PSC(2CS404) Innovative Assignment

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Section: C-(C3)

Project:

Exploratory Data Analysis (EDA) on US-Accidents (2016-2021) Data.

Exploratory Data Analysis (EDA) is an approach used by data scientists to analyse and investigate data sets and summarize their main characteristics, through data visualization methods. It helps determine how to manipulate data sources to get the answers you need, making it easier for data scientists to discover patterns, spot anomalies, test a hypothesis, or check assumptions. This makes it an important first step in any data analysis.

From the US Accidents Dataset Analysis, it can be proved useful to take preventive measures to decrease accidents. Through visualization on number of accidents, timings, weather conditions, temperature, top cities, etc.

Setup Dataset:

1.) Open This Link and Download the Dataset(CSV file): " https://www.kaggle.com/datasets/sobhanmoosavi/us-accidents "

2.) Name the Dataset file to "US_Accidents_Dec21_updated.csv"

3.) Now, move this csv file into folder "eda\src\usaccidents\US_Accidents_Dec21_updated.csv", so csv file is inside usaccidents folder

Installation of Required libraries:

Install the following libraries: (Pandas), (Numpy), (Folium), (Seaborn), (Matplotlib)

```
pip install pandas
pip install numpy
pip install folium
pip install seaborn
```

(Run below two in order to install matplotlib)

```
python -m pip install -U pip
python -m pip install -U matplotlib
```

How to run the program:

1.) Open the "eda\src" folder inside the terminal

2.) Now run the following command in terminal: "python manage.py runserver"

3.) Click (Ctrl+Click) on the link "http://127.0.0.1:8000/" from inside the terminal

4.) Type and append "/mainpage" to the link in the browser. (eg., "http://127.0.0.1:8000/mainpage")

5.) It will take approx 3 minutes and the Data Analysis will be loaded on the webpage.

How does Program work:

1.) Below is the urls.py file which when /mainpage is requested it calls the “main_page” function from the views.py file inside the application “usaccidents”

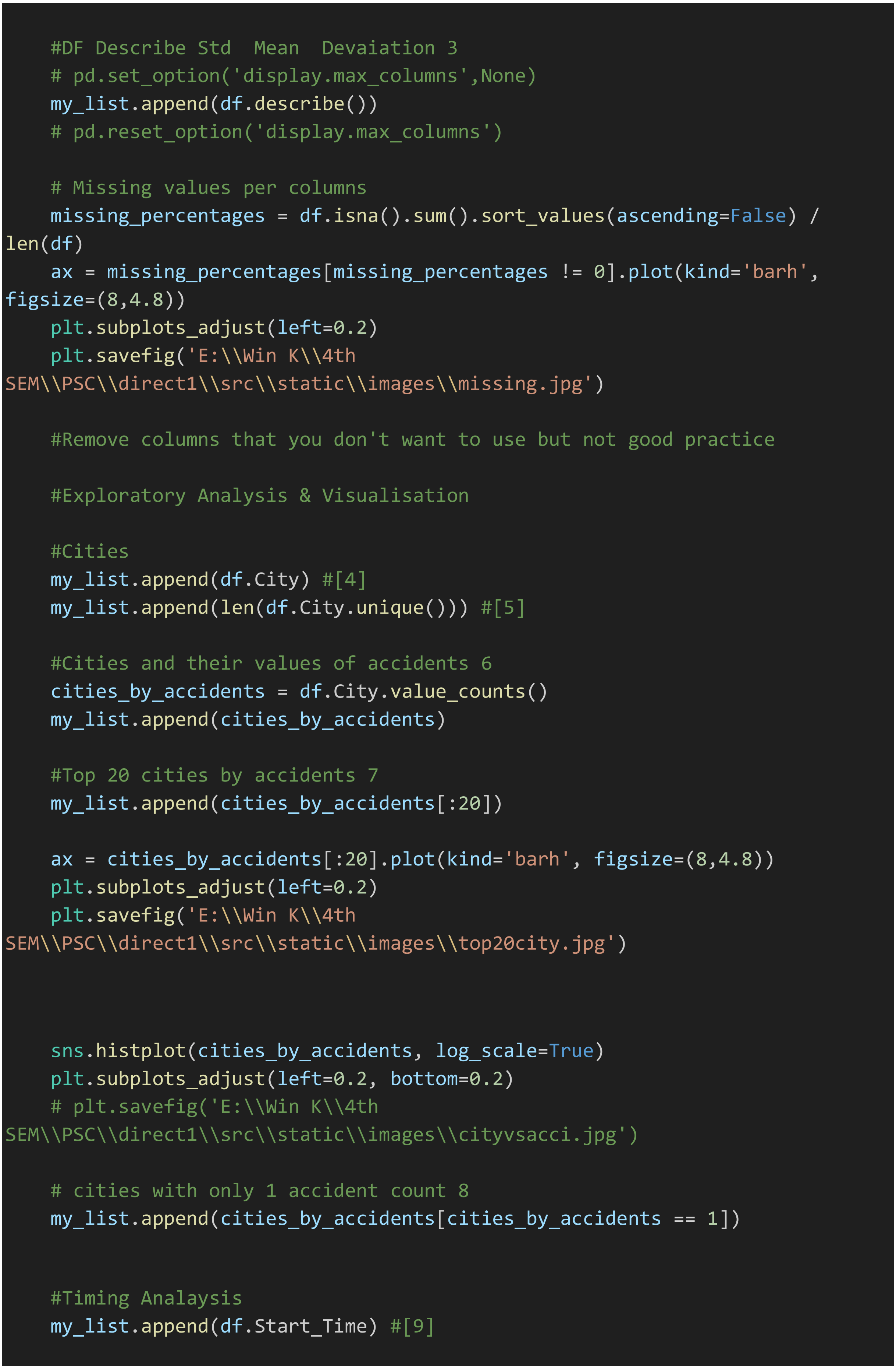
```
from django.contrib import admin
from django.urls import path


from usaccidents.views import main_page

urlpatterns = [

    path('mainpage/',main_page,name='mainpage'),
    path('admin/', admin.site.urls),
]
```

2.) Below is the main_page() function called from urls.py request :

```
def main_page(request, *args, **kwargs):
    df,map_html=main()
    my_context={"dict":df, "map_html":map_html}
    return render(request, "main_page.html",my_context)
```

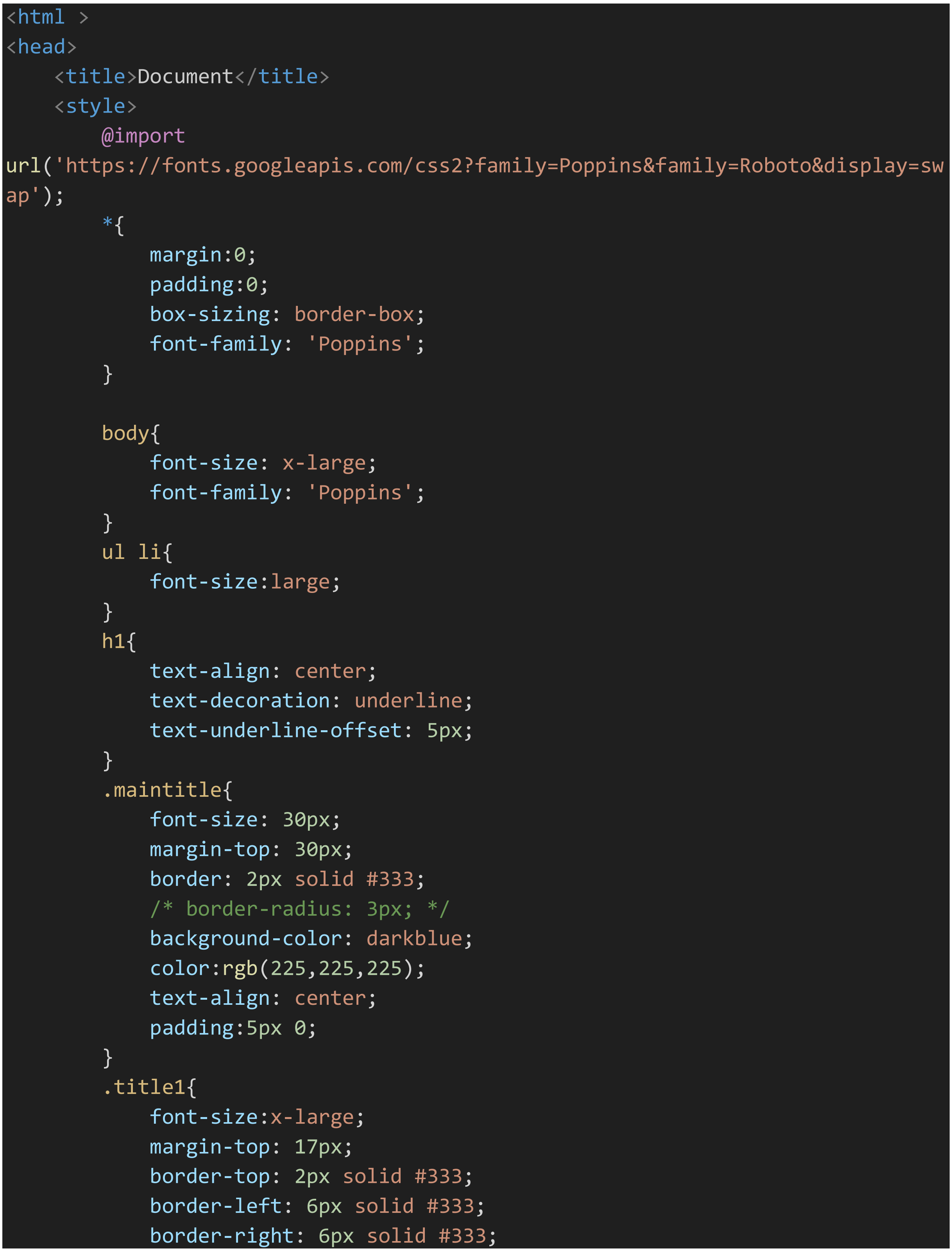
3.) Below is the main function which executes entire data analysis and generate output to view it in “main_page.html” file

```
def main():
    datafile = 'usaccidents\\US_Accidents_Dec21_updated.csv'
    my_list=[]

    # Read CSV 0
    df = pd.read_csv(datafile)
    my_list.append(df)

    # Read Columns 1
    my_list.append(df.columns)

    # Read  Info 2
    # print(df.info())
    output1 = StringIO()
    df.info(buf=output1)
    my_list.append(output1.getvalue())
```

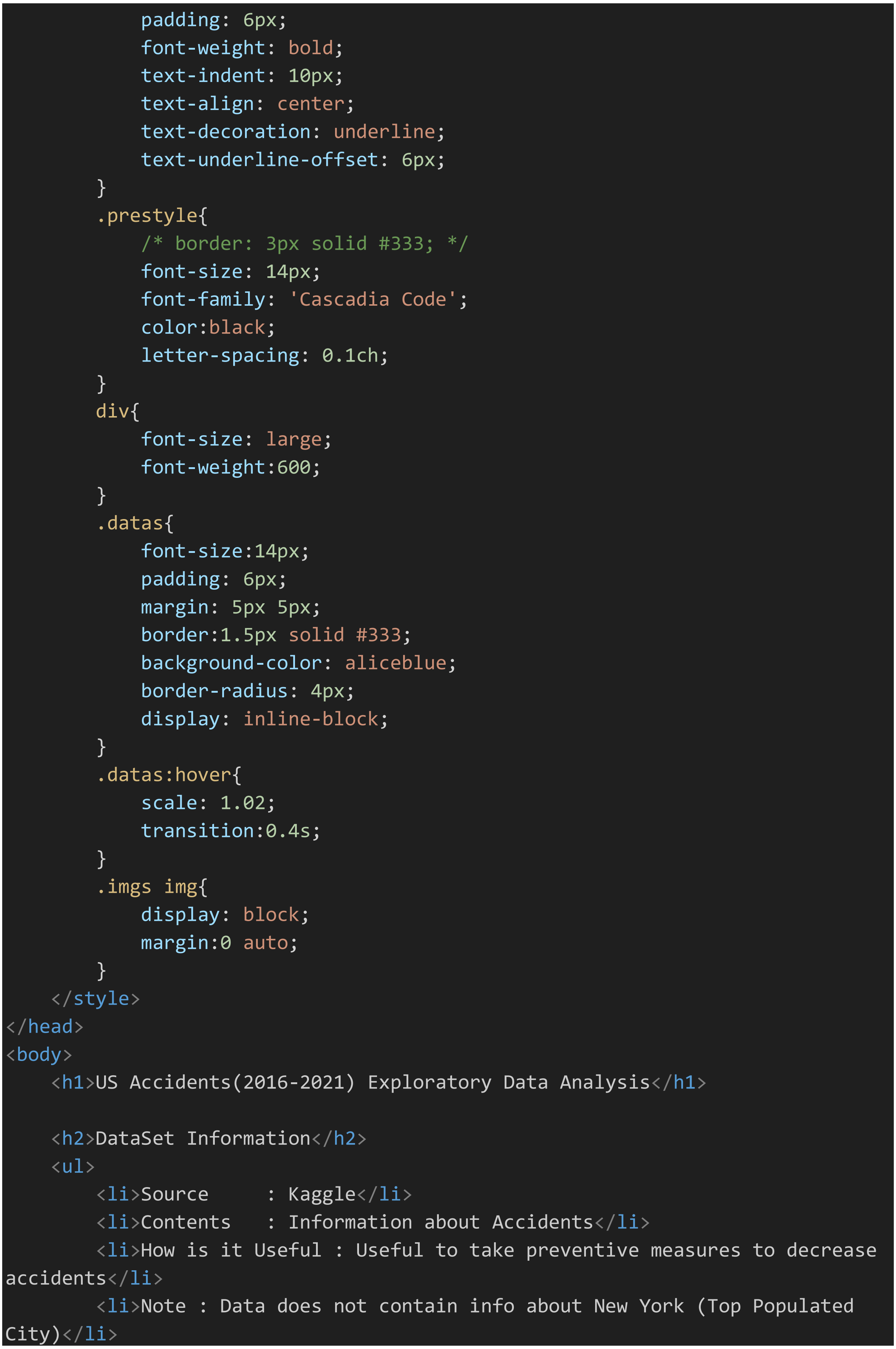


```
    #DF Describe Std  Mean  Devaiation 3
    # pd.set_option('display.max_columns',None)
    my_list.append(df.describe())
    # pd.reset_option('display.max_columns')

    # Missing values per columns
    missing_percentages = df.isna().sum().sort_values(ascending=False) /
len(df)
    ax = missing_percentages[missing_percentages != 0].plot(kind='barh',
figsize=(8,4.8))
    plt.subplots_adjust(left=0.2)
    plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\missing.jpg')

    #Remove columns that you don't want to use but not good practice

    #Exploratory Analysis & Visualisation

    #Cities
    my_list.append(df.City) #[4]
    my_list.append(len(df.City.unique())) #[5]

    #Cities and their values of accidents 6
    cities_by_accidents = df.City.value_counts()
    my_list.append(cities_by_accidents)

    #Top 20 cities by accidents 7
    my_list.append(cities_by_accidents[:20])

    ax = cities_by_accidents[:20].plot(kind='barh', figsize=(8,4.8))
    plt.subplots_adjust(left=0.2)
    plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\top20city.jpg')



    sns.histplot(cities_by_accidents, log_scale=True)
    plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\cityvsacci.jpg')

    # cities with only 1 accident count 8
    my_list.append(cities_by_accidents[cities_by_accidents == 1])


    #Timing Analaysis
    my_list.append(df.Start_Time) #[9]
    df['Start_Time'] = df['Start_Time'].astype(str)
    df_filtered=df[df['Start_Time'].str.match(r'^\d{4}-\d{2}-\d{2}
\d{2}:\d{2}:\d{2}$') == True]

    # df_filtered['Start_Time'] =
pd.to_datetime(df_filtered['Start_Time'],format='%Y-%m-%d %H:%M:%S')
    # sns.histplot(df_filtered['Start_Time'].dt.hour, bins=24, kde=False,
stat='density')
    # plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\starttime.jpg')

#Weekdays vs their density of records present
    # sns.histplot(df_filtered['Start_Time'].dt.dayofweek, bins=7, kde=False,
stat='density')
    # plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\weekdata.jpg')

#Sunday density of accidents on hours
    # sundays_start_time =
df_filtered['Start_Time'][df_filtered['Start_Time'].dt.dayofweek == 6]
    # sns.histplot(sundays_start_time.dt.hour, bins=24, kde=False,
stat='density')
    # plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\sundaydata.jpg')

#Monday Density of accidents on hours
    # monday_start_time =
df_filtered['Start_Time'][df_filtered['Start_Time'].dt.dayofweek == 0]
    # sns.histplot(monday_start_time.dt.hour, bins=24, kde=False,
stat='density')
    # plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\mondaydata.jpg')


#Visualization and Positional Analysis with density of accidents
    my_list.append(df.Start_Lat) #[10]
    my_list.append(df.Start_Lng) #[11]


#Plot in Map
    # sample_df = df.sample(int(0.1 * len(df)))
    # sns.scatterplot(x=sample_df.Start_Lng, y=sample_df.Start_Lat,
size=0.001)
    # plt.subplots_adjust(left=0.2, bottom=0.2)
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\accipos.jpg')


#Interactive map with density of accidents in USA
    zip(list(df.Start_Lat), list(df.Start_Lng))
    sample_df = df.sample(int(0.001 * len(df)))
    lat_lon_pairs = list(zip(list(sample_df.Start_Lat),
list(sample_df.Start_Lng)))
    map = folium.Map()
    HeatMap(lat_lon_pairs).add_to(map)
    map_html = map.get_root().render()


#Temperature Analysis
    my_list.append(df['Temperature(F)']) #[12]

    df['Temperature(C)']=(df['Temperature(F)']-32)*(5/9)
    df['Temperature(C)'].hist(bins=range(-20,45),density=True)
    plt.xlabel('Temperature(C)')
    plt.ylabel('Density of accidents')
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\accivstemp.jpg')


#Weather Conditions during accidents
    my_list.append(df['Weather_Condition'].unique()) #[13]
    weather = df['Weather_Condition'].value_counts()
    percent = weather/weather.sum()*100
    percent = percent.apply(lambda x: x if x>=0.7 else None)
    percent['Others']=percent.isnull().sum()
    percent=percent.dropna()
    weather.plot.pie(autopct='%.1f%%')
    # plt.savefig('E:\\Win K\\4th
SEM\\PSC\\direct1\\src\\static\\images\\weather.jpg')



    return my_list,map_html
```

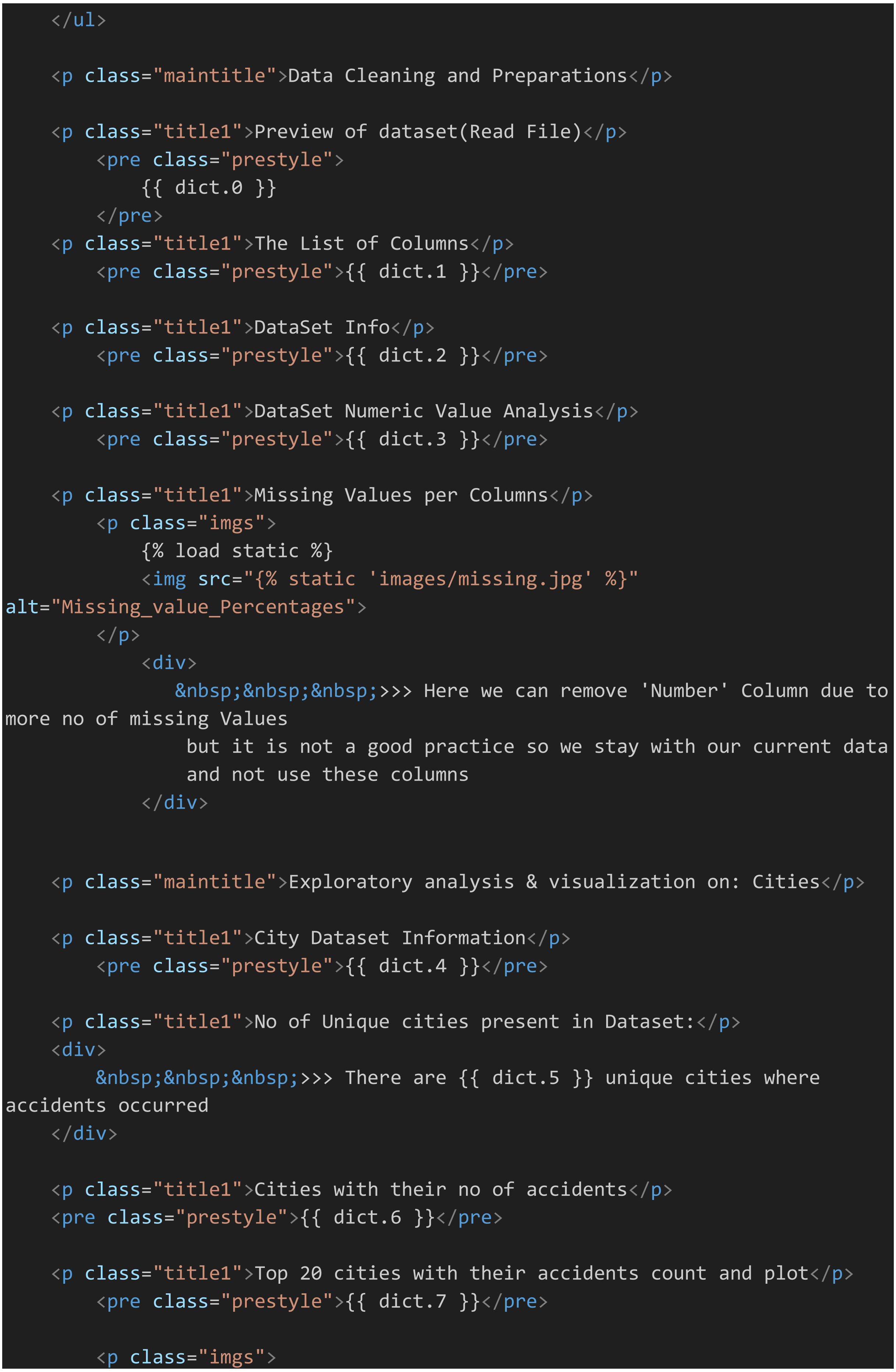
Below is the HTML file which renders from the views.py after request:



```
<html >
<head>
    <title>Document</title>
    <style>
        @import
url('https://fonts.googleapis.com/css2?family=Poppins&family=Roboto&display=swap');
        *{
            margin:0;
            padding:0;
            box-sizing: border-box;
            font-family: 'Poppins';
        }

        body{
            font-size: x-large;
            font-family: 'Poppins';
        }
        ul li{
            font-size:large;
        }
        h1{
            text-align: center;
            text-decoration: underline;
            text-underline-offset: 5px;
        }
        .maintitle{
            font-size: 30px;
            margin-top: 30px;
            border: 2px solid #333;
            /* border-radius: 3px; */
            background-color: darkblue;
            color:rgb(225,225,225);
            text-align: center;
            padding:5px 0;
        }
        .title1{
            font-size:x-large;
            margin-top: 17px;
            border-top: 2px solid #333;
            border-left: 6px solid #333;
            border-right: 6px solid #333;
```

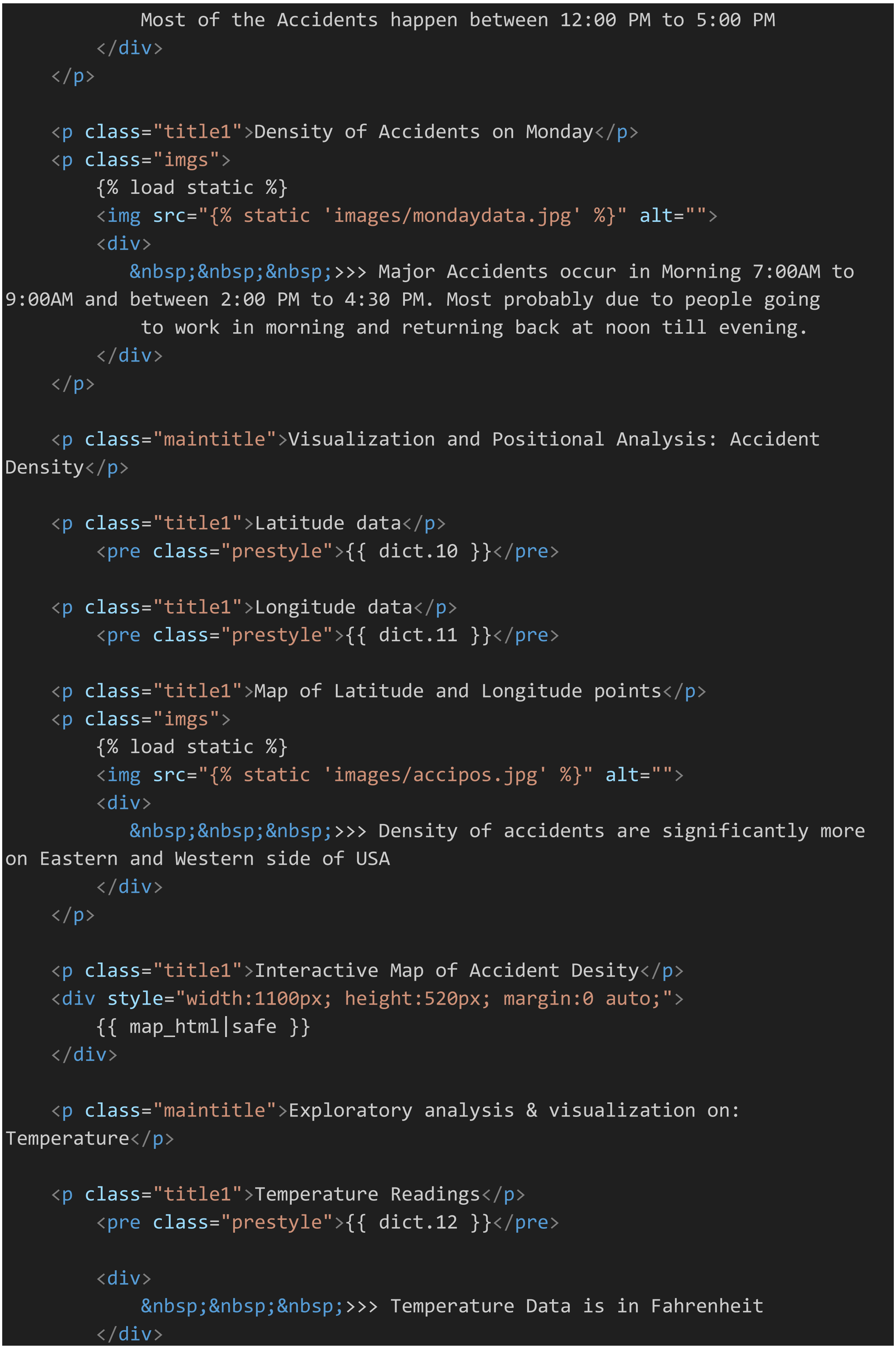


```
            padding: 6px;
            font-weight: bold;
            text-indent: 10px;
            text-align: center;
            text-decoration: underline;
            text-underline-offset: 6px;
        }
        .prestyle{
            /* border: 3px solid #333; */
            font-size: 14px;
            font-family: 'Cascadia Code';
            color:black;
            letter-spacing: 0.1ch;
        }
        div{
            font-size: large;
            font-weight:600;
        }
        .datas{
            font-size:14px;
            padding: 6px;
            margin: 5px 5px;
            border:1.5px solid #333;
            background-color: aliceblue;
            border-radius: 4px;
            display: inline-block;
        }
        .datas:hover{
            scale: 1.02;
            transition:0.4s;
        }
        .imgs img{
            display: block;
            margin:0 auto;
        }
    </style>
</head>
<body>
    <h1>US Accidents(2016-2021) Exploratory Data Analysis</h1>

    <h2>DataSet Information</h2>
    <ul>
        <li>Source     : Kaggle</li>
        <li>Contents   : Information about Accidents</li>
        <li>How is it Useful : Useful to take preventive measures to decrease
accidents</li>
        <li>Note : Data does not contain info about New York (Top Populated
City)</li>
```

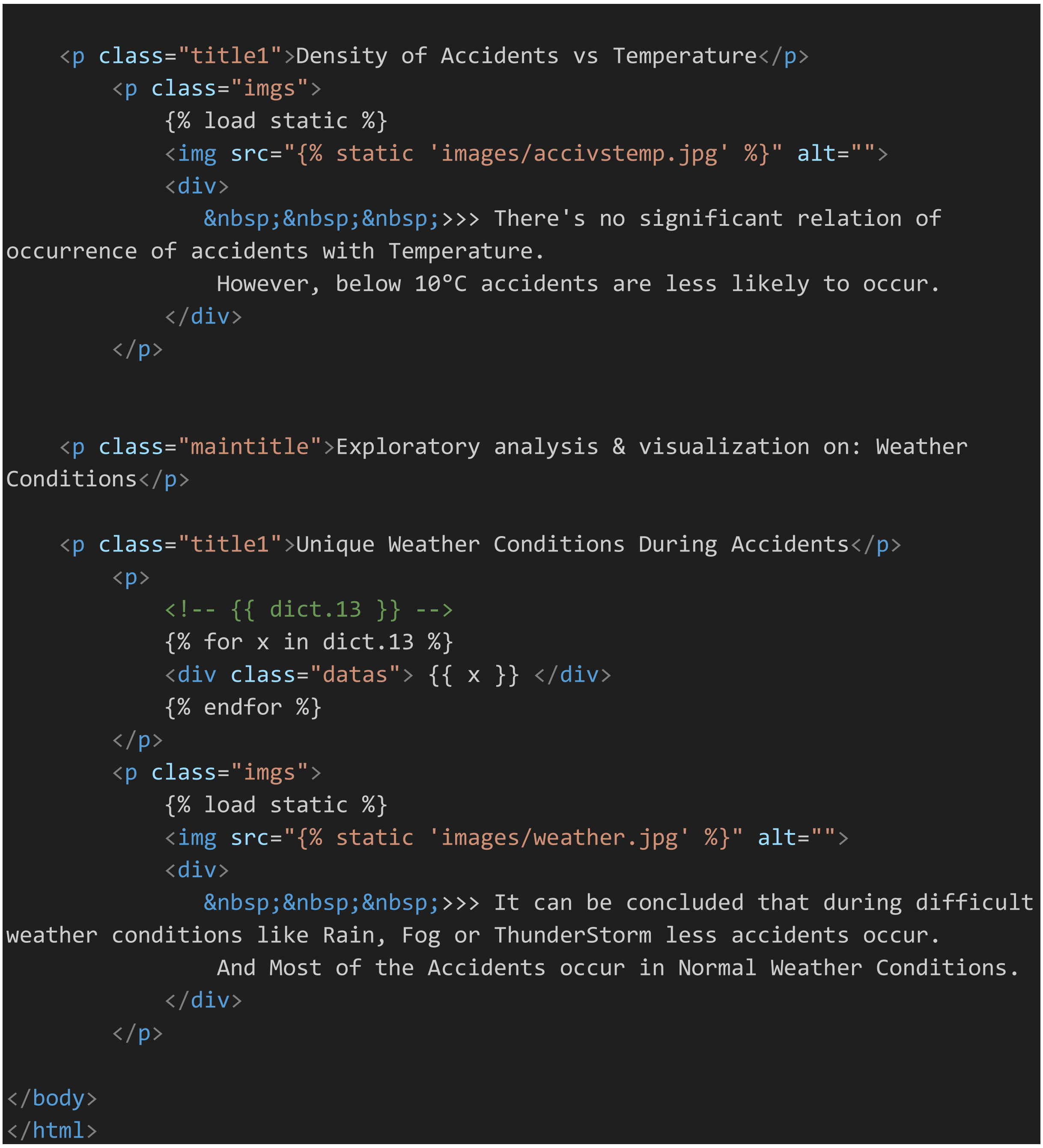


```
    </ul>

    <p class="maintitle">Data Cleaning and Preparations</p>

    <p class="title1">Preview of dataset(Read File)</p>
        <pre class="prestyle">
            {{ dict.0 }}
        </pre>
    <p class="title1">The List of Columns</p>
        <pre class="prestyle">{{ dict.1 }}</pre>

    <p class="title1">DataSet Info</p>
        <pre class="prestyle">{{ dict.2 }}</pre>

    <p class="title1">DataSet Numeric Value Analysis</p>
        <pre class="prestyle">{{ dict.3 }}</pre>

    <p class="title1">Missing Values per Columns</p>
        <p class="imgs">
            {% load static %}
            <img src="{% static 'images/missing.jpg' %}"
alt="Missing_value_Percentages">
        </p>
            <div>
               &nbsp;&nbsp;&nbsp;>>> Here we can remove 'Number' Column due to
more no of missing Values
                but it is not a good practice so we stay with our current data
                and not use these columns
            </div>


    <p class="maintitle">Exploratory analysis & visualization on: Cities</p>

    <p class="title1">City Dataset Information</p>
        <pre class="prestyle">{{ dict.4 }}</pre>

    <p class="title1">No of Unique cities present in Dataset:</p>
    <div>
        &nbsp;&nbsp;&nbsp;>>> There are {{ dict.5 }} unique cities where
accidents occurred
    </div>

    <p class="title1">Cities with their no of accidents</p>
    <pre class="prestyle">{{ dict.6 }}</pre>

    <p class="title1">Top 20 cities with their accidents count and plot</p>
        <pre class="prestyle">{{ dict.7 }}</pre>

        <p class="imgs">
```

```
            {% load static %}
            <img src="{% static 'images/top20city.jpg' %}" alt="">
        </p>

    <p class="title1">Cities vs Accidents</p>
        <p class="imgs">
            {% load static %}
            <img src="{% static 'images/cityvsacci.jpg' %}" alt="">
        </p>

    <p class="title1">Cities with only 1 accident count</p>
        <pre class="prestyle">{{ dict.8 }}</pre>


    <p class="maintitle">Exploratory analysis & visualization on: Accident
Timings</p>

    <p class="title1">Accidents Timing list</p>
    <pre class="prestyle">{{ dict.9 }}</pre>

    <p class="title1">Plot Analysis of Accident Timing</p>
        <p class="imgs">
            {% load static %}
            <img src="{% static 'images/starttime.jpg' %}" alt="">
            <div>
               &nbsp;&nbsp;&nbsp;>>> We can conclude that most of the
accidents occurr between 3:00 PM to 5:00 PM.
                And 7:00 AM to 9:00 AM.
            </div>
        </p>

    <p class="title1">Week days (0-Monday, 6-Sunday) vs density of records
present</p>
    <p class="imgs">
        {% load static %}
        <img src="{% static 'images/weekdata.jpg' %}" alt="">
        <div>
           &nbsp;&nbsp;&nbsp;>>> Weekend Days data has less density compared
to Workdays
        </div>
    </p>

    <p class="title1">Density of Accidents on Sunday</p>
    <p class="imgs">
        {% load static %}
        <img src="{% static 'images/sundaydata.jpg' %}" alt="">
        <div>
           &nbsp;&nbsp;&nbsp;>>> There's a peak in accidents at 00:00 AM
night.
```



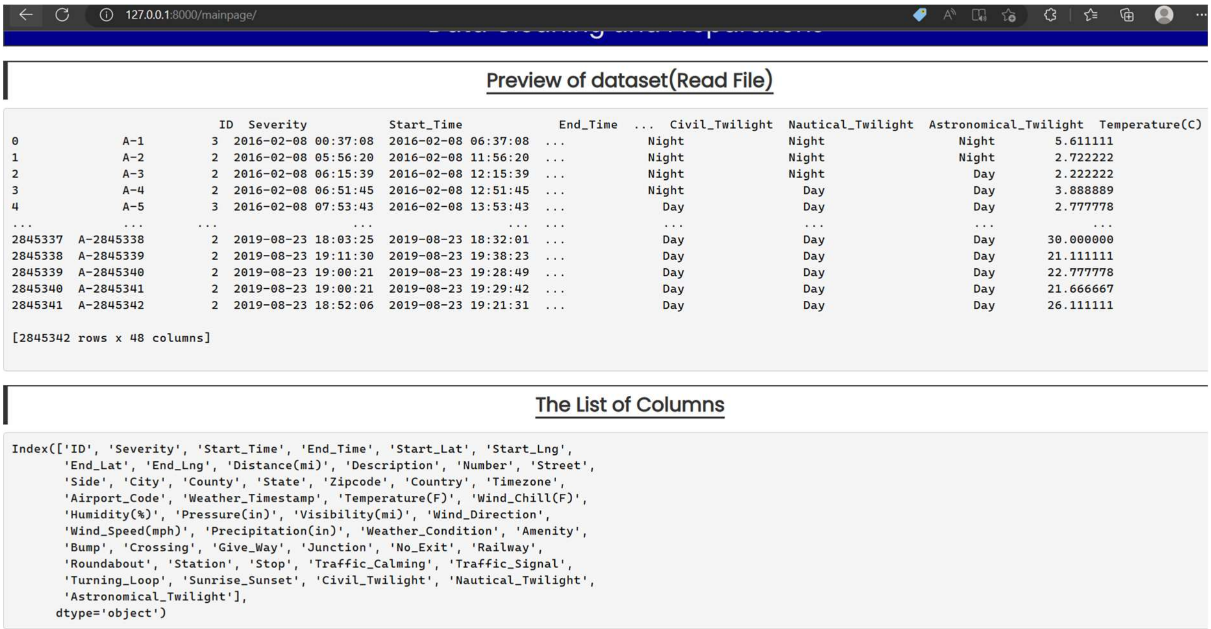
```
            Most of the Accidents happen between 12:00 PM to 5:00 PM
        </div>
    </p>

    <p class="title1">Density of Accidents on Monday</p>
    <p class="imgs">
        {% load static %}
        <img src="{% static 'images/mondaydata.jpg' %}" alt="">
        <div>
           &nbsp;&nbsp;&nbsp;>>> Major Accidents occur in Morning 7:00AM to
9:00AM and between 2:00 PM to 4:30 PM. Most probably due to people going
            to work in morning and returning back at noon till evening.
        </div>
    </p>

    <p class="maintitle">Visualization and Positional Analysis: Accident
Density</p>

    <p class="title1">Latitude data</p>
        <pre class="prestyle">{{ dict.10 }}</pre>

    <p class="title1">Longitude data</p>
        <pre class="prestyle">{{ dict.11 }}</pre>

    <p class="title1">Map of Latitude and Longitude points</p>
    <p class="imgs">
        {% load static %}
        <img src="{% static 'images/accipos.jpg' %}" alt="">
        <div>
           &nbsp;&nbsp;&nbsp;>>> Density of accidents are significantly more
on Eastern and Western side of USA
        </div>
    </p>

    <p class="title1">Interactive Map of Accident Desity</p>
    <div style="width:1100px; height:520px; margin:0 auto;">
        {{ map_html|safe }}
    </div>

    <p class="maintitle">Exploratory analysis & visualization on:
Temperature</p>

    <p class="title1">Temperature Readings</p>
        <pre class="prestyle">{{ dict.12 }}</pre>

        <div>
            &nbsp;&nbsp;&nbsp;>>> Temperature Data is in Fahrenheit
        </div>
```



```
    <p class="title1">Density of Accidents vs Temperature</p>
        <p class="imgs">
            {% load static %}
            <img src="{% static 'images/accivstemp.jpg' %}" alt="">
            <div>
               &nbsp;&nbsp;&nbsp;>>> There's no significant relation of
occurrence of accidents with Temperature.
                However, below 10°C accidents are less likely to occur.
            </div>
        </p>


    <p class="maintitle">Exploratory analysis & visualization on: Weather
Conditions</p>

    <p class="title1">Unique Weather Conditions During Accidents</p>
        <p>
            <!-- {{ dict.13 }} -->
            {% for x in dict.13 %}
            <div class="datas"> {{ x }} </div>
            {% endfor %}
        </p>
        <p class="imgs">
            {% load static %}
            <img src="{% static 'images/weather.jpg' %}" alt="">
            <div>
               &nbsp;&nbsp;&nbsp;>>> It can be concluded that during difficult
weather conditions like Rain, Fog or ThunderStorm less accidents occur.
                And Most of the Accidents occur in Normal Weather Conditions.
            </div>
        </p>

</body>
</html>
```

Below are some insights of the analysis done on the data:

Preview of dataset:



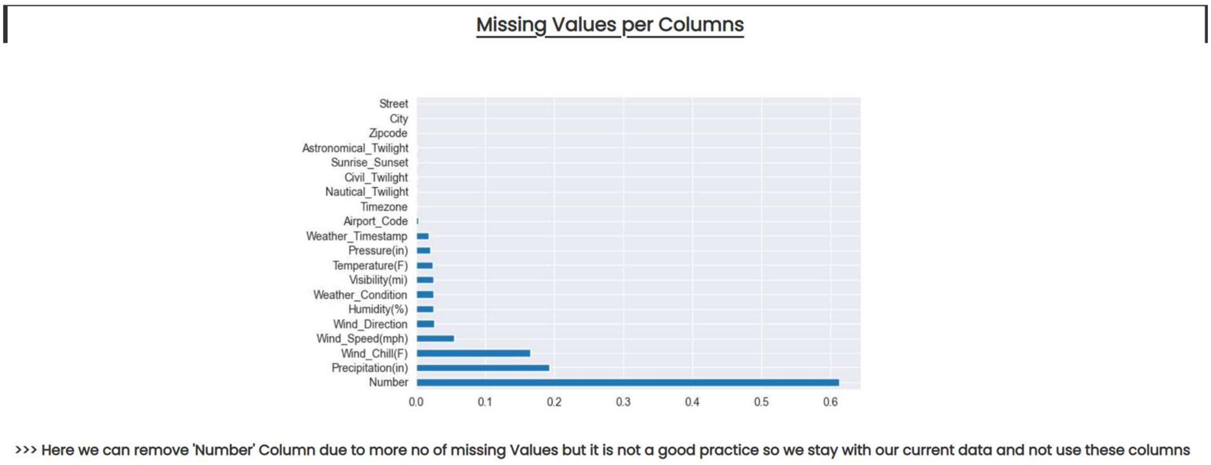
Preview of dataset(Read File)

```
                              ID  Severity           Start_Time             End_Time  ...  Civil_Twilight  Nautical_Twilight  Astronomical_Twilight  Temperature(C)
0                A-1         3  2016-02-08 00:37:08  2016-02-08 06:37:08  ...           Night              Night                  Night        5.611111
1                A-2         2  2016-02-08 05:56:20  2016-02-08 11:56:20  ...           Night              Night                  Night        2.722222
2                A-3         2  2016-02-08 06:15:39  2016-02-08 12:15:39  ...           Night              Night                    Day        2.222222
3                A-4         2  2016-02-08 06:51:45  2016-02-08 12:51:45  ...           Night                Day                    Day        3.888889
4                A-5         3  2016-02-08 07:53:43  2016-02-08 13:53:43  ...             Day                Day                    Day        2.777778
...              ...       ...                  ...                  ...  ...             ...                ...                    ...             ...
2845337  A-2845338         2  2019-08-23 18:03:25  2019-08-23 18:32:01  ...             Day                Day                    Day       30.000000
2845338  A-2845339         2  2019-08-23 19:11:30  2019-08-23 19:38:23  ...             Day                Day                    Day       21.111111
2845339  A-2845340         2  2019-08-23 19:00:21  2019-08-23 19:28:49  ...             Day                Day                    Day       22.777778
2845340  A-2845341         2  2019-08-23 19:00:21  2019-08-23 19:29:42  ...             Day                Day                    Day       21.666667
2845341  A-2845342         2  2019-08-23 18:52:06  2019-08-23 19:21:31  ...             Day                Day                    Day       26.111111

[2845342 rows x 48 columns]
```

The List of Columns

```
Index(['ID', 'Severity', 'Start_Time', 'End_Time', 'Start_Lat', 'Start_Lng',
       'End_Lat', 'End_Lng', 'Distance(mi)', 'Description', 'Number', 'Street',
       'Side', 'City', 'County', 'State', 'Zipcode', 'Country', 'Timezone',
       'Airport_Code', 'Weather_Timestamp', 'Temperature(F)', 'Wind_Chill(F)',
       'Humidity(%)', 'Pressure(in)', 'Visibility(mi)', 'Wind_Direction',
       'Wind_Speed(mph)', 'Precipitation(in)', 'Weather_Condition', 'Amenity',
       'Bump', 'Crossing', 'Give_Way', 'Junction', 'No_Exit', 'Railway',
       'Roundabout', 'Station', 'Stop', 'Traffic_Calming', 'Traffic_Signal',
       'Turning_Loop', 'Sunrise_Sunset', 'Civil_Twilight', 'Nautical_Twilight',
       'Astronomical_Twilight'],
      dtype='object')
```

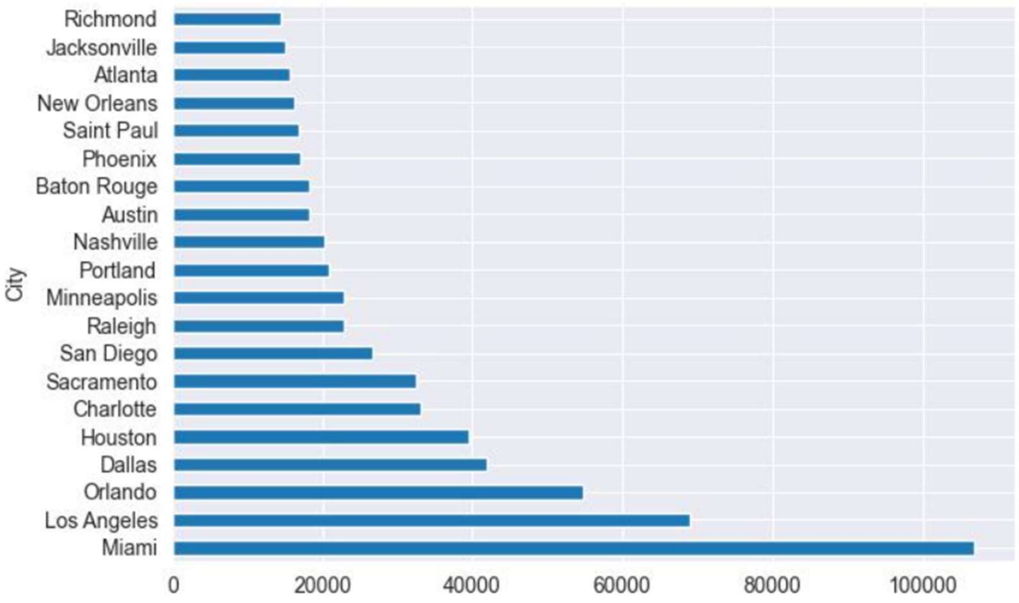
Data Cleaning (Missing Values) of dataset:



Missing Values per Columns

>>> Here we can remove 'Number' Column due to more no of missing Values but it is not a good practice so we stay with our current data and not use these columns

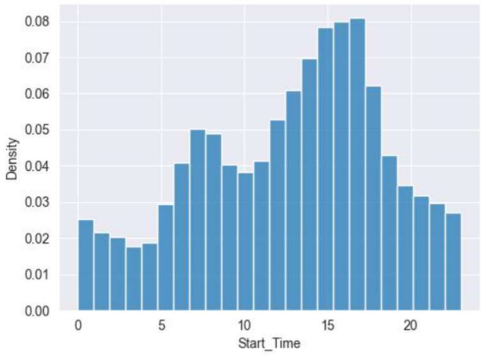
Top cities with accidents of dataset:



Cities vs Accidents

Accidents Timing of dataset:

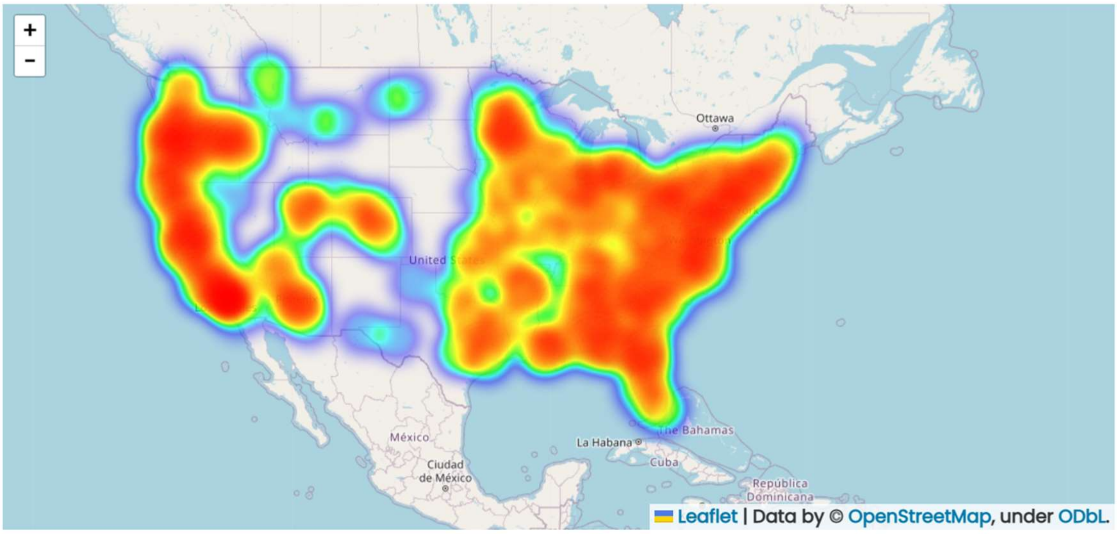
Plot Analysis of Accident Timing



>>> We can conclude that most of the accidents occurr between 3:00 PM to 5:00 PM. And 7:00 AM to 9:00 AM.

Interactive Heatmap of accidents location from dataset:

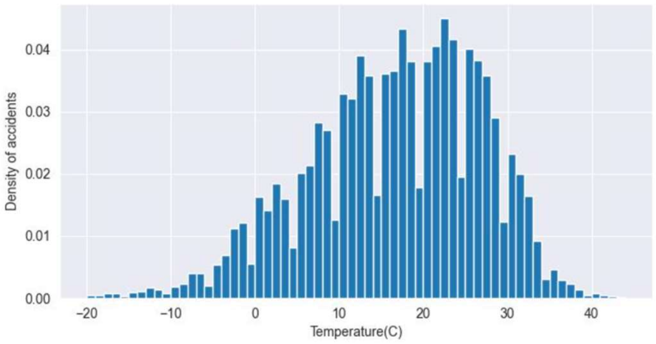
Interactive Map of Accident Desity



Temperature and Weather Conditions:

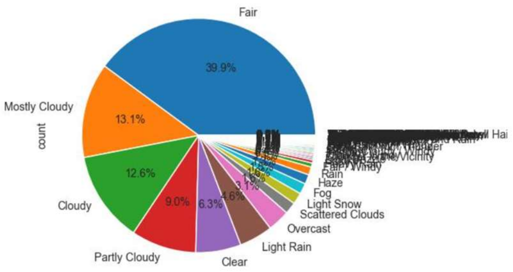
>>> Temperature Data is in Fahrenheit

Density of Accidents vs Temperature



>>> There's no significant relation of occurrence of accidents with Temperature. However, below 10ºC accidents are less likely to occur.

- Light Freezing Rain / Windy
- Duststorm
- Light Snow and Sleet / Windy
- Heavy Rain Shower / Windy
- Sand / Dust Whirlwinds / Windy
- Light Rain Shower / Windy
- Thunder and Hail
- Freezing Rain
- Heavy Sleet
- Sleet
- Freezing Drizzle
- Snow and Sleet / Windy
- Heavy Freezing Drizzle
- Heavy Freezing Rain
- Blowing Sand
- Thunder / Wintry Mix / Windy
- Mist / Windy
- Sleet / Windy
- Patches of Fog / Windy
- Sand / Dust Whirls Nearby
- Heavy Rain Shower
- Drifting Snow
- Heavy Blowing Snow
- Low Drifting Snow
- Light Blowing Snow
- Heavy Rain Showers
- Light Haze
- Heavy Thunderstorms with Small Hail
- Heavy Snow with Thunder
- Thunder and Hail / Windy



>>> It can be concluded that during difficult weather conditions like Rain, Fog or ThunderStorm less accidents occur. And Most of the Accidents occur in Normal Weather Conditions.