



Project 1: Standardized Test Analysis



Problem Statement

Explore trends in SAT and ACT participation in the United States for the years 2017-2019 and seeks to identify factors that lead to increase in SAT participation rate.



Methodology used in this project

1. Defining problem statement
2. Data selection
3. Data cleaning
4. Exploratory Data Analysis
5. Data Visualization
6. Conclusions and Recommendations



Data selection

ACT (2017 - 2019)

1. State : State name
2. Participation rate : Participation rate for each state
3. Composite scores : Mean ACT composite score for each state

SAT (2017 - 2019)

1. State: : State name
2. Participation Rate : Participation rate for each state
3. Total scores : Mean SAT total score for each state
4. Subject scores : Mean individual subject scores for each state



Data cleaning

Potential issues identified from the raw data:

1. National average should be remove.
2. District of Columbia, Puerto Rico, Virgin Islands are incorrectly identified as a state
3. Composite score for Wyoming does not has a proper value, e.g. 20.2x
4. Science score for Maryland is too low. Should be 23.2 instead of 2.3
5. Duplicated values for Maine state



Data cleaning

Data cleaning required:

1. Remove national average, duplicated values, and incorrect region identified as state.
2. Update values were erroneously reported.
3. Changing to appropriate data attribute to numeric type
4. Renaming data attribute for consistency and easy reference



Exploratory Data Analysis

ACT

	2017	2018	2019
Mean Participation %	65.9	62.3	59.2
SD	32.1	34.1	34.6

SAT

	2017	2018	2019
Mean Participation %	38.6	44.8	48.2
SD	34.6	37.1	38.6



Exploratory Data Analysis

States with highest and lowest ACT participation rate in 2017

- States with high ACT participation rate in 2017 are: Alabama, Kentucky, Wisconsin, Utah, Tennessee

(all 100%)
- States with low ACT participation rate in 2017 are: Maine 8% , Delaware 18%, New Hampshire 18%, Rhode Island 21%, Pennsylvania 23%



Exploratory Data Analysis

States with highest and lowest SAT participation rate in 2017

- States with high SAT participation rate in 2017 are: Michigan 100%, Connecticut 100%, Delaware 100%, New Hampshire 96%, Maine 96%
- States with low SAT participation rate in 2017 are: North Dakota 2%, Mississippi 2%, Iowa 2%, Missouri 3%, Utah 3%

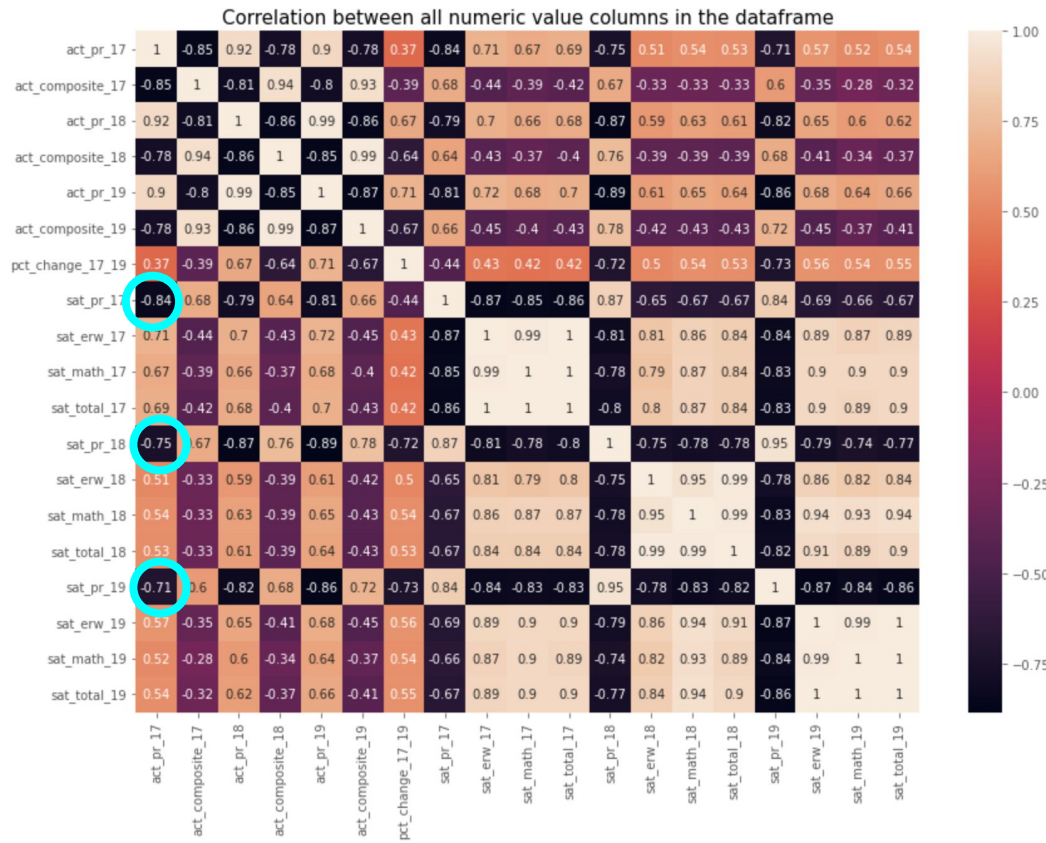
Data Visualization

Heatmap

From the heatmap figure, there are a few strong correlation between few variables.

For example:

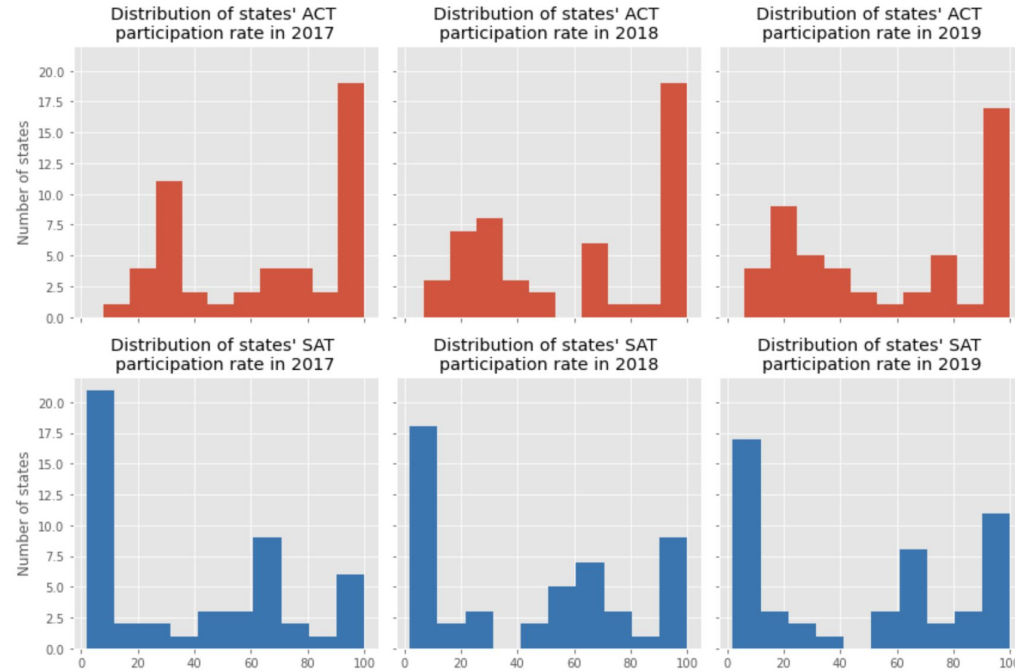
- there is a strong negative correlation between ACT participation rate and SAT participation rate
- there is a strong negative correlation between the ACT & SAT score and their respective participation rate



Data Visualization

Histogram for ACT and SAT participation

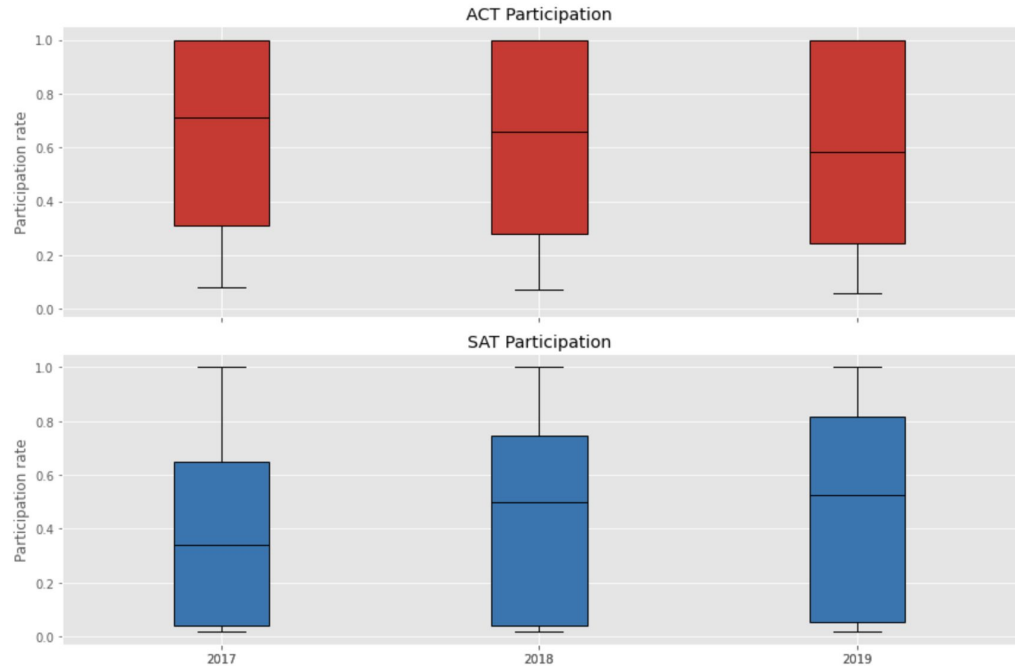
- In general, the distribution of the states' participation rate in either ACT or SAT does not follow a normal distribution.
- From the histogram, the distribution are multimodal. e.g. 2, 3 peaks



Data Visualization

Boxplot for ACT and SAT participation

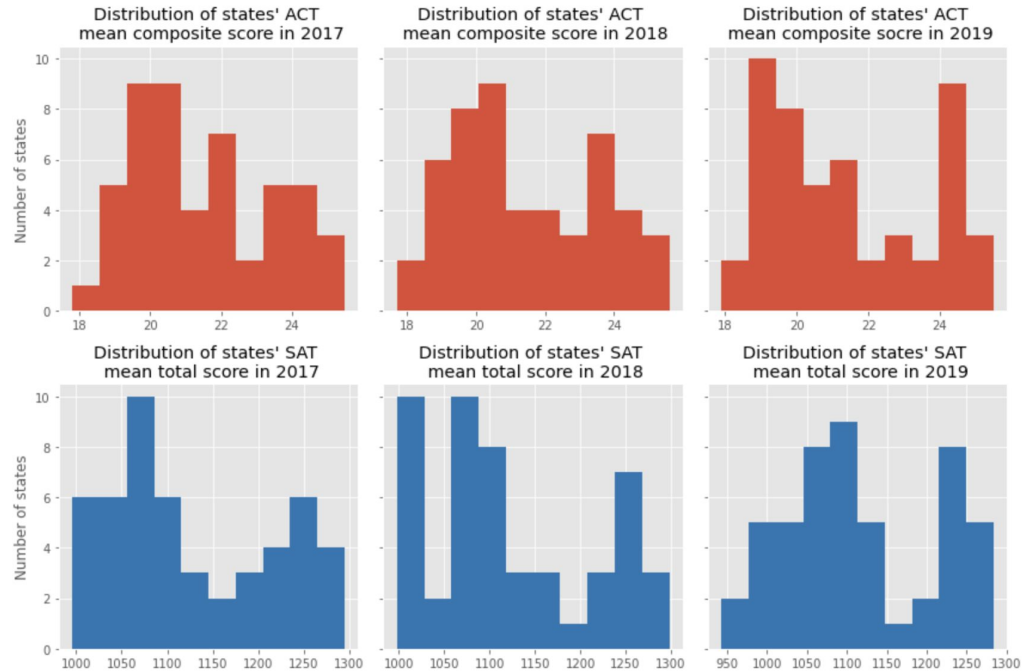
- Based on the median lines of the boxplot, there is a decreasing trend of the ACT participation among all the states. However, the reverse is true for SAT participation.
- Throughout 2017 to 2019, there is a healthier participation rate among states for ACT than SAT as there is already 100% participation rate at the 3rd quartile.



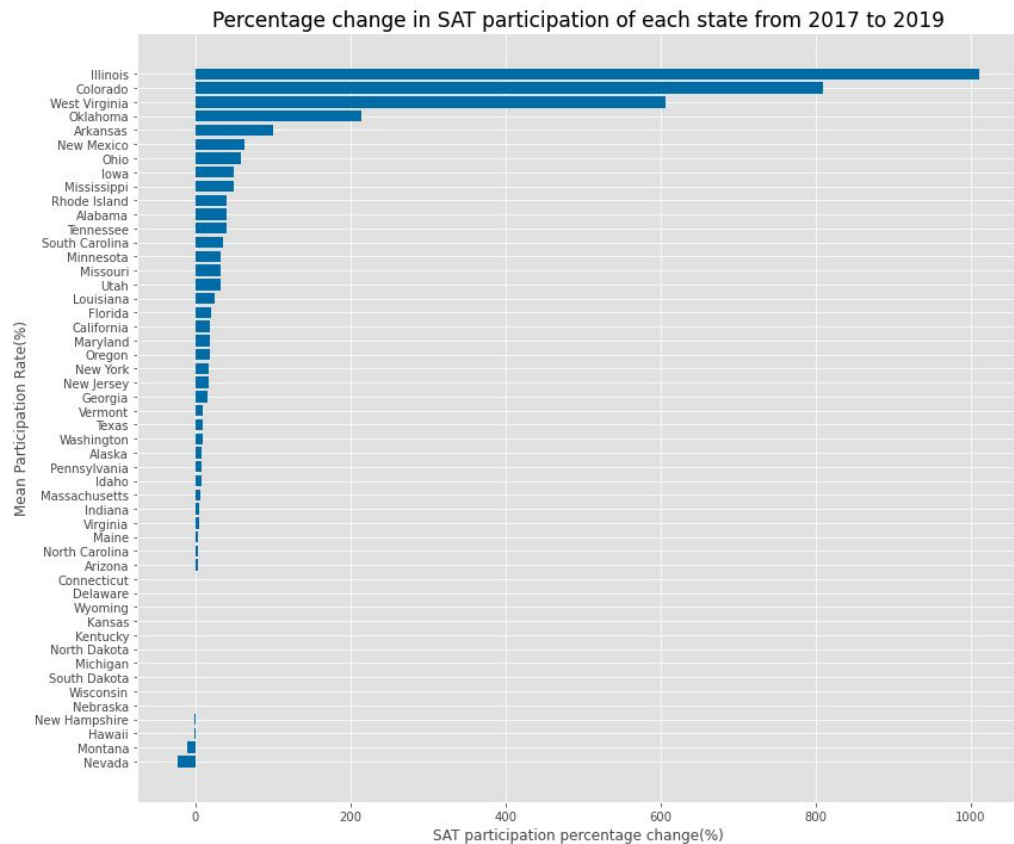
Data Visualization

Histogram for ACT and SAT scores

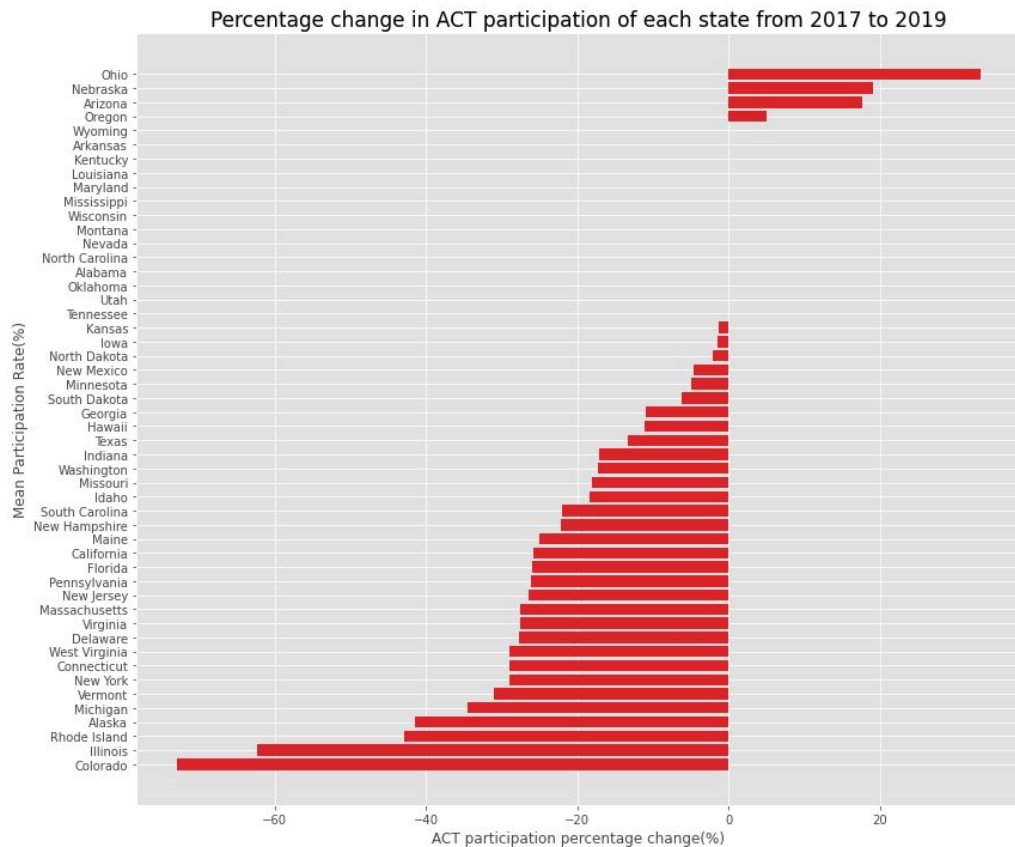
- Similar to the distribution of participation rate, there is no unimodal distribution observed in either of the standardized test.
- The distribution follows a bimodal distribution where there are 2 peaks at the both end of the spectrum. For ACT, the peaks are at 20 and 24. Whereas for SAT, the peaks are at 1075 and 1250.



Data Visualization



Data Visualization





Data Visualization

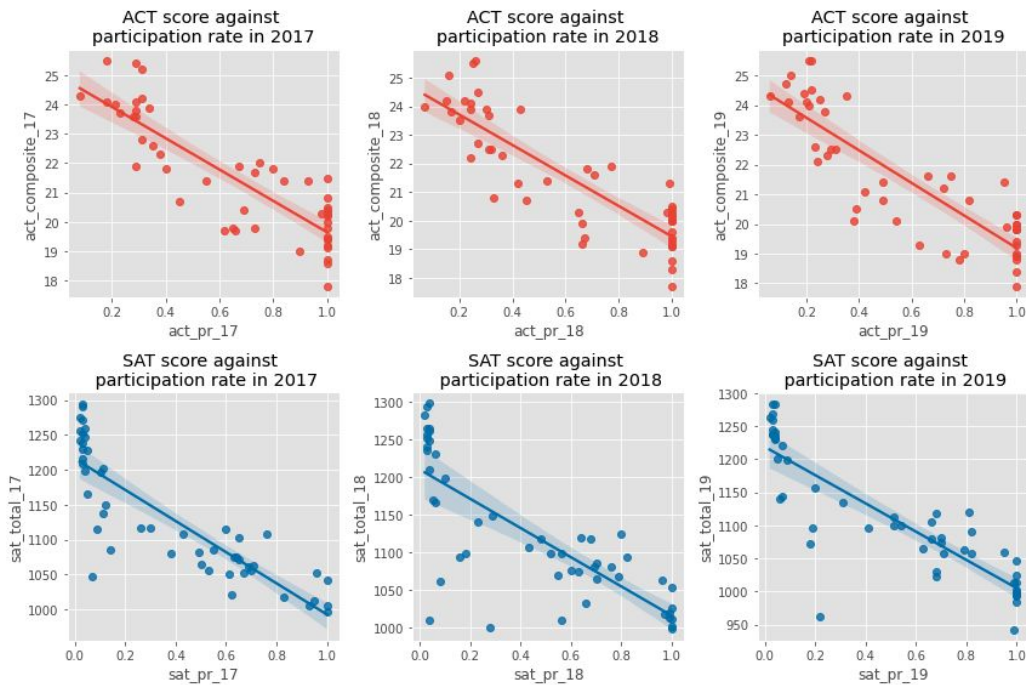
Bar graph for percentage change in participation

- Based on the 2 figures above, a few states have significant changes in the participation in 2019 compared to 2017.
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- For significant changes in ACT participation, the states are: Colorado, Illinois, Rhode Island, Alaska, Michigan
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- For significant changes in SAT participation, the states are: Illinois, Colorado, West Virginia, Oklahoma, Arkansas

Data Visualization

Scatter plots

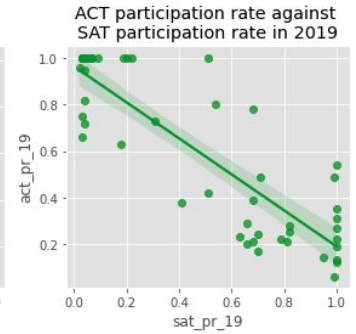
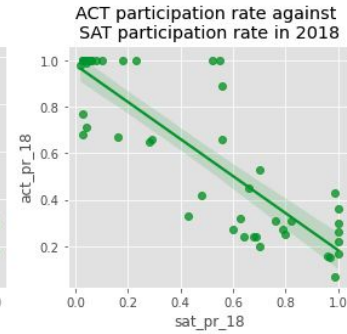
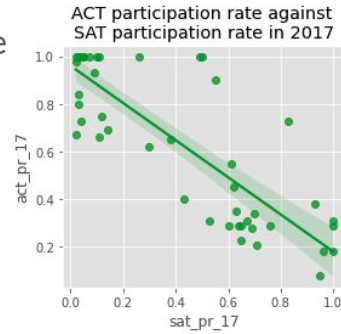
- From the correlation value displayed in the headmap diagram and the scatter plots, we can see the trend that states with high participation rate will score lower average score of either of the standardized test.



Data Visualization

Scatter plots

- There is an inverse relationship between the state's ACT participation rate vs the SAT participation rate.





Conclusions and Recommendations

Summarized findings:

1. There is an inverse relationship between state's ACT participation and SAT participation
2. There is an inverse relationship between state's standardized test participation and the state's mean score
3. There is a decreasing trend of ACT participation rate and an increasing trend for SAT participation rate
4. Several states with significant changes ACT & SAT participation from 2017 to 2019



Conclusions and Recommendations

Recommendations:

- To increase SAT participation rate, we can consider making SAT mandatory for high school graduation. Based on the data that was explored earlier, states with changes in testing policies had the largest change in SAT participation.
- Secondly, we can consider subsidizing SAT so that students are allowed to participate at no additional cost.