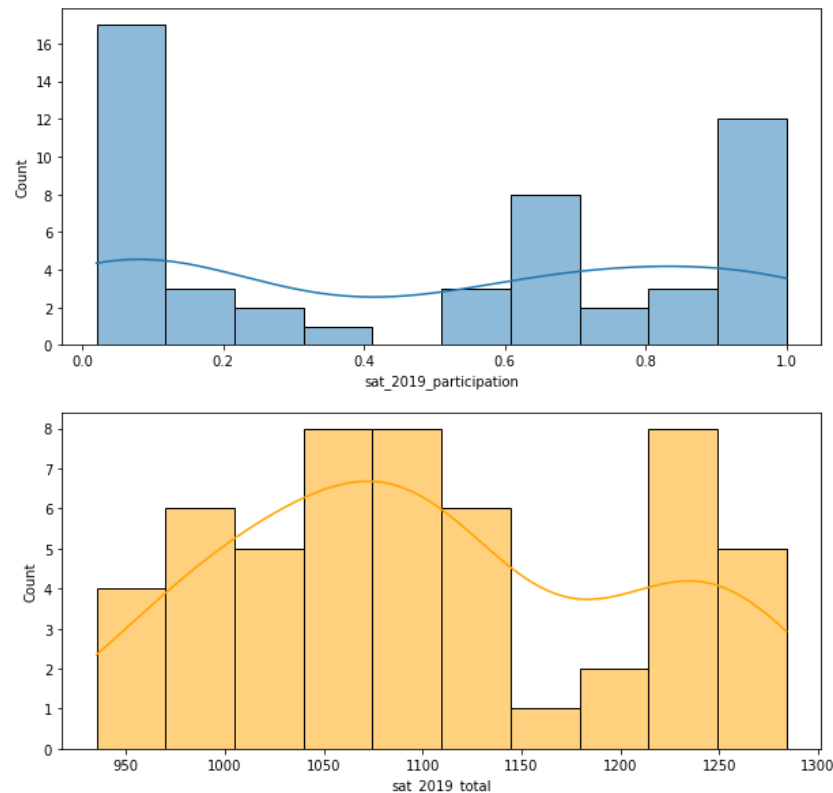
Scatter Plot Diagram for SAT Total Scores vs. Participation Rate



Scatter Plots for SAT Total Scores vs. Participation Rate for 2017 - 2019

EXPLORATORY DATA ANALYSIS (EDA)

Histograms of Participation and Total SAT Scores across All US States in 2019



Histogram graphs for 2019 SAT Dataset

Histograms were also plotted for SAT Participation Rate and Average Total Scores in 2019

SAT Participation Distribution

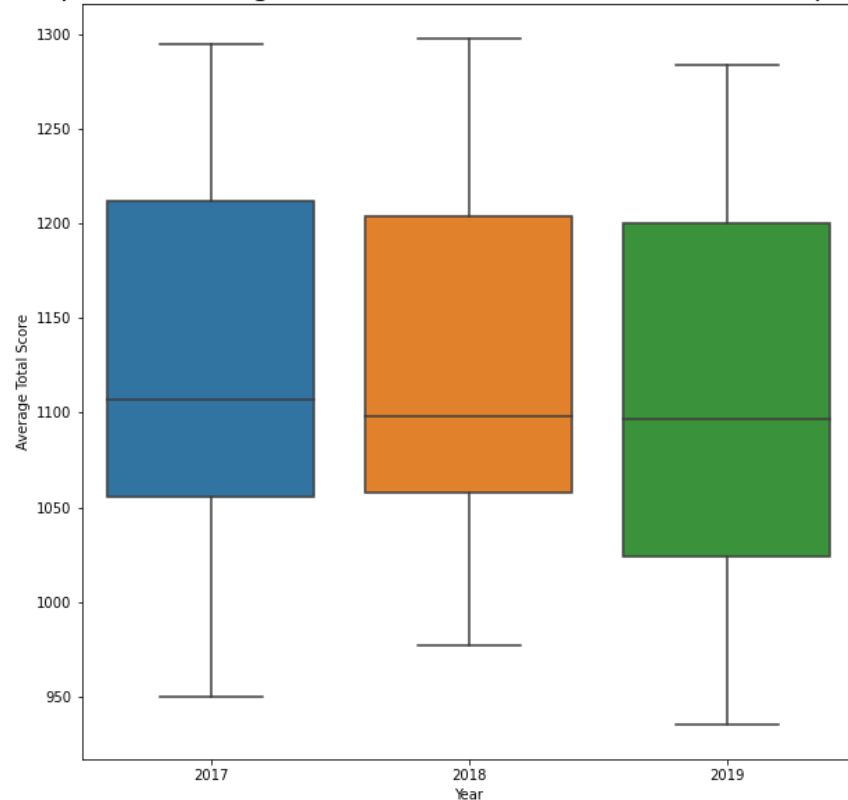
- Although only showing for 2019 above, the distribution for SAT participation has two peaks (Bimodal), with the top two peaks at close to 0% and at 100%. This observation aligns with current real-world observation whereby certain states choose one of the two major standardized test as a graduation requirement.

SAT Average Total Scores Distribution

- SAT Average Total Scores for 2019 also shows a bimodal distribution with unclear peaks at around 1075 and 1225. These two peaks maybe due to different demographic makeups of each state. Participants with Asian descent scored higher as compared to participants with White descent in 2019.¹

EXPLORATORY DATA ANALYSIS (EDA)

Boxplots of Average Total SAT scores across All US States per Year



Boxplots for Average Total SAT Scores across all US States for each year

Boxplots of Average Total Scores for SATs in 2017, 2018, 2019 were plotted.

Following findings were observed:

1. The interquartile range for SAT scores in 2019 is wider compared to 2017 and 2018.
 - This means that the spread of average total scores across all US States are wider. This can be attributed to the fact that there are higher participation rates for SATS seen in 2019.
2. The "Minimum" line for the 2018 box plot has a higher value compared to the other two years.
 - This may be due to the fact that there were some questions from previous years that were reused in the 2018 SAT test papers, which led to simpler paper overall.¹

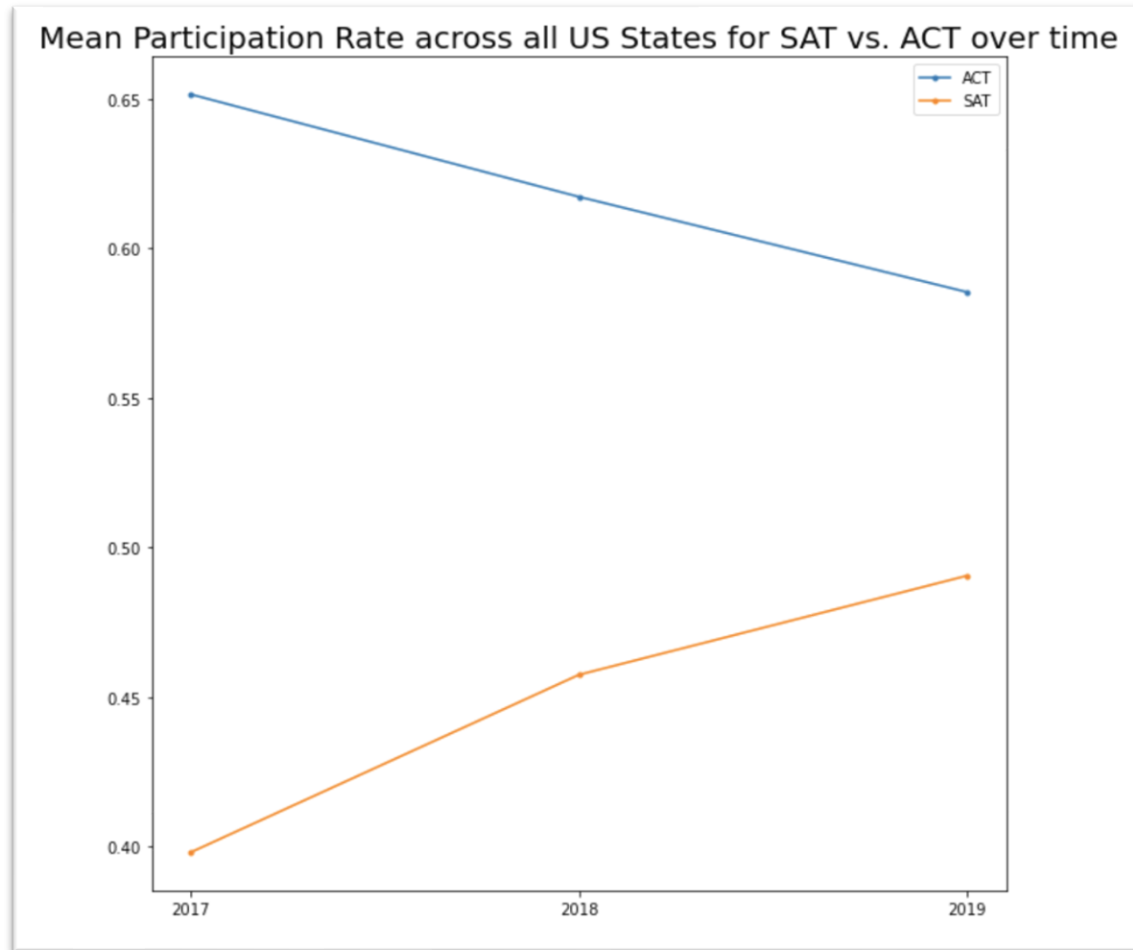
1) Unpacking the August SAT Cheating Scandal: <https://www.applerouth.com/blog/2018/08/30/unpacking-the-august-sat-cheating-scandal/>



RECOMMENDATIONS



INTRODUCTION



Line Plot of Mean Participation Rate across all US States for SAT vs. ACT in 2017 - 2019

- Upward trend in the mean participation rate for SAT across all US states (with ACT mean participation rate falling over the same period)
- This means that the efforts by CollegeBoard and its partners have been successful so far in getting more students and schools on board with SAT.
- However, at present, there are opportunities that can be explored to further increase SAT's market share.

FOCUS ON STATES WITH LOW SAT PARTICIPATION RATES

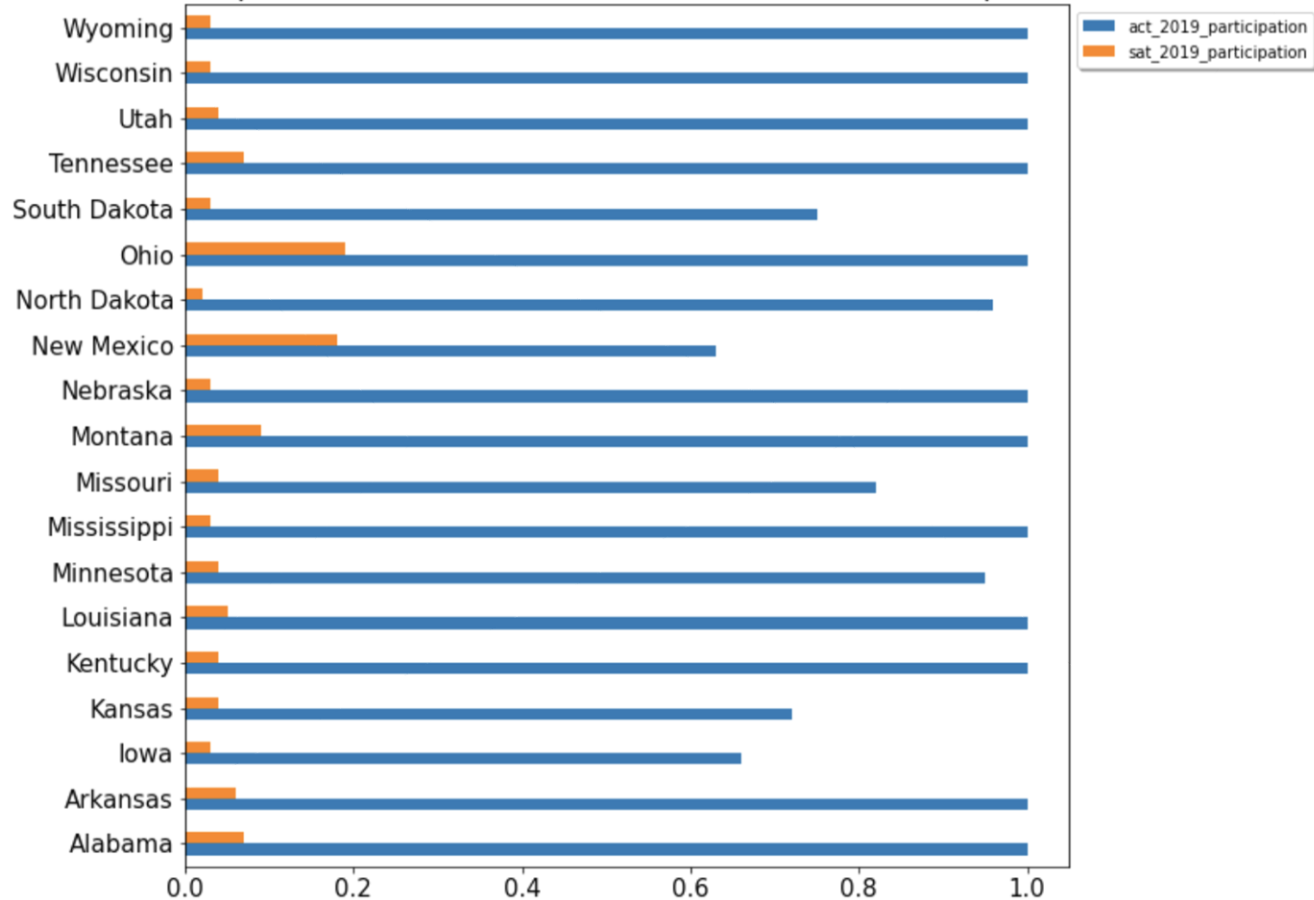
State	SAT Participation Rate		
	2017	2018	2019
Alabama	0.05	0.06	0.07
Arkansas	0.03	0.05	0.06
Iowa	0.02	0.03	0.03
Kansas	0.04	0.04	0.04
Kentucky	0.04	0.04	0.04
Louisiana	0.04	0.04	0.05
Minnesota	0.03	0.04	0.04
Mississippi	0.02	0.03	0.03
Missouri	0.03	0.04	0.04
Montana	0.10	0.10	0.09
Nebraska	0.03	0.03	0.03
New Mexico	0.11	0.16	0.18
North Dakota	0.02	0.02	0.02
Ohio	0.12	0.18	0.19
South Dakota	0.03	0.03	0.03
Tennessee	0.05	0.06	0.07
Utah	0.03	0.04	0.04
Wisconsin	0.03	0.03	0.03
Wyoming	0.03	0.03	0.03

Table of Identified 19 US States with Low SAT Participation Rate (less than 20%) in 2017 - 2019

- The states identified in the table on the left have had low participation rates for SATs across 2017 – 2019 (less than 20%).
- These states can be the target of CollegeBoard's effort in increasing market share, especially since SAT has yet to measurably penetrate these markets.

STATES WITH LOW SAT PARTICIPATION RATES VS. ACT PARTICIPATION RATE

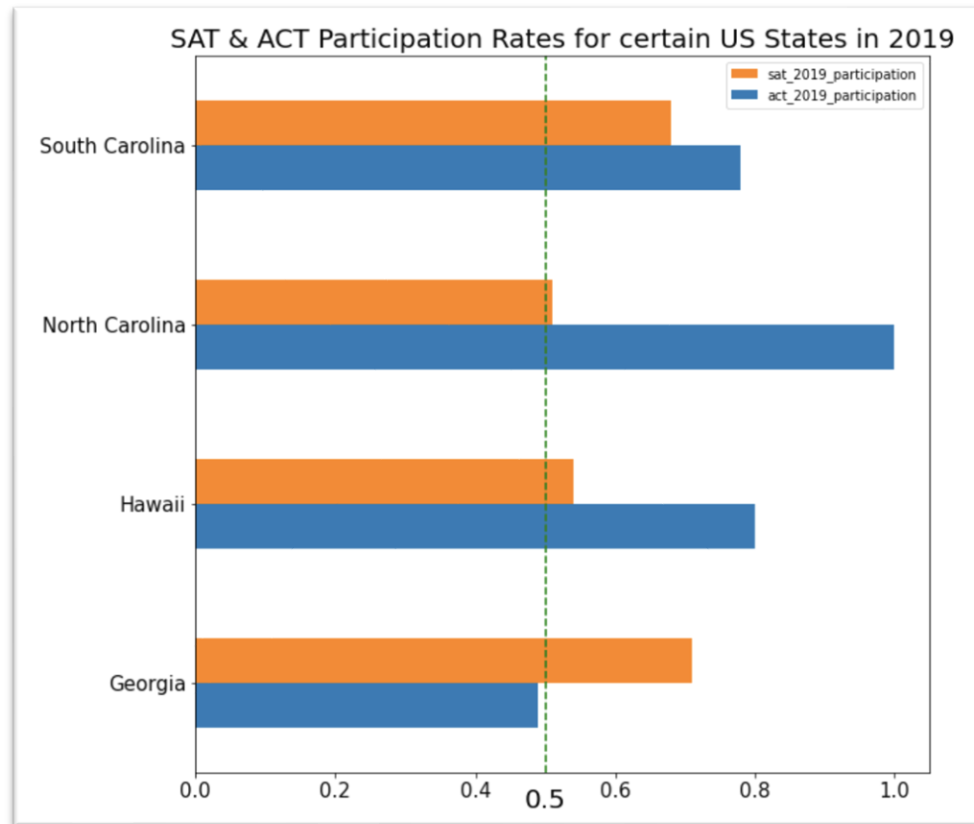
SAT vs. ACT Participation Rates for US States with Low SAT Participation Rates in 2019



Bar Graph of SAT Vs. ACT Participation Rates for Certain US States

- However, it may be hard to lobby at these states who may have already chosen ACT as their choice for standardized test, as seen by the high participation rate for ACTs in 2019 compared to SATs for the states from the previous slide.
- Thus, besides waiting for current ACT contracts to expire, CollegeBoard can focus on states not exclusively contracted to ACTs instead.

FOCUS ON STATES WITH OVERALL HEALTHY TEST PARTICIPATION RATES

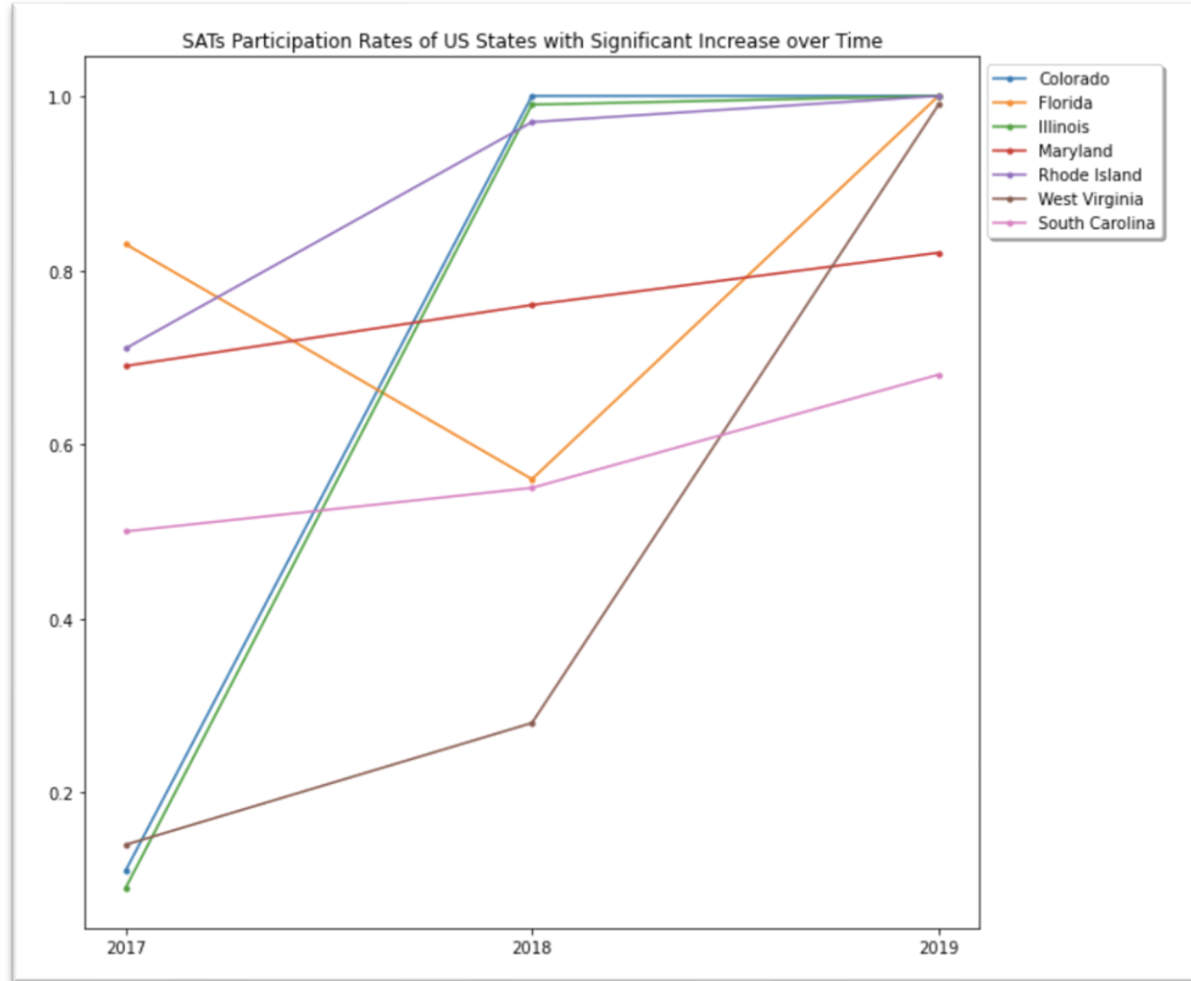


Bar Graph of SAT & ACT Participation Rates for Certain US States

- The graph on the left shows the participation rates of SATs and ACTs for 4 US states with healthy participation rates (close or more than 50% participation for both).
- CollegeBoard can look to make it enticing for students in those states to elect to take SATs instead of or even on top of ACTs.
- Also, for the near term, recommendation for CollegeBoard, inc. is to focus their efforts on states who may have not yet have mandated for SAT to be the exclusive standardized test in their state (like Ohio, Oklahoma, Tennessee, and Idaho).¹

1) The ACT or SAT as a Graduation Requirement: Your 2021 Lowdown, 2021. Source: <https://prepmaven.com/blog/test-prep/states-require-sat-act/>

LEVERAGE ON SUCCESSES



Line Plot of SATs Participation Rates of US States with Significant Increase over Time

Positive actions that contributed to the increase in participation rates of these states were:

- 1) Successful lobbying the states of Colorado¹ and Illinois² to obtain exclusive contracts for SAT as the state's choice for standardised test.
- 2) Initiatives such as 'SAT School Days' and test fee waivers to allow for students, especially from lower income bracket, to take the tests during their school time.³
- 3) Initiatives such as partnering with Khan Academy to offer free test prep and offering fee waivers for college applications of those eligible for free or reduced-price lunch (FRPL) under the National School Lunch Program (NSLP) offer benefits to those of the lower income bracket.¹

These initiatives should be used as leverage in gaining contracts with states to choose SAT as their choice for standardized test.

1) Colorado's Switch from ACT to SAT, January 2016. Source: https://www.coloradokids.org/wp-content/uploads/2016/01/ACTvsSAT_FINAL.pdf
2) Illinois moves ahead with new testing plan, replacing ACT with SAT, February 2016. Source: <https://www.chicagotribune.com/news/ct-illinois-chooses-sat-met-20160211-story.html>
3) More Students Are Taking the SAT Than Ever Before, September 2019. Source: <https://www.usnews.com/news/education-news/articles/2019-09-24/more-students-are-taking-the-sat-than-ever-before>

CONCLUSION

- Although there is an upward trend in the participation rate for SAT over 2017 – 2019, more can be done to increase market share and participation rate for SAT across the US.
- These can be done by the following:
 1. Focus on states with low participation rate.
 2. Focus on states with healthy test participation rates and those that has no mandated/exclusive rights to ACTs.
 3. Leverage on successful campaigns that have caused marked increase in participation rates in some states.