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MTA Inclement Weather Impacts Study

Essential Question:

Does inclement weather impact ridership on NYC subways?

- Motivation: To determine if the MTA should make capital investments to improve subway stations or create targeted marketing campaigns so that ridership is increased during inclement weather.
- Objective: Analyze MTA turnstile data and NOAA weather data, including precipitation and temperature, to see if there is a correlation.

Methodology: Data

MTA Daily Turnstile Data

- 2019 data only
- 5 highest traffic subway stations:
  - Penn Station,
  - Grand Central Station,
  - Herald Square,
  - 23rd Street,
  - Canal St
- Weekday traffic only
- Federal Holidays excluded

National Oceanic and Atmospheric Administration (NOAA) Daily Climate Data

- 2019 data only
- Features:
  - rain,
  - snow,
  - high temperatures
  - low temperatures

Methodology: Metrics and Tools

Metrics:

- Daily Entries: total entries per turnstile for each station
- Dates: weekdays only from 1/2/2019 through 12/27/2019, federal holidays excluded
- Precipitation (rain) and snow (in inches) recorded daily by NYC weather station
- Minimum and Maximum Temperatures (°F) recorded daily by NYC weather station
- Summer months included June, July and August
- Winter months included December, January and February

Tools:

- Python
- Jupyter Notebook
- Python libraries:
  - pandas,
  - matplotlib,
  - seaborn
- SQLite
- GitHub

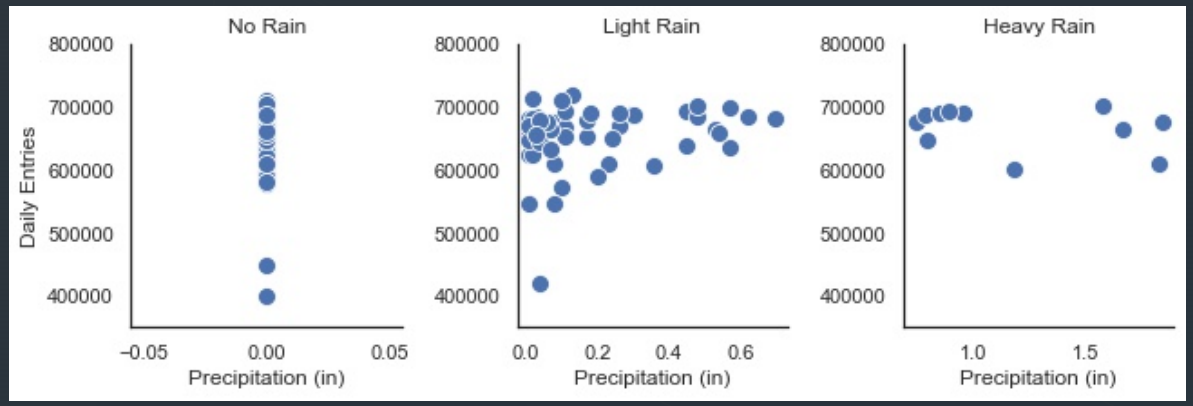
Results

Insights

1. There is a weak correlation between inclement weather and ridership.
2. Summer and winter weather temperature extremes appear to have more impact overall on ridership.
    - Fewer people are riding the subway when it is very hot or very cold out.
3. There were few extreme weather events in NYC in 2019.

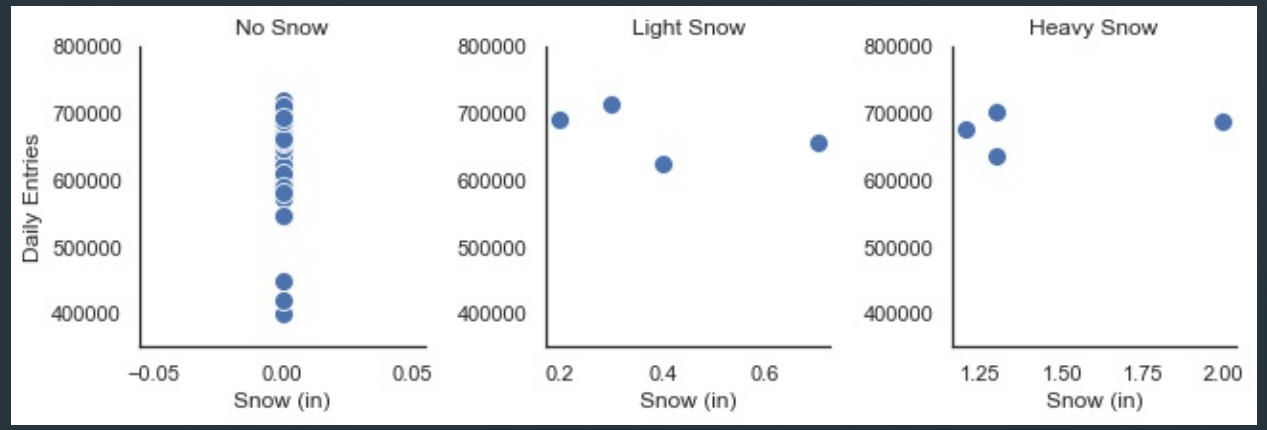
There could be some investments be made that could potentially increase ridership on inclement weather days, but more study is needed on data containing more extreme weather events and with subway stations with reported flooding or HVAC issues.

Insight 1:There is a weak positive correlation between precipitation/snow and ridership:
As precipitation and snow increases, ridership increases.



Precipitation to Daily Entries Correlation Coefficient:

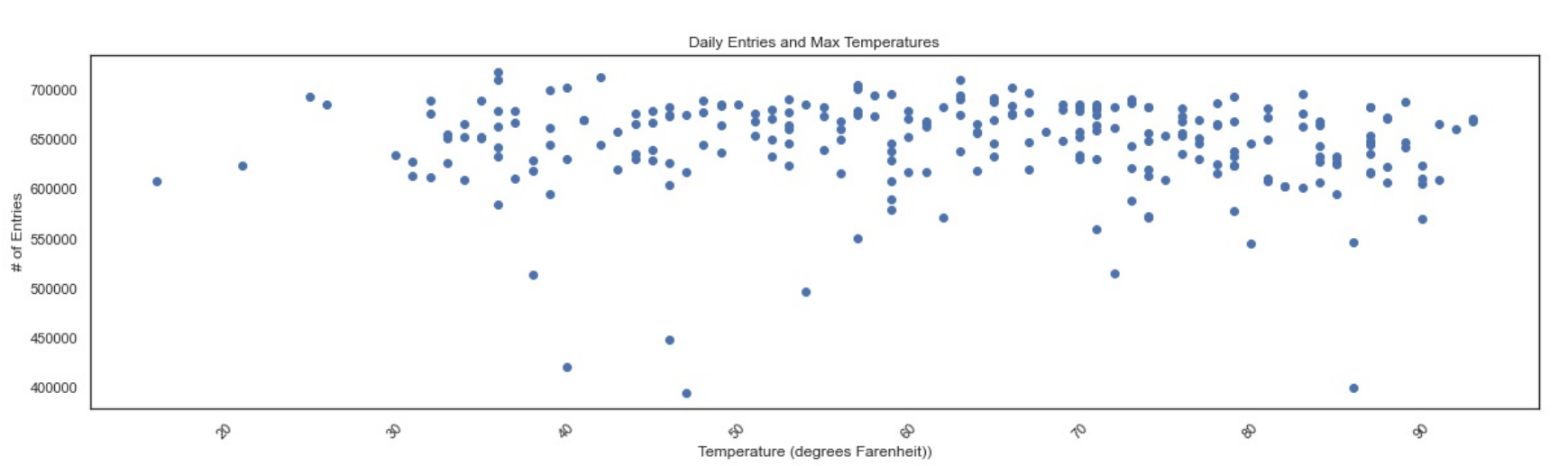
0.09



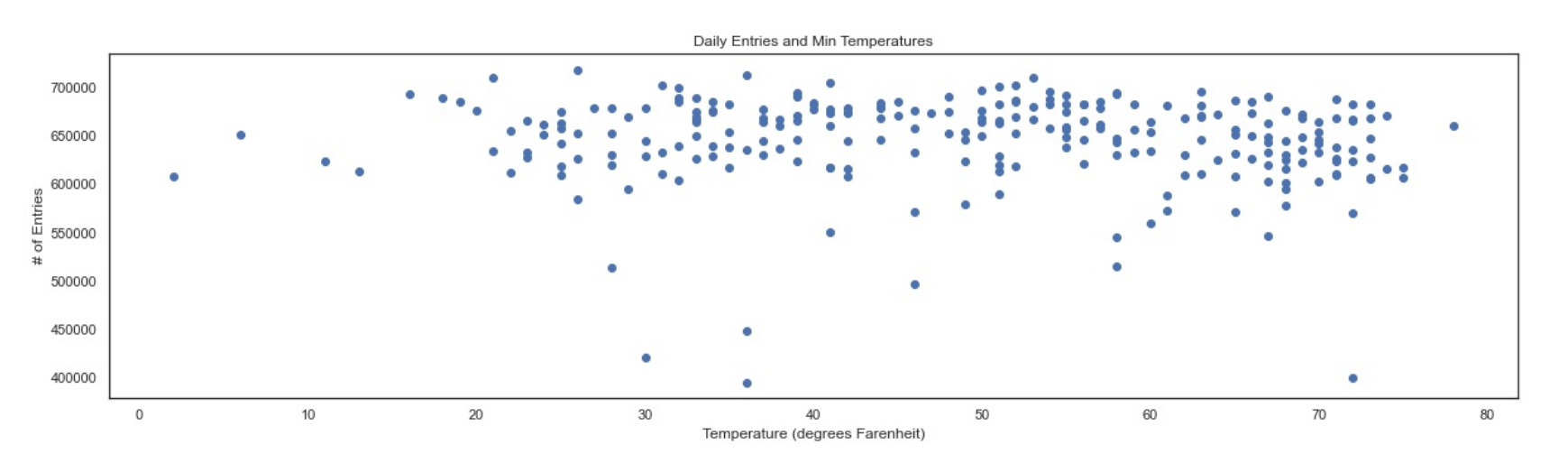
Snow to Daily Entries Correlation Coefficient:

0.08

Insight 1:There is a weak negative correlation between inclement weather and ridership:
It appears that fewer people use subway when it is warmer, more people use it when it is colder.



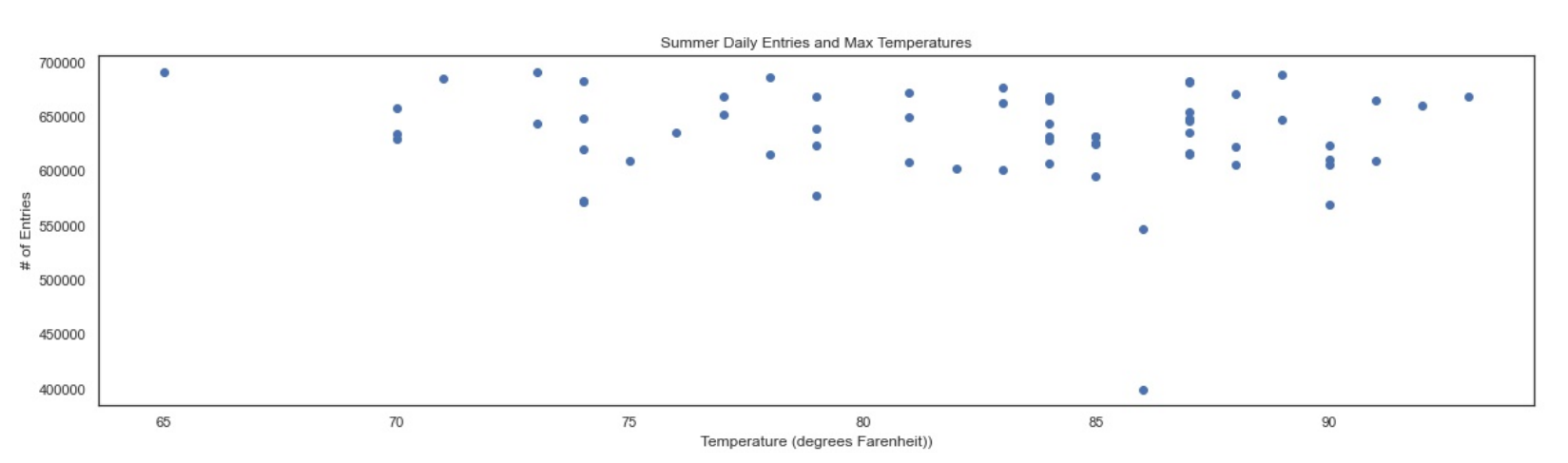
High Temperature to Daily Entries Correlation Coefficient:
-0.12



Low Temperature to Daily Entries Correlation Coefficient:
-0.11

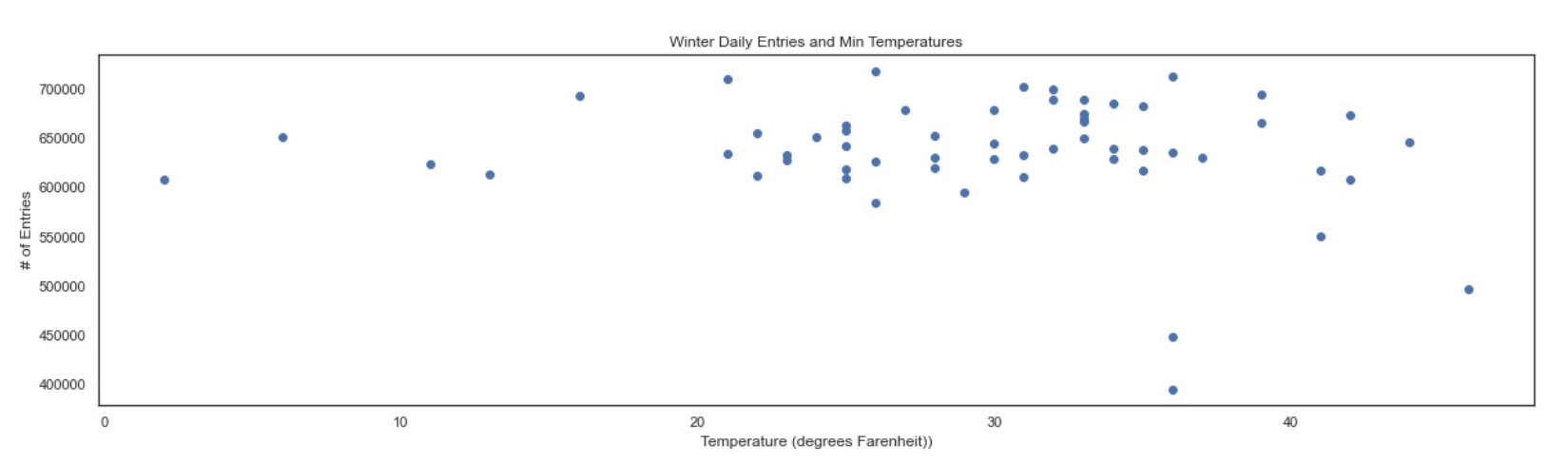
Insight 2:

- Fewer people are riding the subway when it is very hot or very cold out.



High Summer Temperature to Daily Entries Correlation Coefficient:

-0.24



Low Winter Temperature to Daily Entries Correlation Coefficient:

0.15

Insight 3: There were few extreme weather events in NYC in 2019.

- Number of Heavy Snow Days: 5
- Number of Heavy Rain Days: 18
- Number of Hot Days (> 90): 4
- Number of Cold Days (< 32): 31

Conclusions

- Inclement weather has a weak correlation with ridership at major hub subway stations
- Fewer people are riding the subway when it is very hot or very cold out.
- There could be some capital investments that MTA can make to increase ridership on these days but more in-depth study is necessary.
- **Future Studies:**
  - Apply study to specific stations where there may be complaints about air conditioning/heating or flooding.
  - Analyze specific extreme events like historic rainfall/snowfall, hurricanes/tropical storm and impact on all stations.