

# SAT & ACT Analysis

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# The background

## Company

College Board is the organization that administers the SAT (Scholastic Assessment Test)

## Changes

SAT had a new format released in 2016

## Context

College Board would like to utilize data analysis on SAT participation rate across the US

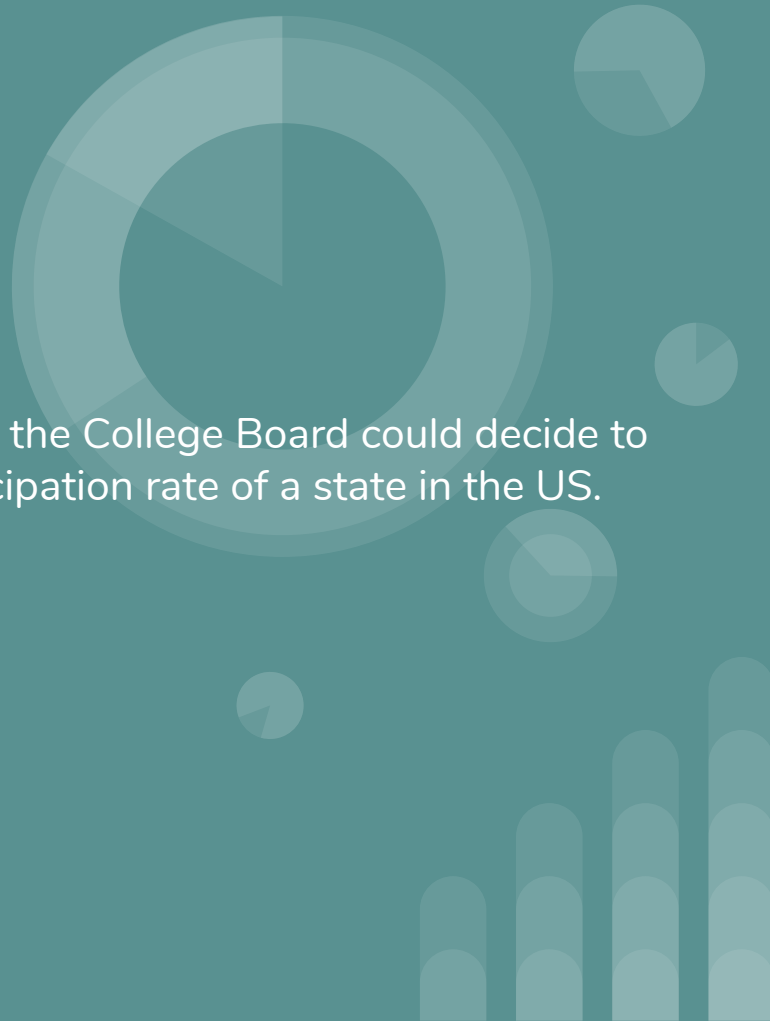
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# Problem Statement

The project is to make recommendations about how the College Board could decide to allocate funding to work and increase the SAT participation rate of a state in the US.



# Exploratory Data Analysis

	state	act2017_participation_rate
0	Alabama	1.00
17	Kentucky	1.00
49	Wisconsin	1.00
44	Utah	1.00
42	Tennessee	1.00
40	South Carolina	1.00
36	Oklahoma	1.00
33	North Carolina	1.00
28	Nevada	1.00
26	Montana	1.00
24	Mississippi	1.00
23	Minnesota	1.00
18	Louisiana	1.00
25	Missouri	1.00
50	Wyoming	1.00
5	Colorado	1.00
3	Arkansas	1.00

-100% ACT participation rate occurs in 17 out of 50 states

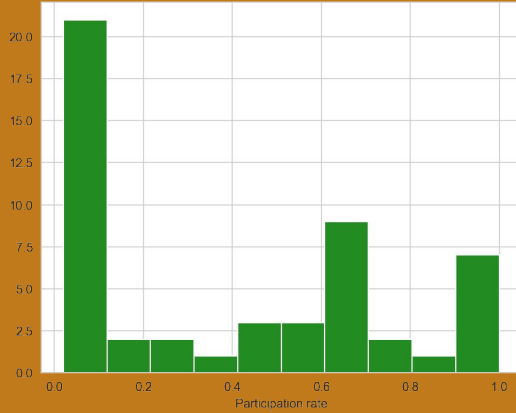
Compared to 100% SAT participation rates for just about 4 out of 50 states

-We can see ACT participation rates tend to fare better than SAT

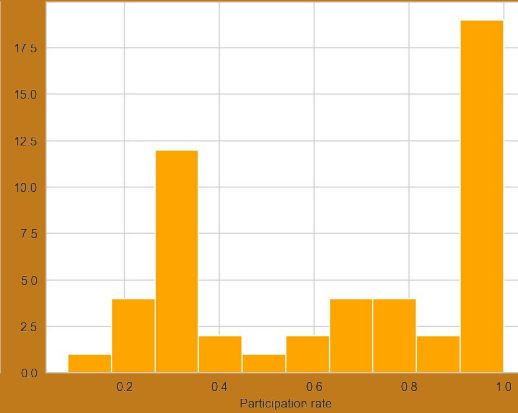
-We will further touch on this in data visualization

# Data visualization

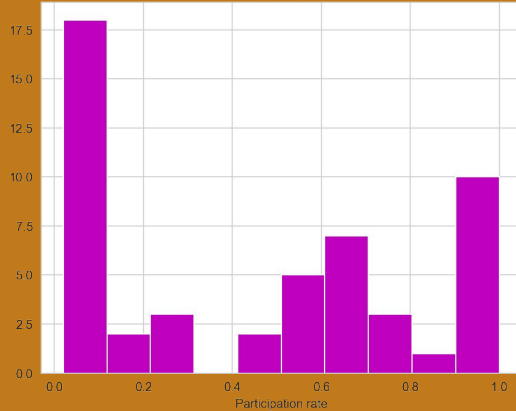
SAT2017 participation rate



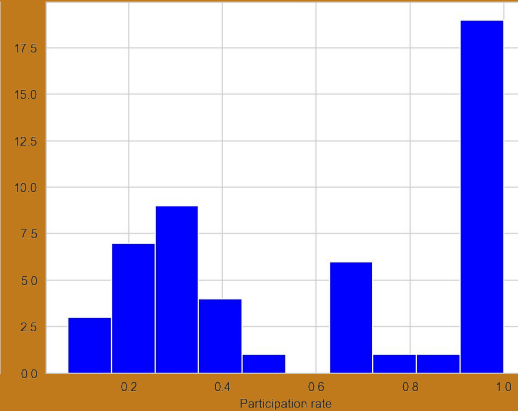
ACT2017 participation rate



SA12018 participation rate



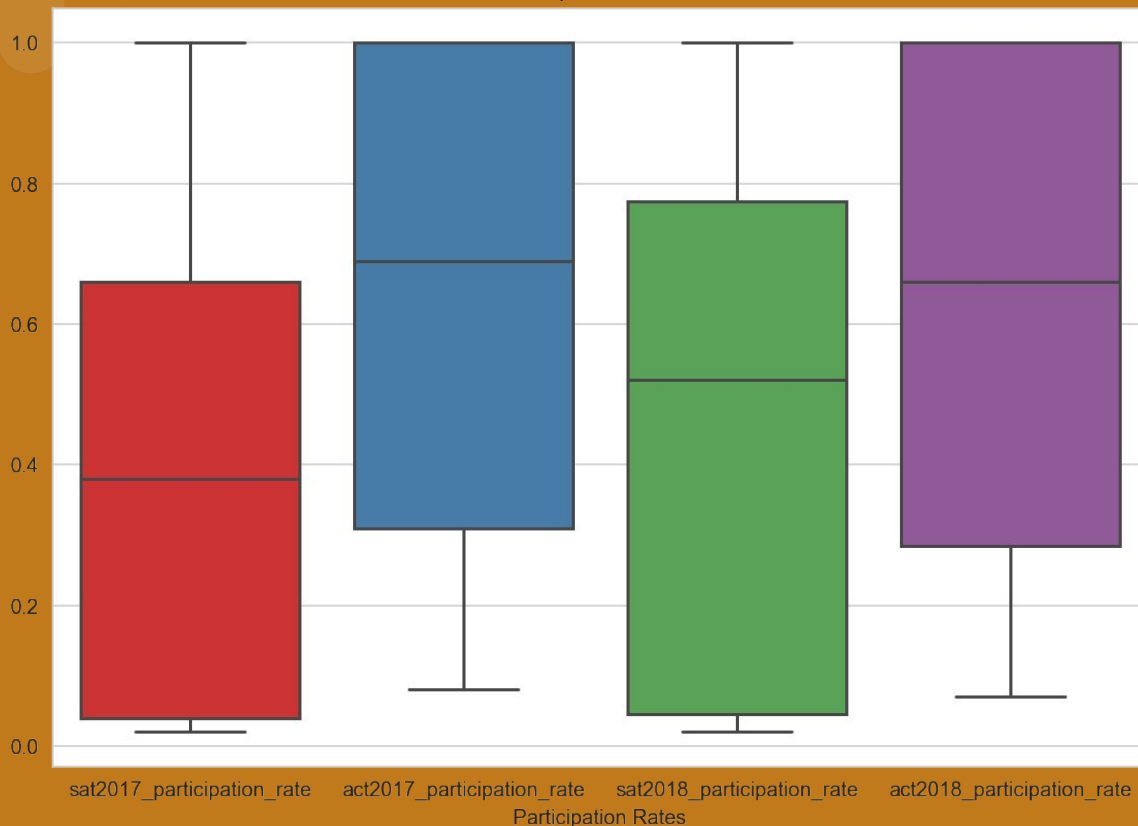
ACT2018 participation rate



- Notice the SAT participation rate histograms having left sided peaks
- Indicates low participation close to 0% is most frequently occurring
- Notice the ACT participation rate histograms having right sided peaks
- Indicates high participation close to 100% is most frequently occurring
- Could possibly suggest data might be biased

# Continued

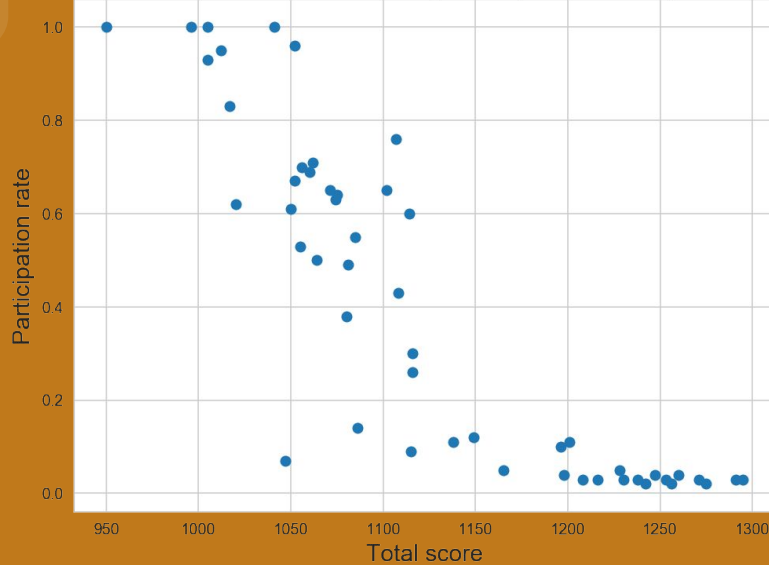
SAT and ACT Participation Rates 2017 and 2018



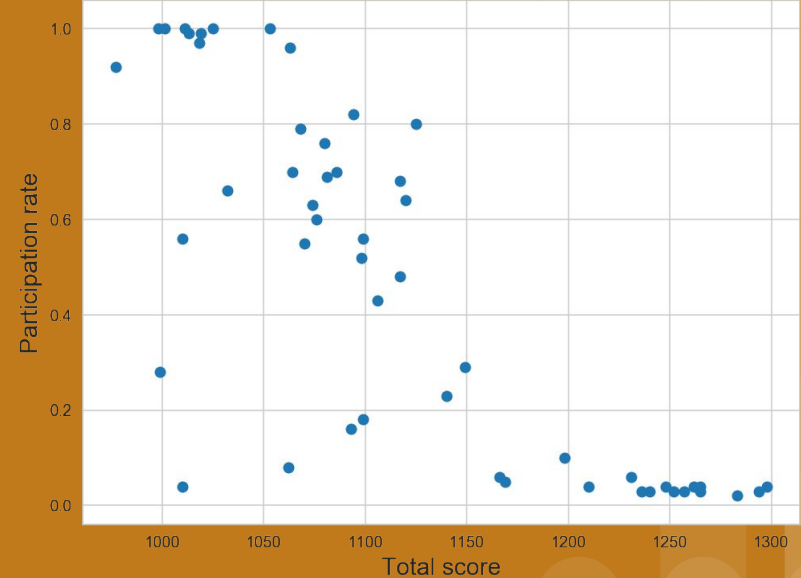
- Boxplot can help describe the behavior of the histograms
- SAT participation rate 25-50-75 quartiles are around the lower end of participation rates
- Has long top whiskers indicating outlier datapoints have high participation rates
- ACT participation rate 25-50-75 quartiles are around the higher end of participation rates
- Has longer bottom whiskers indicating outlier datapoints have low participation rates

# Continued

SAT2017 total score and participation comparsion



SAT2018 total score and participation comparsion

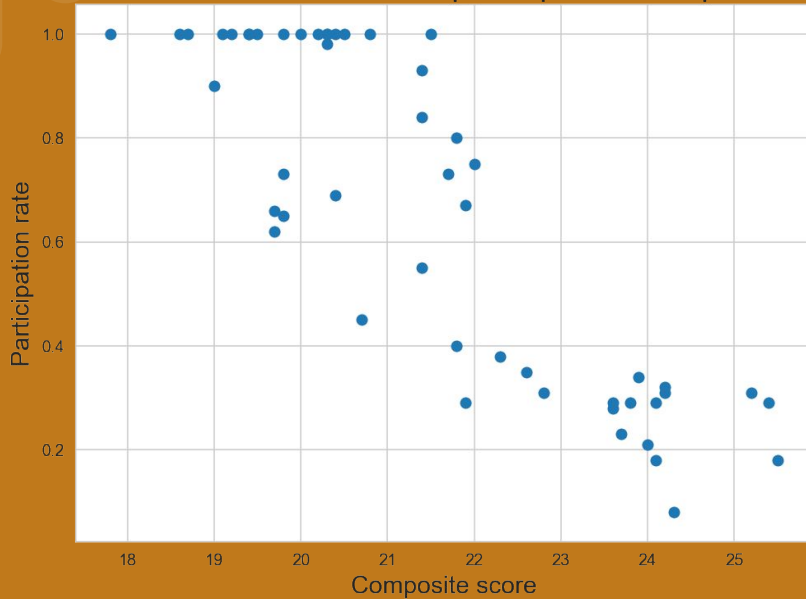


-We observe negative correlation between SAT participation rates and total scores

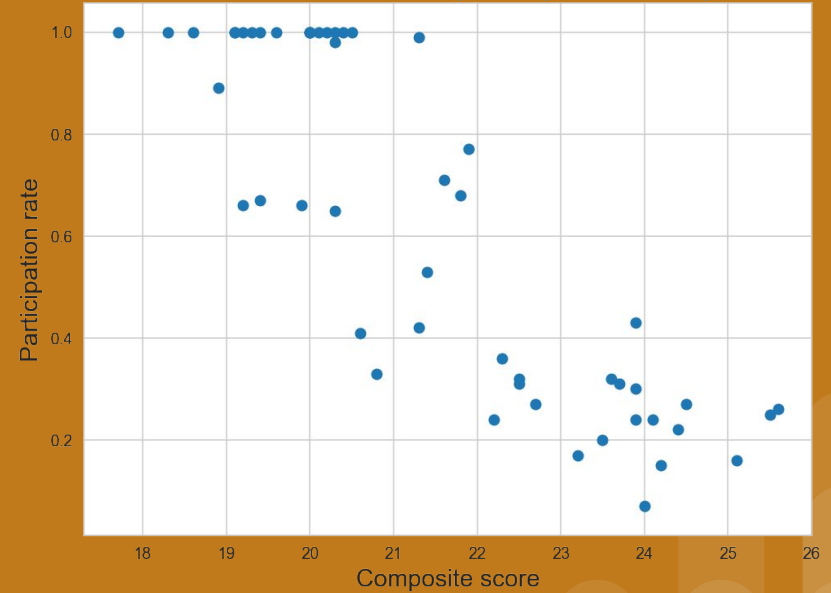


# Continued

ACT2017 total score and participation comparison



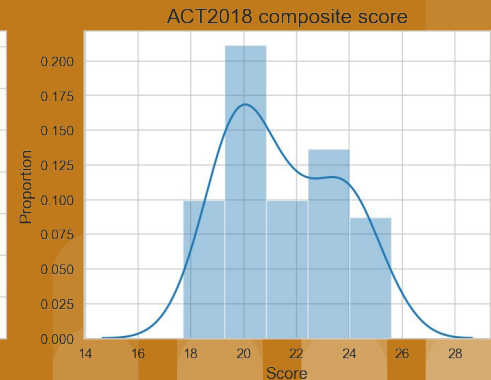
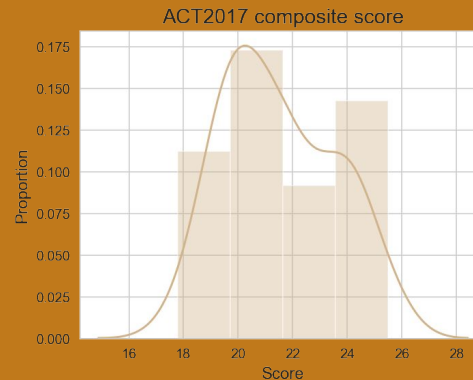
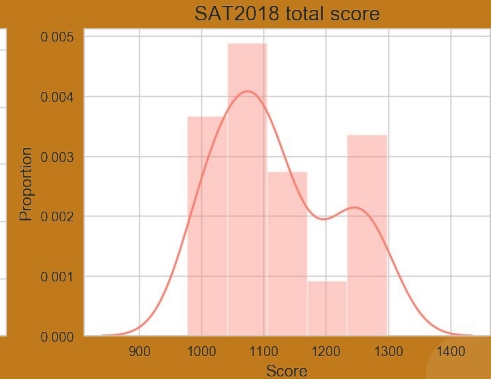
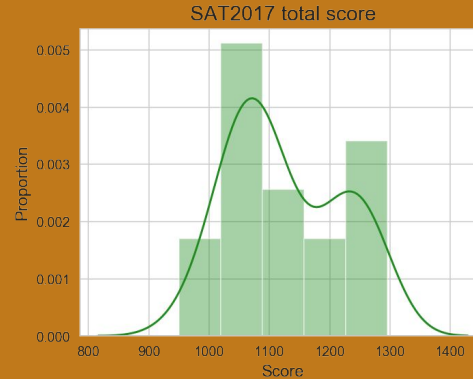
ACT2018 total score and participation comparison



-We also observe negative correlation between ACT participation rates and composite scores

# Descriptive and Inferential Statistics

- Graphs shown earlier on indicates data is biased towards extremes of participation rates
- Negative correlation is observed
- The central limit theorem states that as  $n$  gets bigger and is at least 30 and data is randomly distributed, the distribution would look like a normal distribution. However, this is not the case
- We can see perhaps participation is not all random and bias exists.
- Observe the SAT total and ACT composite scores distribution plots
- Kernel density estimators are non parameter descriptions of the probability density function
- They do not form the normal distribution



# Continued

-Conducted hypothesis testing

## **Scenario 1**

-null hypothesis is population mean of SAT participation rate 2017 is equal to ACT participation rate 2017

-Alternative hypothesis is population mean of SAT participation rate 2017 is not equal as ACT participation rate 2017

-p value obtained is 0.00024

-Assuming alpha is 0.05, reject the null hypothesis

## **Scenario 2**

-null hypothesis is population mean of SAT participation rate 2018 is equal to ACT participation rate 2018

-Alternative hypothesis is population mean of SAT participation rate 2018 is not equal as ACT participation rate 2018

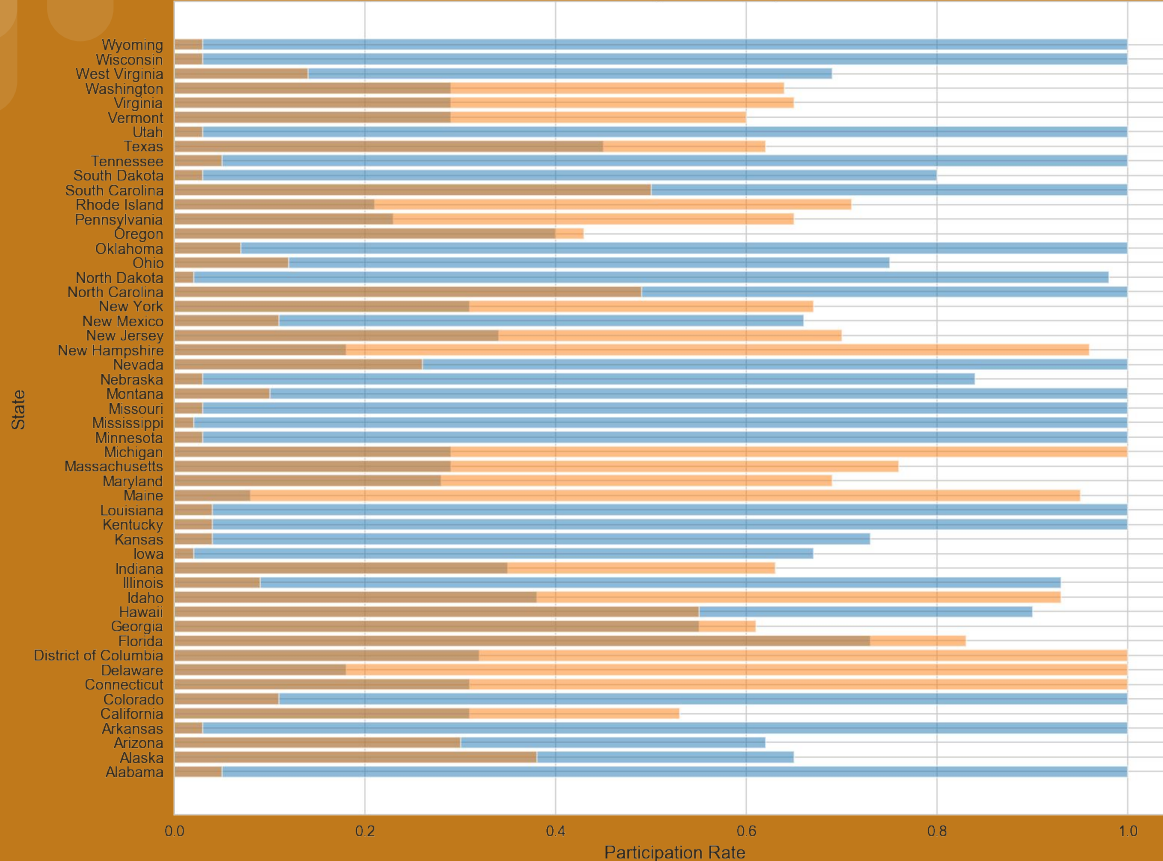
-p value obtained is 0.02684

-Assuming alpha is 0.05, reject the null hypothesis

-Though we carried out hypothesis testing, it is not reliable as data is assumed to not be randomly distributed

# Outside Research

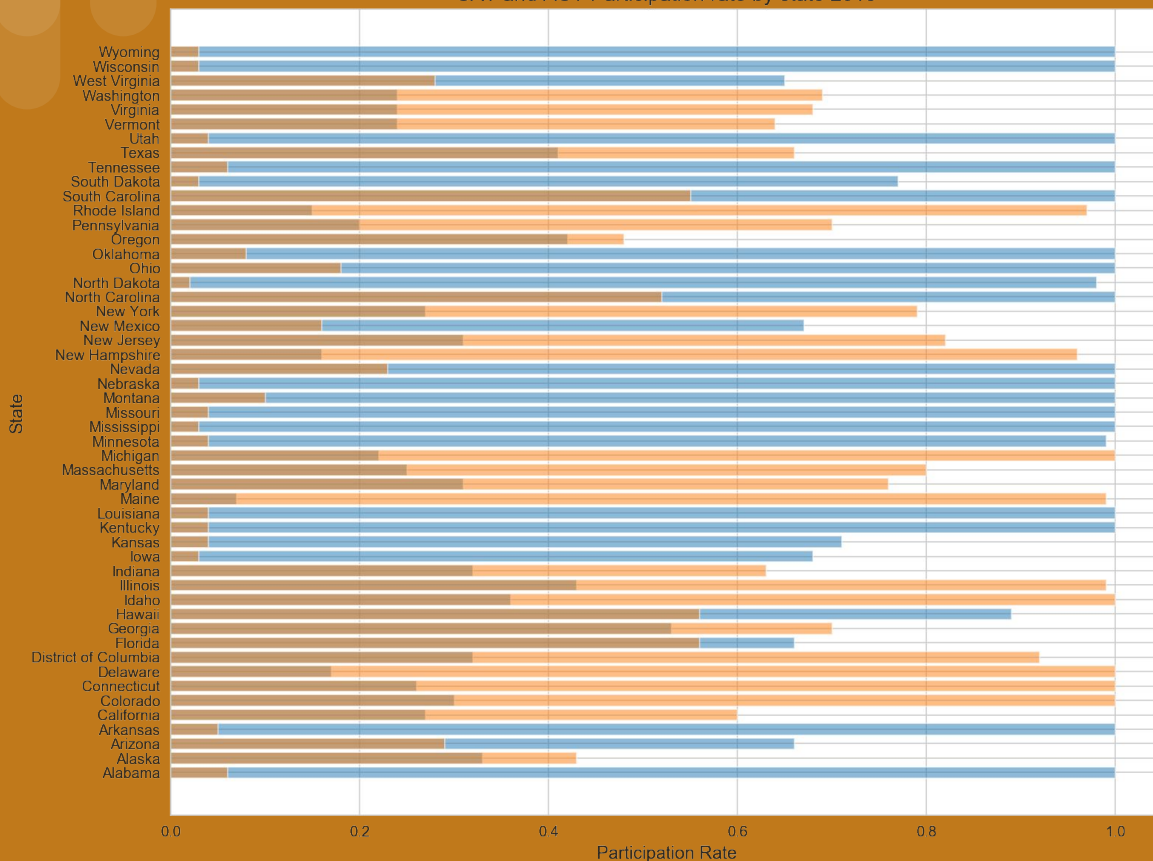
SAT and ACT Participation rate by state 2017



- Bar chart shows participation rates for 2017
- Orange is SAT
- Blue is ACT
- Brown is overlapping

# Continued

SAT and ACT Participation rate by state 2018



- Bar chart shows participation rates for 2018
- Orange is SAT
- Blue is ACT
- Brown is overlapping

# Continued

- "PR" is participation rate

- Alaska's PR for ACT was higher than SAT in 2017 at 65% vs 38% respectively but in 2018 it did a flipside and SAT PR overtook the ACT PR at 43% vs 33% respectively as seen in the table above. The Anchorage daily news reported that as of 2017, high school students in Alaska are not required to take either the SAT, ACT or Workkeys which is a job skills test in order to graduate. This could be part of the explanation why Alaska doesn't see full or near full PR for either SAT or ACT.

- Colorado saw full ACT PR at 100% in 2017 while its SAT PR was at a meager 11% but in 2018 it's SAT PR shot up to 100% while ACT PR went down to 30%. Colorado made a switch from ACT to SAT in 2017 for its high school students. Due to feedback of lack of preparation for the sudden change, high school students were allowed to take the ACT then. It was found by the state selection committee that the College Board's Practice SAT, given to 10th-graders, aligned better with the high school Colorado Academic Standards

- Illinois also showed high ACT PR in 2017 at 93% while its SAT PR was 9% but in 2018 it was the opposite and SAT PR was at 99% while its ACT PR was 43%. The Chicago Tribune reported that college board won the tender for SAT to be the standardized test and dropped the ACT after 15 years as it was decided the SAT was better aligned with standards for what students should know in Illinois.

# Conclusions and Recommendations

What has been done is to:

- Filter out SAT participation rates of 90% and above (Those that are under state policies and already high participation rates)

- Filter out ACT participation rates of 90% and above (Those that are under state policies and already high participation rates)

What we understand so far:

- Sampling bias, partly due to state policies implementing mandatory SAT or ACT

- States with high SAT participation rates had low ACT participation rates and vice versa

- Negative correlation between SAT total score and participation rate, so states with lower participation rates might be a better choice

- Coastal states to have high SAT participation rates so can consider looking at other states

-States with significant total score improvement and not too high participation rates would be Alaska, Arizona and Florida. However, Arizona saw relatively high ACT participation rates for both years and Florida's ACT participation rate overtook SAT in 2018. Alaska would then be a recommendation as both SAT and ACT participation rates are somewhat similar and in 2018 the SAT participation rate overtook ACT.

# Conclusion

-I would not recommend College board to direct their resources to states that have seen high ACT participation rates in both years as their rates tend to be dominant and SAT participation rate minimally fluctuates in those states

-Look at states besides those with high or near full participation rates as they might have already implemented policies on making SATs mandatory for high school students

-It might be more worthwhile investing resources to a state with lower participation rate to maximize nurturing and getting the students and other stakeholders such as school faculty accustomed to SAT.

-Alaska would seem like a suitable choice for College board to allocate resources to increase the participation rate. Alaska does not have any mandatory policies on SAT or ACT

-SAT participation rate overtook the ACT participation rate at 43% vs 33% respectively in 2018 suggesting that an increasing number of Alaskan high school students see the SAT as a way to get into university on their own accord.

-7796 high school students in 2018, 3334 chose to take SAT which represents the 43% so it would be great to increase the figure and significantly lead ahead of ACT participation rates

-Low 12% of SAT participants in Alaska using fee waiver and it would be an incentive to encourage more high school students to take SAT by giving awareness about the fee waivers.

-Tempting to recommend for Alaska to implement state policy on making SAT mandatory but there's negative correlation between high SAT participation rate and total scores, therefore I would recommend the resources are focused on test preparation access and quality



# The End!

# Thank you!

References:

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