In [7]:
```
import pandas as pd
```

In [6]:
```
data_filepath = "C:/Users/anitt/Downloads/US_Accidents_March23.csv"
```

In [8]:
```
df = pd.read_csv(data_filepath)
df.head(10)
```

Out[8]:

	ID	Severity	Start_Time	End_Time	Start_Lat	Start_Lng	End_Lat	End_Lng	Dista
0	A-1	2	2019-05-21 08:29:55	2019-05-21 09:29:40	34.808868	-82.269157	34.808868	-82.269157	
1	A-2	2	2019-10-07 17:43:09	2019-10-07 19:42:50	35.090080	-80.745560	35.090080	-80.745560	
2	A-3	2	2020-12-13 21:53:00	2020-12-13 22:44:00	37.145730	-121.985052	37.165850	-121.988062	
3	A-4	2	2018-04-17 16:51:23	2018-04-17 17:50:46	39.110390	-119.773781	39.110390	-119.773781	
4	A-5	3	2016-08-31 17:40:49	2016-08-31 18:10:49	26.102942	-80.265091	26.102942	-80.265091	
5	A-6	3	2018-10-17 16:40:36	2018-10-17 17:10:18	35.348240	-80.847221	35.348240	-80.847221	
6	A-7	4	2019-12-12 09:48:52	2019-12-12 10:18:05	39.523970	-107.777000	39.565780	-107.516950	
7	A-8	2	2019-12-21 23:59:00	2019-12-22 00:32:06	34.034017	-118.026972	34.034017	-118.026972	
8	A-9	2	2018-05-23 16:50:24	2018-05-23 22:50:24	35.863490	-86.831680	35.849480	-86.832530	
9	A-10	2	2019-01-30 08:44:18	2019-01-30 09:14:17	34.426330	-118.585100	34.420220	-118.581900	

In [9]:
```
df.columns
```

Out[9]:
```
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')
```

In [10]:
```
print("Number of columns: ",len(df.columns))
print("Number of rows: ",len(df))
```

```
Number of columns:  47
Number of rows:  2906610
```

Gathering information about the dataset

- Missing values
- Null values
- Type of data in the file

In [11]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2906610 entries, 0 to 2906609
Data columns (total 47 columns):
 #   Column                 Dtype  
---  ------                 -----  
 0   ID                     object 
 1   Severity               int64  
 2   Start_Time             object 
 3   End_Time               object 
 4   Start_Lat              float64
 5   Start_Lng              float64
 6   End_Lat                float64
 7   End_Lng                float64
 8   Distance(mi)           float64
 9   Description            object 
 10  Number                 float64
 11  Street                 object 
 12  Side                   object 
 13  City                   object 
 14  County                 object 
 15  State                  object 
 16  Zipcode                object 
 17  Country                object 
 18  Timezone               object 
 19  Airport_Code           object 
 20  Weather_Timestamp      object 
 21  Temperature(F)         float64
 22  Wind_Chill(F)          float64
 23  Humidity(%)            float64
 24  Pressure(in)           float64
 25  Visibility(mi)         float64
 26  Wind_Direction         object 
 27  Wind_Speed(mph)        float64
 28  Precipitation(in)      float64
 29  Weather_Condition      object 
 30  Amenity                bool   
 31  Bump                   bool   
 32  Crossing               bool   
 33  Give_Way               bool   
 34  Junction               bool   
 35  No_Exit                bool   
 36  Railway                bool   
 37  Roundabout             bool   
 38  Station                bool   
 39  Stop                   bool   
 40  Traffic_Calming        bool   
 41  Traffic_Signal         bool   
 42  Turning_Loop           bool   
 43  Sunrise_Sunset         object 
 44  Civil_Twilight         object 
 45  Nautical_Twilight      object 
 46  Astronomical_Twilight  object 
dtypes: bool(13), float64(13), int64(1), object(20)
memory usage: 790.0+ MB
```

In [12]:
```
df.describe()
```

Out[12]:

	Severity	Start_Lat	Start_Lng	End_Lat	End_Lng	Distance(mi
count	2.906610e+06	2.906610e+06	2.906610e+06	2.623789e+06	2.623789e+06	2.906610e+06
mean	2.288649e+00	3.653027e+01	-9.642676e+01	3.651733e+01	-9.620367e+01	3.980541e-01
std	5.541618e-01	5.013964e+00	1.775412e+01	5.016609e+00	1.765971e+01	1.592556e+00
min	1.000000e+00	2.455527e+01	-1.246238e+02	2.455527e+01	-1.246238e+02	0.000000e+00
25%	2.000000e+00	3.366453e+01	-1.178232e+02	3.364659e+01	-1.177020e+02	0.000000e+00
50%	2.000000e+00	3.609977e+01	-9.116690e+01	3.605898e+01	-9.105163e+01	0.000000e+00
75%	3.000000e+00	4.037505e+01	-8.085814e+01	4.033133e+01	-8.084679e+01	2.790000e-01
max	4.000000e+00	4.900220e+01	-6.711317e+01	4.907500e+01	-6.710924e+01	3.336300e+02

How many columns are numerical data?

In [13]:
```
len(df.select_dtypes(['int64', 'float64']).columns)
```

Out[13]:
```
14
```

Missing or incorrect values?

In [14]:
```
df.isnull().sum()
```

Out[14]:
```
ID                          0
Severity                    0
Start_Time                  0
End_Time                    0
Start_Lat                   0
Start_Lng                   0
End_Lat                282821
End_Lng                282821
Distance(mi)                0
Description                 0
Number                1891672
Street                      0
Side                        0
City                      108
County                      0
State                       0
Zipcode                  1114
Country                     0
Timezone                 3430
Airport_Code             6608
Weather_Timestamp       46917
Temperature(F)          67224
Wind_Chill(F)         1183859
Humidity(%)             71270
Pressure(in)            56908
Visibility(mi)          72078
Wind_Direction          63474
Wind_Speed(mph)        307163
Precipitation(in)     1301326
Weather_Condition       71851
Amenity                     0
Bump                        0
Crossing                    0
Give_Way                    0
Junction                    0
No_Exit                     0
Railway                     0
Roundabout                  0
Station                     0
Stop                        0
Traffic_Calming             0
Traffic_Signal              0
Turning_Loop                0
Sunrise_Sunset            110
Civil_Twilight            110
Nautical_Twilight         110
Astronomical_Twilight     110
dtype: int64
```

In [15]:
```
df.isna().sum()
```

Out[15]:
```
ID                          0
Severity                    0
Start_Time                  0
End_Time                    0
Start_Lat                   0
Start_Lng                   0
End_Lat                282821
End_Lng                282821
Distance(mi)                0
Description                 0
Number                1891672
Street                      0
Side                        0
City                      108
County                      0
State                       0
Zipcode                  1114
Country                     0
Timezone                 3430
Airport_Code             6608
Weather_Timestamp       46917
Temperature(F)          67224
Wind_Chill(F)         1183859
Humidity(%)             71270
Pressure(in)            56908
Visibility(mi)          72078
Wind_Direction          63474
Wind_Speed(mph)        307163
Precipitation(in)     1301326
Weather_Condition       71851
Amenity                     0
Bump                        0
Crossing                    0
Give_Way                    0
Junction                    0
No_Exit                     0
Railway                     0
Roundabout                  0
Station                     0
Stop                        0
Traffic_Calming             0
Traffic_Signal              0
Turning_Loop                0
Sunrise_Sunset            110
Civil_Twilight            110
Nautical_Twilight         110
Astronomical_Twilight     110
dtype: int64
```

Finding the percantage of missing data per columns?

In [16]:
```
df.isna().sum().sort_values(ascending=False) * 100. / len(df)
```

Out[16]:
```
Number                   65.081728
Precipitation(in)        44.771263
Wind_Chill(F)            40.729888
Wind_Speed(mph)          10.567740
End_Lat                   9.730270
End_Lng                   9.730270
Visibility(mi)            2.479796
Weather_Condition         2.471986
Humidity(%)               2.451997
Temperature(F)            2.312797
Wind_Direction            2.183781
Pressure(in)              1.957882
Weather_Timestamp         1.614148
Airport_Code              0.227344
Timezone                  0.118007
Zipcode                   0.038326
Nautical_Twilight         0.003784
Astronomical_Twilight     0.003784
Civil_Twilight            0.003784
Sunrise_Sunset            0.003784
City                      0.003716
Amenity                   0.000000
Severity                  0.000000
Start_Time                0.000000
End_Time                  0.000000
Start_Lat                 0.000000
Start_Lng                 0.000000
Distance(mi)              0.000000
Description               0.000000
Turning_Loop              0.000000
Street                    0.000000
Side                      0.000000
County                    0.000000
Bump                      0.000000
State                     0.000000
Traffic_Signal            0.000000
Country                   0.000000
Traffic_Calming           0.000000
Stop                      0.000000
Station                   0.000000
Roundabout                0.000000
Railway                   0.000000
No_Exit                   0.000000
Junction                  0.000000
Give_Way                  0.000000
Crossing                  0.000000
ID                        0.000000
dtype: float64
```

Plotting the missing percentages

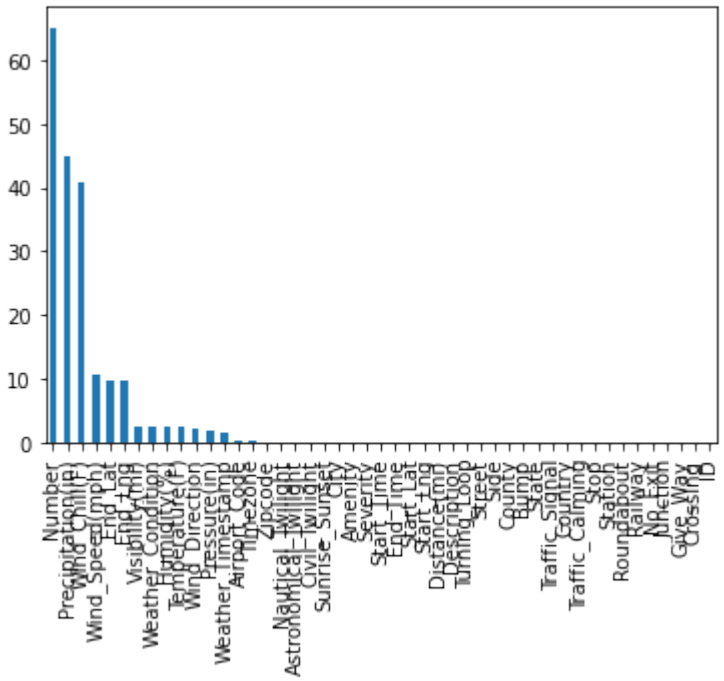
In [17]:
```
# Plotting a Pandas.Series data
missing_data = df.isna().sum().sort_values(ascending=False) * 100. / len(df
```

In [18]:
```
type(missing_data) # we can directly plot the Pandas.Series using plot()
```

Out[18]:
```
pandas.core.series.Series
```

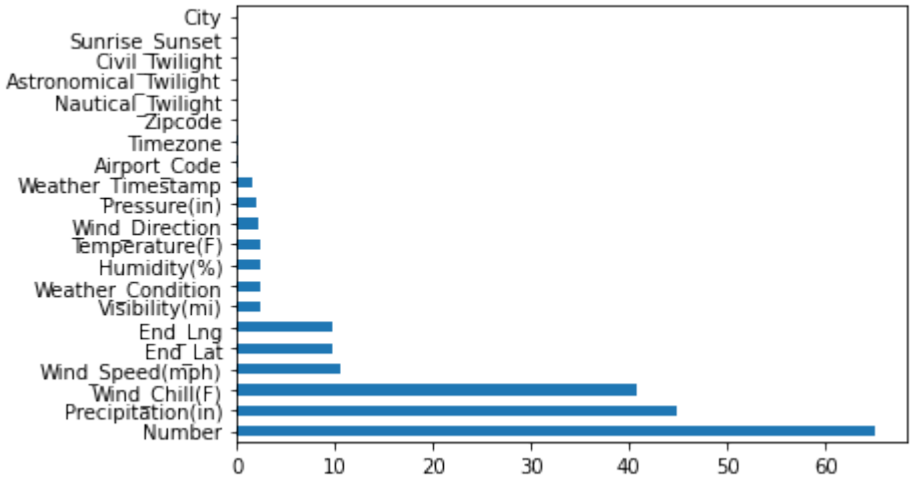
In [19]:
```
missing_data.plot(kind='bar')
```

Out[19]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd7016fd910>
```



In [20]:
```
missing_data[missing_data!=0].plot(kind='barh')
```

Out[20]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd701690750>
```



In [102]:
```
# Printing all the columns
df.columns
```

Out[102]:
```
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')
```

In [22]:
```
df.City.unique()
```

Out[22]:
```
array(['Greenville', 'Charlotte', 'Los Gatos', ..., 'Allons', 'Adolphus',
       'Gowanda'], dtype=object)
```

In [23]:
```
cities = df.City.unique()
len(cities)
```

Out[23]:
```
11790
```

Getting the number of accidents in each city over all years (2016-2020)

In [24]:
```
cities_by_accident = df.City.value_counts()
cities_by_accident[:20]
```

Out[24]:
```
Los Angeles      68411
Houston          68265
Charlotte        56176
Miami            49965
Dallas           48525
Austin           38808
Raleigh          31355
Atlanta          29244
Sacramento       28984
Orlando          28092
Nashville        25277
Baton Rouge      25080
Minneapolis      22469
San Diego        22329
Phoenix          21370
Oklahoma City    21292
Portland         19432
Richmond         18343
Seattle          17384
Saint Paul       17266
Name: City, dtype: int64
```

In [25]:
```
'New York' in cities
```

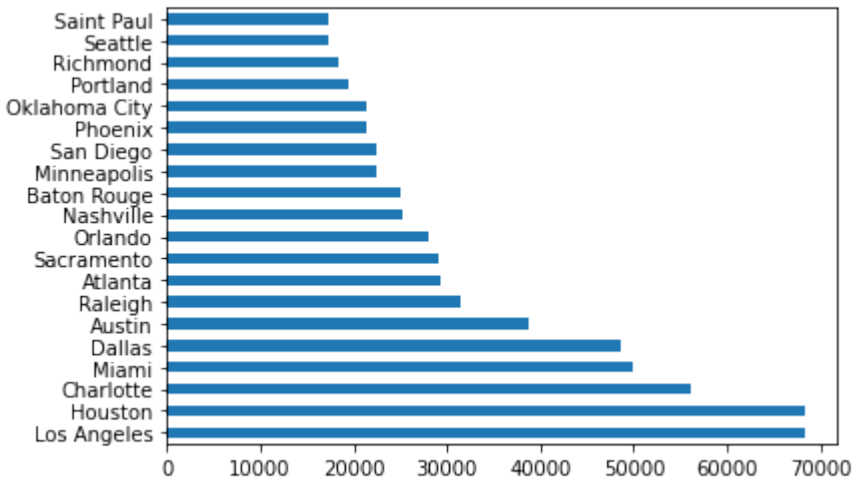
Out[25]:
```
True
```

In [26]:
```
cities_by_accident["New York"]
```

Out[26]:
```
7328
```

In [27]:
```
cities_by_accident[:20].plot(kind='barh')
```

Out[27]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd701090c90>
```



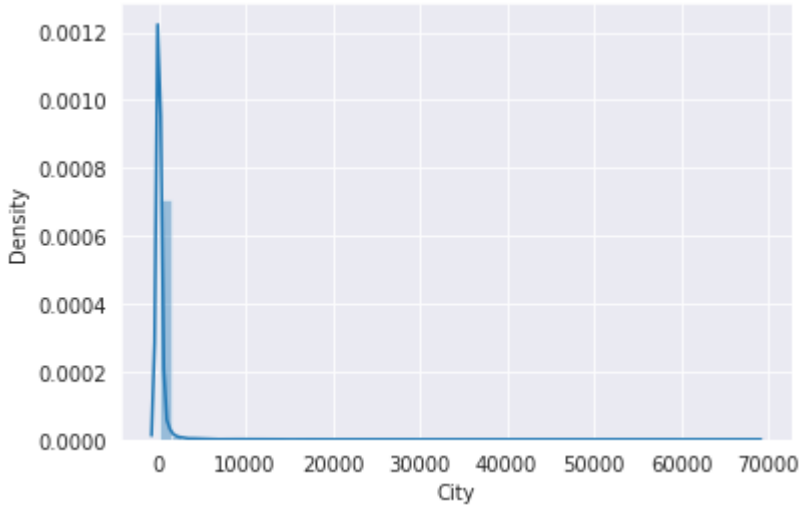
In [28]:
```
import seaborn as sns
sns.set_style("darkgrid")
```

Plotting all the citis by number of accidents accidents

In [29]:
```
sns.distplot(cities_by_accident)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: Futu
reWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-lev
el function with similar flexibility) or `histplot` (an axes-level functio
n for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[29]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6f25f0fd0>
```



In [30]:
```
high_accident_cities = cities_by_accident[cities_by_accident >=1000] # havi
low_accident_cities = cities_by_accident[cities_by_accident < 1000]  # havi
```

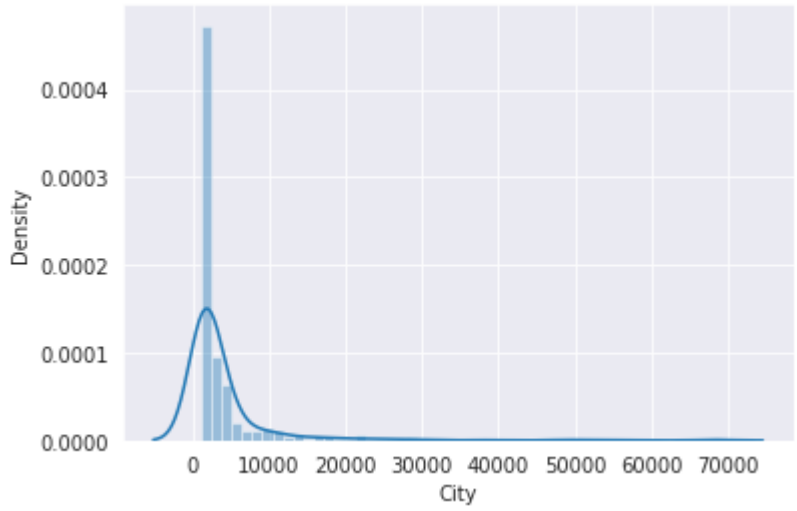
In [31]:
```
# Percentage of high accident cities
len(high_accident_cities) / len(cities_by_accident)
```

Out[31]:
```
0.04351514123335313
```

In [32]:
```
# Distribution of high accident cities
sns.distplot(high_accident_cities)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: Futu
reWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-lev
el function with similar flexibility) or `histplot` (an axes-level functio
n for histograms).
  warnings.warn(msg, FutureWarning)
```

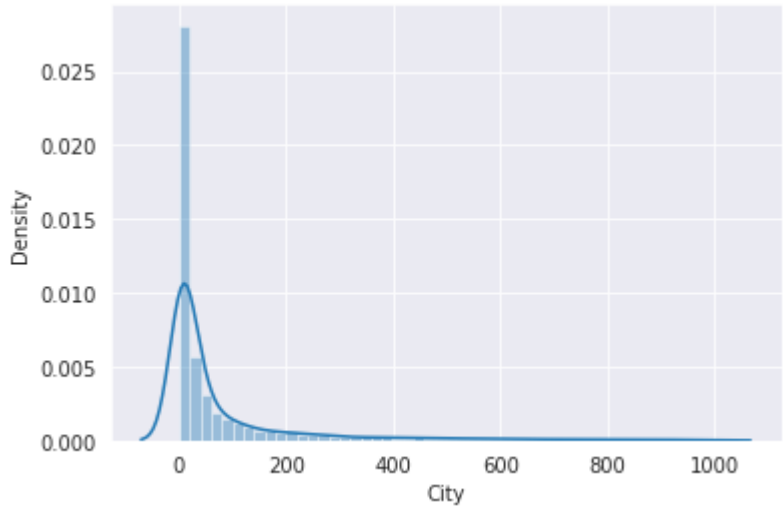
Out[32]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7c7e2d0>



In [33]:
```
# Distribution of low accident cities
sns.distplot(low_accident_cities)
```

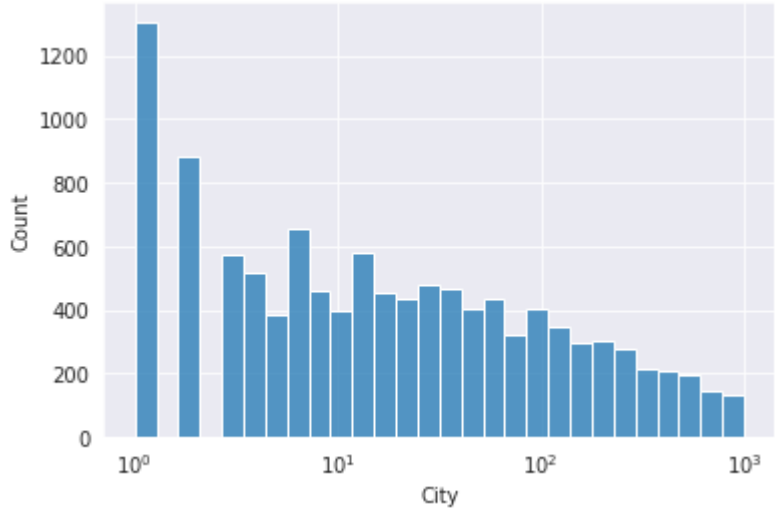
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: Futu
reWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-lev
el function with similar flexibility) or `histplot` (an axes-level functio
n for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[33]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7c66750>



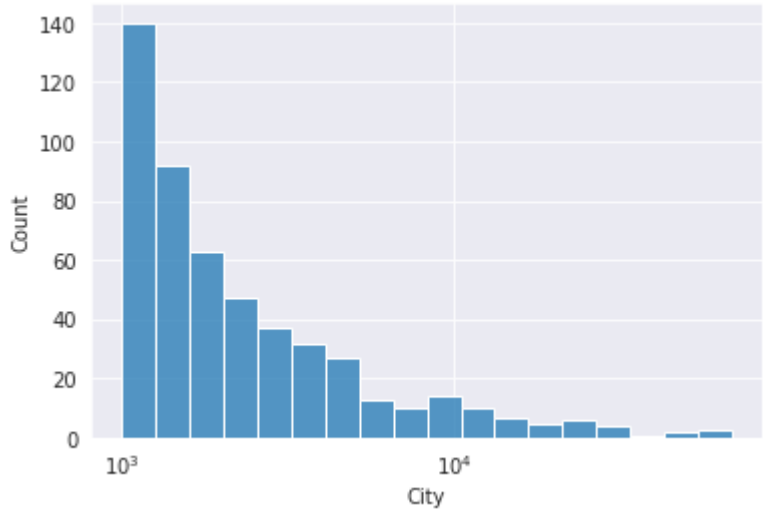
In [34]:
```
# Distribution of low accident cities
sns.histplot(low_accident_cities, log_scale=True)
```

Out[34]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7a3f110>



In [35]:
```
# Distribution of high accident cities
sns.histplot(high_accident_cities, log_scale=True)
```

Out[35]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7a57650>



There are alos cities which have reported just 1 accident in 4 years.

This could be an indication of some missing data/ irregularities or the impact of population, per-capitaincome, government spending, average age of city, etc. as hypothesised earlier

In [36]:
```
cities_by_accident[cities_by_accident == 1]
```

Out[36]:
```
Clinchco                    1
Conemaugh                   1
Beardstown                  1
Tompkinsville               1
Fairchild Air Force Base    1
                           ..
Manitowish Waters           1
Polo                        1
East Dorset                 1
Marine City                 1
Wardsboro                   1
Name: City, Length: 1306, dtype: int64
```

In [37]:
```
#checking out an entry
df.Start_Time[0]
```

Out[37]:
```
'2019-05-21 08:29:55'
```

In [38]:
```
# converting date time to correct format
df.Start_Time = pd.to_datetime(df.Start_Time)
```

In [39]:
```
df.Start_Time[0]
```

Out[39]:
```
Timestamp('2019-05-21 08:29:55')
```

In [40]:
```
# Segregating the different aspects of date-time
df.Start_Time[0].day, df.Start_Time[0].month, df.Start_Time[0].year, df.Sta
```

Out[40]:
```
(21, 5, 2019, 8, 29, 55)
```

Get the hour of the day for all the data

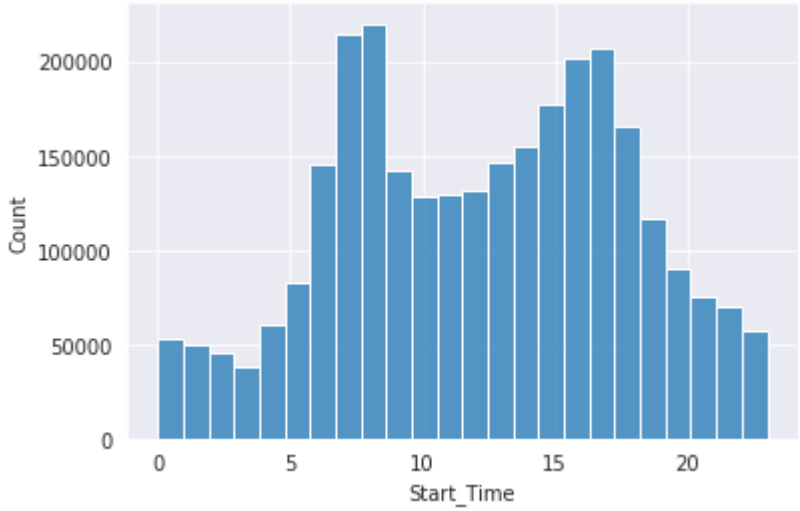
In [41]:
```
df.Start_Time.dt.hour
```

Out[41]:
```
0           8
1          17
2          21
3          16
4          17
           ..
2906605     8
2906606     2
2906607    12
2906608    22
2906609    13
Name: Start_Time, Length: 2906610, dtype: int64
```

Plotting the density distribution and count distribution of accidents at each hour of the day

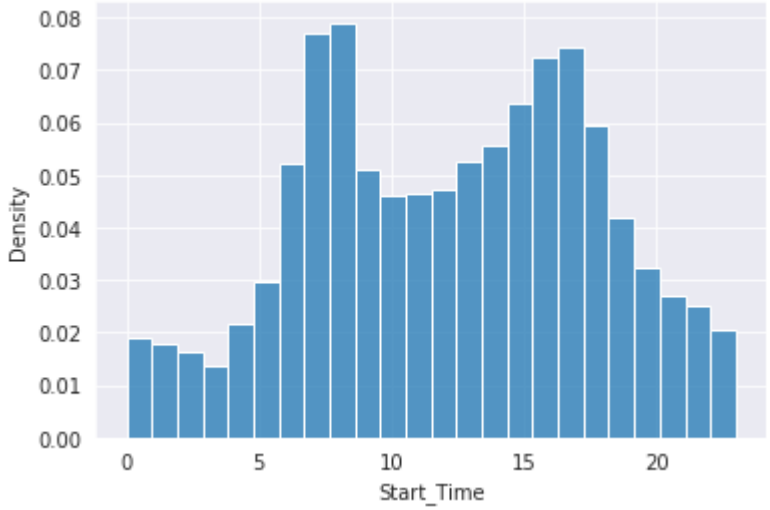
In [42]:
```
sns.histplot(df.Start_Time.dt.hour, bins=24)
```

Out[42]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7b41090>
```



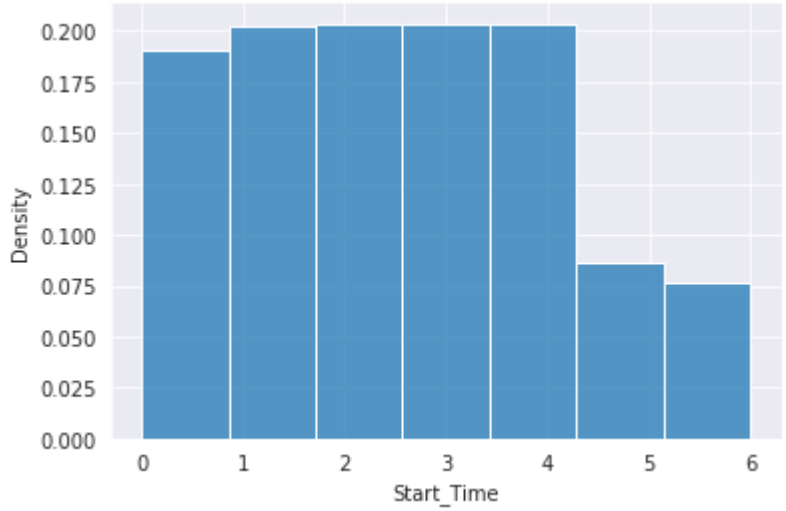
In [43]:
```
sns.histplot(df.Start_Time.dt.hour, bins=24, stat='density')
```

Out[43]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e792c210>
```



In [44]:
```
sns.histplot(df.Start_Time.dt.dayofweek, bins=7, stat='density')
```

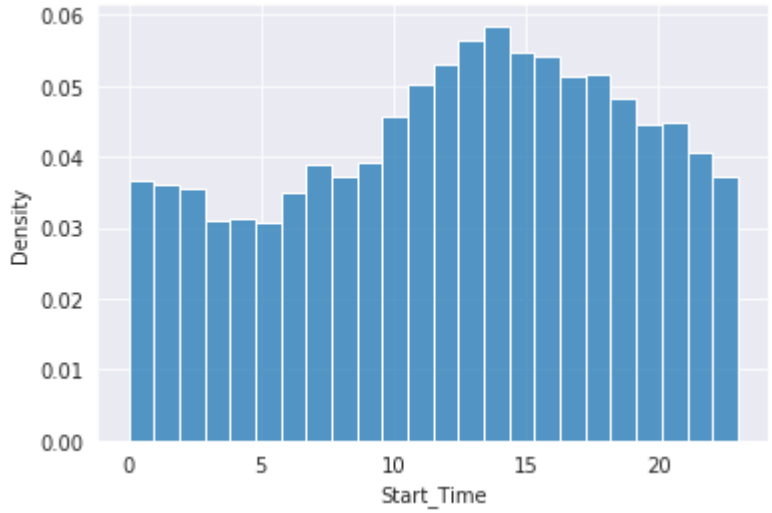
Out[44]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e76aea50>
```



In [45]:
```
sundays_start_time = df.Start_Time[df.Start_Time.dt.dayofweek == 6]
```

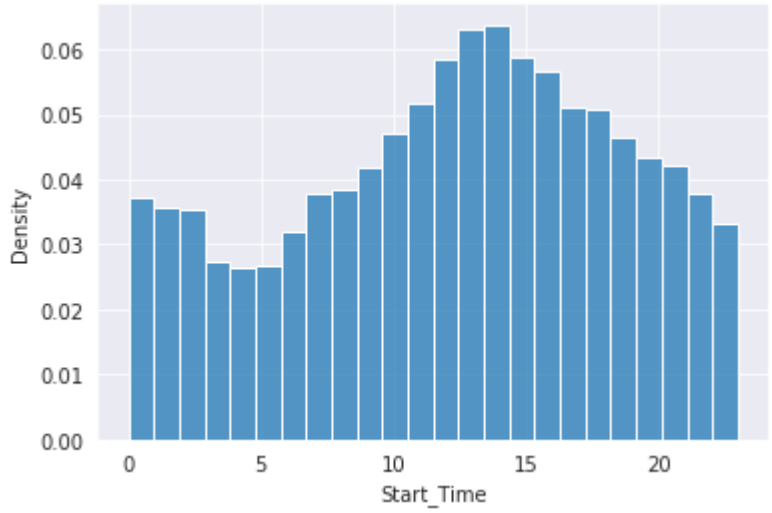
In [46]:
```
sns.histplot(sundays_start_time.dt.hour, bins=24, stat='density')
```

Out[46]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e75ce750>
```



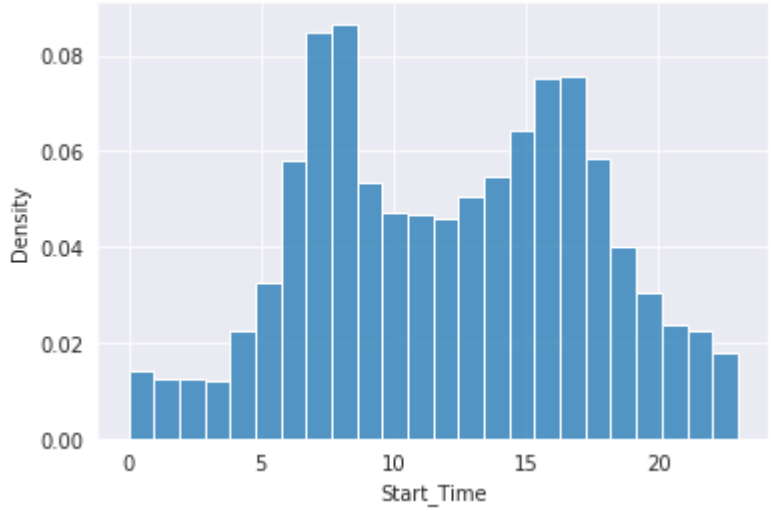
In [47]:
```
saturdays_start_time = df.Start_Time[df.Start_Time.dt.dayofweek == 5]
sns.histplot(saturdays_start_time.dt.hour, bins=24, stat='density')
```

Out[47]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e74f8190>



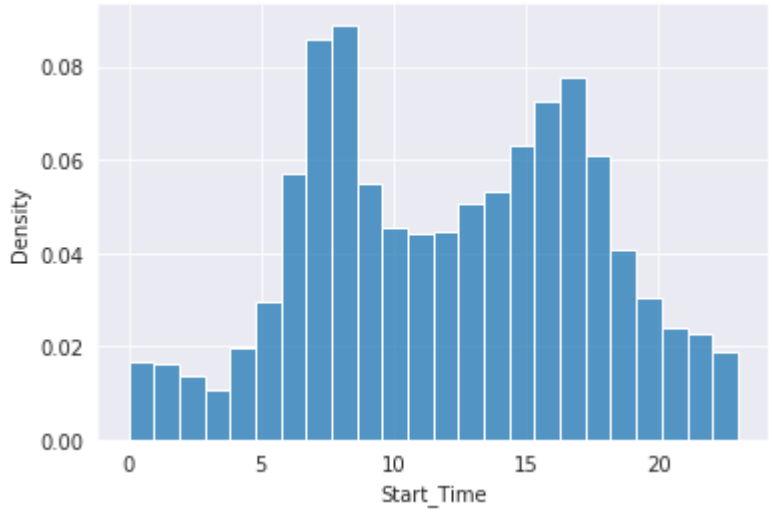
In [48]:
```
mondays_start_time = df.Start_Time[df.Start_Time.dt.dayofweek == 0]
sns.histplot(mondays_start_time.dt.hour, bins=24, stat='density')
```

Out[48]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e743a950>



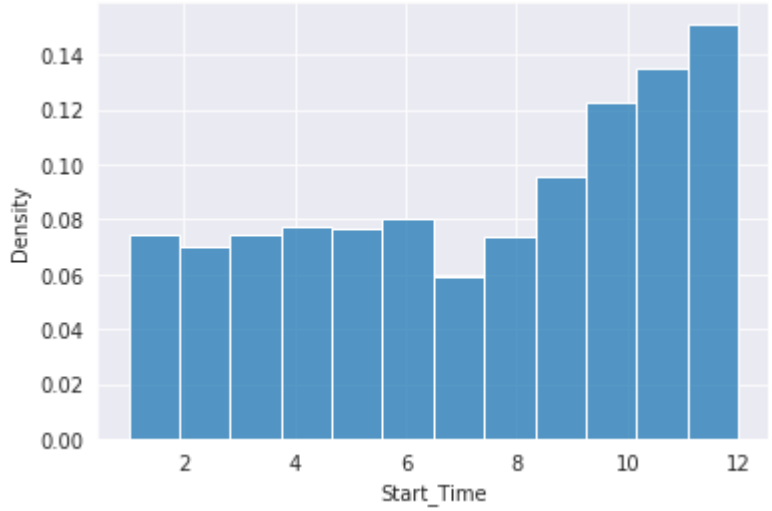
In [103]:
```
wednesdays_start_time = df.Start_Time[df.Start_Time.dt.dayofweek == 2]
sns.histplot(wednesdays_start_time.dt.hour, bins=24, stat='density')
```

Out[103]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e74ab610>



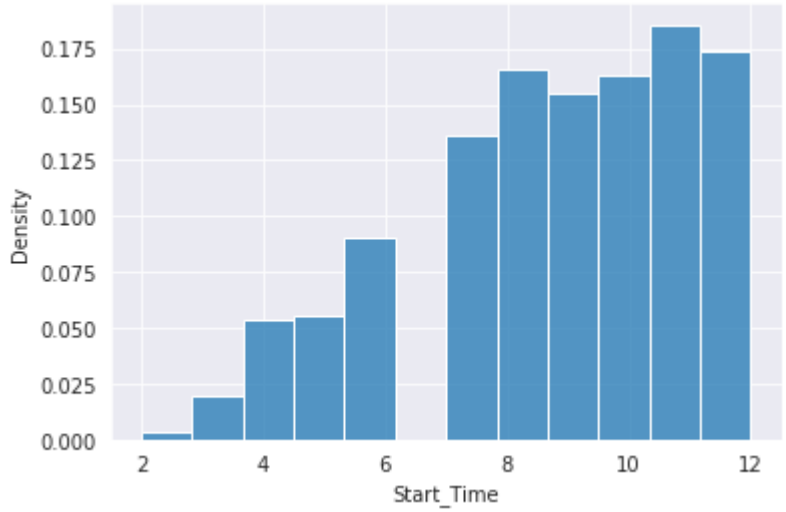
In [49]:
```
sns.histplot(df.Start_Time.dt.month, bins=12, stat='density')
```

Out[49]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7457f50>



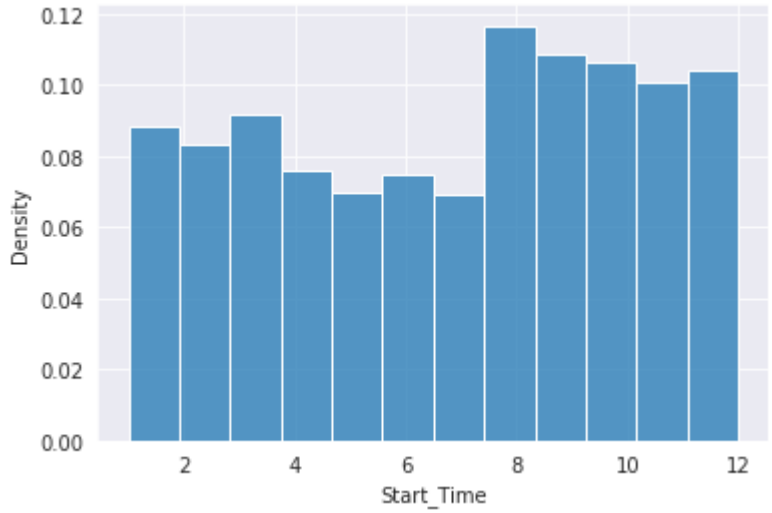
In [50]:
```
df_particular_year = df[df.Start_Time.dt.year == 2016]
sns.histplot(df_particular_year.Start_Time.dt.month, bins=12, stat='density
```

Out[50]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7348390>



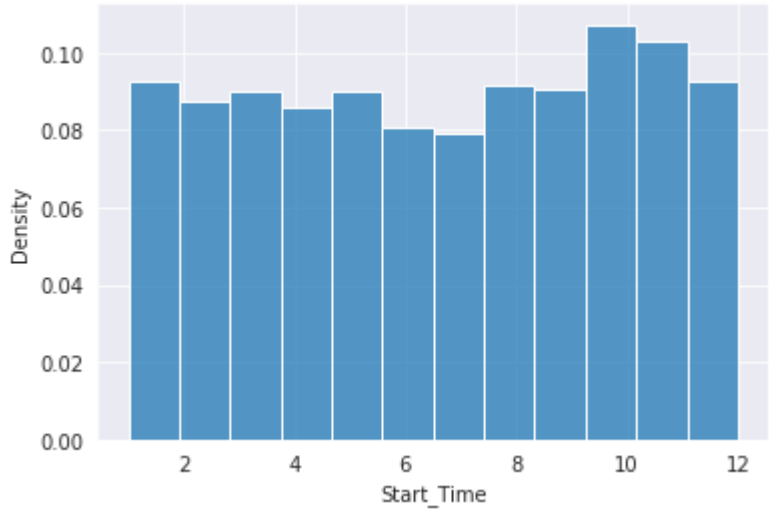
In [51]:
```
df_particular_year = df[df.Start_Time.dt.year == 2017]
sns.histplot(df_particular_year.Start_Time.dt.month, bins=12, stat='density
```

Out[51]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e72e3510>



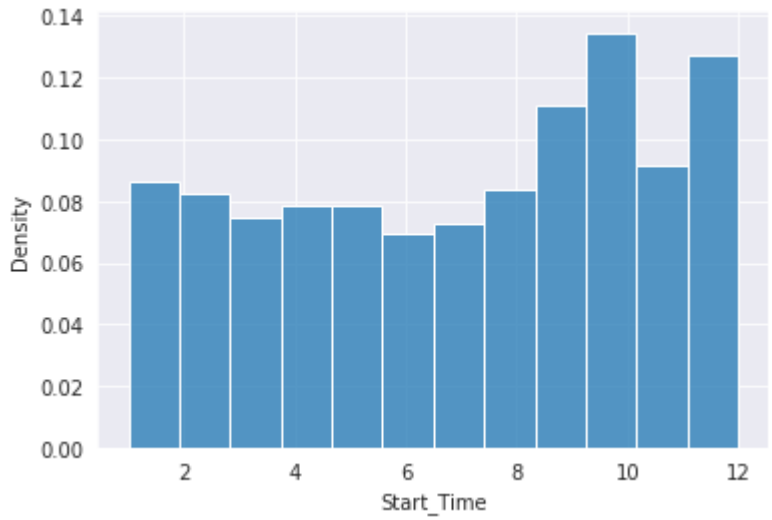
In [52]:
```
df_particular_year = df[df.Start_Time.dt.year == 2018]
sns.histplot(df_particular_year.Start_Time.dt.month, bins=12, stat='density
```

Out[52]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e7273650>



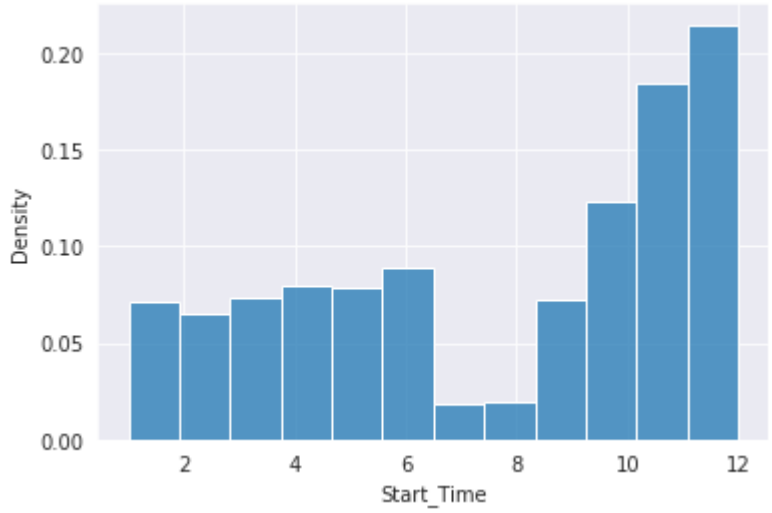
In [53]:
```
df_particular_year = df[df.Start_Time.dt.year == 2019]
sns.histplot(df_particular_year.Start_Time.dt.month, bins=12, stat='density
```

Out[53]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e721ed10>



In [54]:
```
df_particular_year = df[df.Start_Time.dt.year == 2020]
sns.histplot(df_particular_year.Start_Time.dt.month, bins=12, stat='density
```

Out[54]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e71121d0>
```



In [55]:
```
df.Start_Lat
```

Out[55]:
```
0          34.808868
1          35.090080
2          37.145730
3          39.110390
4          26.102942
               ...
2906605    29.813824
2906606    34.068890
2906607    25.702200
2906608    40.660140
2906609    38.831749
Name: Start_Lat, Length: 2906610, dtype: float64
```

In [56]:
```
df.Start_Lng
```

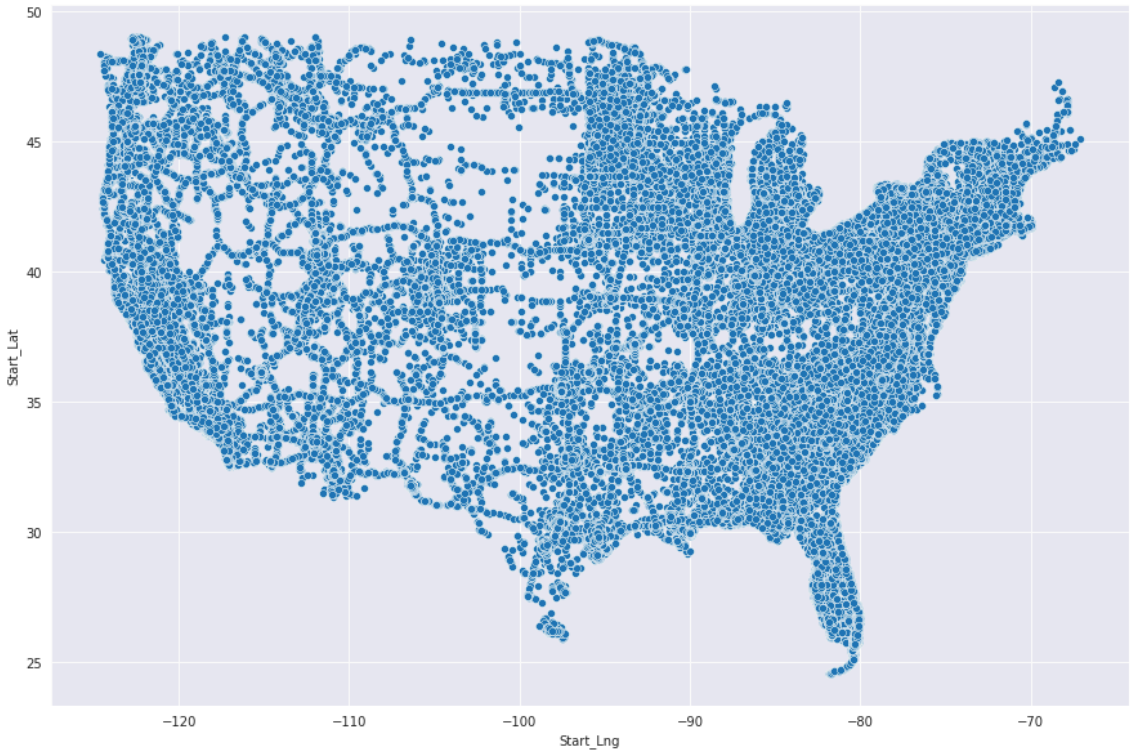
Out[56]:
```
0          -82.269157
1          -80.745560
2         -121.985052
3         -119.773781
4          -80.265091
               ...
2906605    -95.399437
2906606   -117.342010
2906607    -80.335556
2906608   -111.952460
2906609   -104.748161
Name: Start_Lng, Length: 2906610, dtype: float64
```

In [57]:
```
import matplotlib.pyplot as plt
```

Plotting the latitudes and longitudes

In [58]:
```
plt.figure(figsize=(15,10))
sns.scatterplot(y=df.Start_Lat, x=df.Start_Lng)
```

Out[58]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e710cb90>



In [104]:
```
df.info()
```

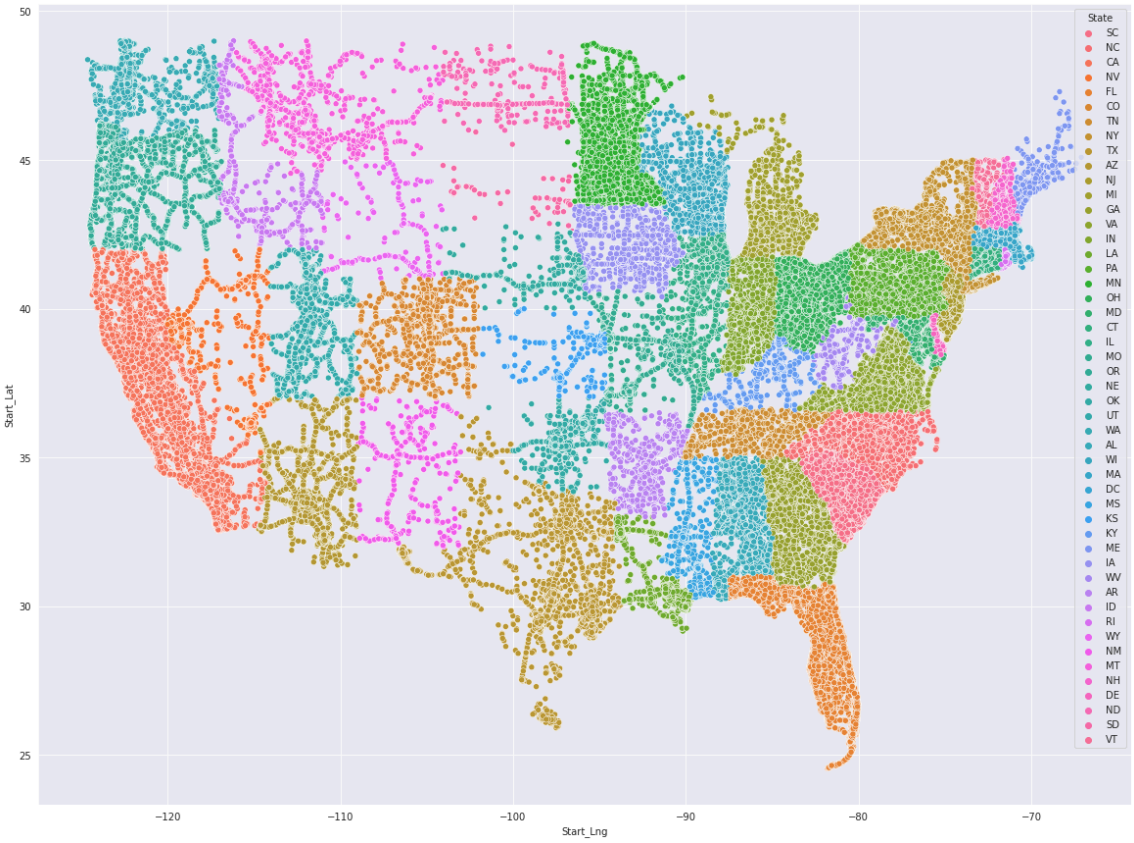
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2906610 entries, 0 to 2906609
Data columns (total 47 columns):
 #   Column                 Dtype
---  ------                 -----
 0   ID                     object
 1   Severity               int64
 2   Start_Time             datetime64[ns]
 3   End_Time               object
 4   Start_Lat              float64
 5   Start_Lng              float64
 6   End_Lat                float64
 7   End_Lng                float64
 8   Distance(mi)           float64
 9   Description            object
 10  Number                 float64
 11  Street                 object
 12  Side                   object
 13  City                   object
 14  County                 object
 15  State                  object
 16  Zipcode                object
 17  Country                object
 18  Timezone               object
 19  Airport_Code           object
 20  Weather_Timestamp      object
 21  Temperature(F)         float64
 22  Wind_Chill(F)          float64
 23  Humidity(%)            float64
 24  Pressure(in)           float64
 25  Visibility(mi)         float64
 26  Wind_Direction         object
 27  Wind_Speed(mph)        float64
 28  Precipitation(in)      float64
 29  Weather_Condition      object
 30  Amenity                bool
 31  Bump                   bool
 32  Crossing               bool
 33  Give_Way               bool
 34  Junction               bool
 35  No_Exit                bool
 36  Railway                bool
 37  Roundabout             bool
 38  Station                bool
 39  Stop                   bool
 40  Traffic_Calming        bool
 41  Traffic_Signal         bool
 42  Turning_Loop           bool
 43  Sunrise_Sunset         object
 44  Civil_Twilight         object
 45  Nautical_Twilight      object
 46  Astronomical_Twilight  object
dtypes: bool(13), datetime64[ns](1), float64(13), int64(1), object(19)
memory usage: 790.0+ MB
```

In [60]:
```
plt.figure(figsize=(20,15))
sns.scatterplot(y=df.Start_Lat, x=df.Start_Lng, hue=df.State)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2906610 entries, 0 to 2906609
Data columns (total 47 columns):
 #   Column                 Dtype
---  ------                 -----
 0   ID                     object
 1   Severity               int64
 2   Start_Time             datetime64[ns]
 3   End_Time               object
 4   Start_Lat              float64
 5   Start_Lng              float64
 6   End_Lat                float64
 7   End_Lng                float64
 8   Distance(mi)           float64
 9   Description            object
 10  Number                 float64
 11  Street                 object
 12  Side                   object
 13  City                   object
 14  County                 object
 15  State                  object
 16  Zipcode                object
 17  Country                object
 18  Timezone               object
 19  Airport_Code           object
 20  Weather_Timestamp      object
 21  Temperature(F)         float64
 22  Wind_Chill(F)          float64
 23  Humidity(%)            float64
 24  Pressure(in)           float64
 25  Visibility(mi)         float64
 26  Wind_Direction         object
 27  Wind_Speed(mph)        float64
 28  Precipitation(in)      float64
 29  Weather_Condition      object
 30  Amenity                bool
 31  Bump                   bool
 32  Crossing               bool
 33  Give_Way               bool
 34  Junction               bool
 35  No_Exit                bool
 36  Railway                bool
 37  Roundabout             bool
 38  Station                bool
 39  Stop                   bool
 40  Traffic_Calming        bool
 41  Traffic_Signal         bool
 42  Turning_Loop           bool
 43  Sunrise_Sunset         object
 44  Civil_Twilight         object
 45  Nautical_Twilight      object
 46  Astronomical_Twilight  object
dtypes: bool(13), datetime64[ns](1), float64(13), int64(1), object(19)
memory usage: 790.0+ MB
```

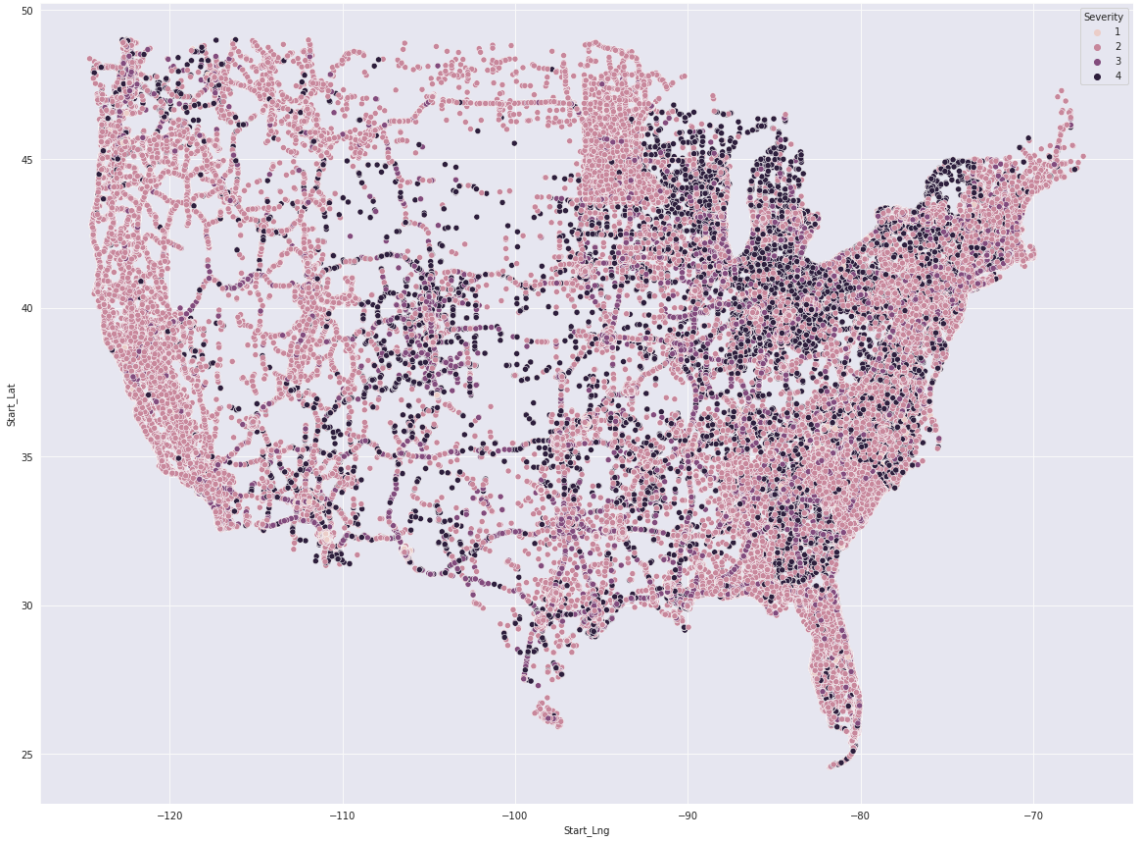
Out[60]: <matplotlib.axes._subplots.AxesSubplot at 0x7fd6e76b5ed0>

```
/usr/local/lib/python3.7/dist-packages/google/colab/_event_manager.py:28:
UserWarning: Creating legend with loc="best" can be slow with large amount
s of data.
  func(*args, **kwargs)
/usr/local/lib/python3.7/dist-packages/IPython/core/pylabtools.py:125: Use
rWarning: Creating legend with loc="best" can be slow with large amounts o
f data.
  fig.canvas.print_figure(bytes_io, **kw)
```



In [61]:
```
plt.figure(figsize=(20,15))
sns.scatterplot(y=df.Start_Lat, x=df.Start_Lng, hue=df.Severity)
```

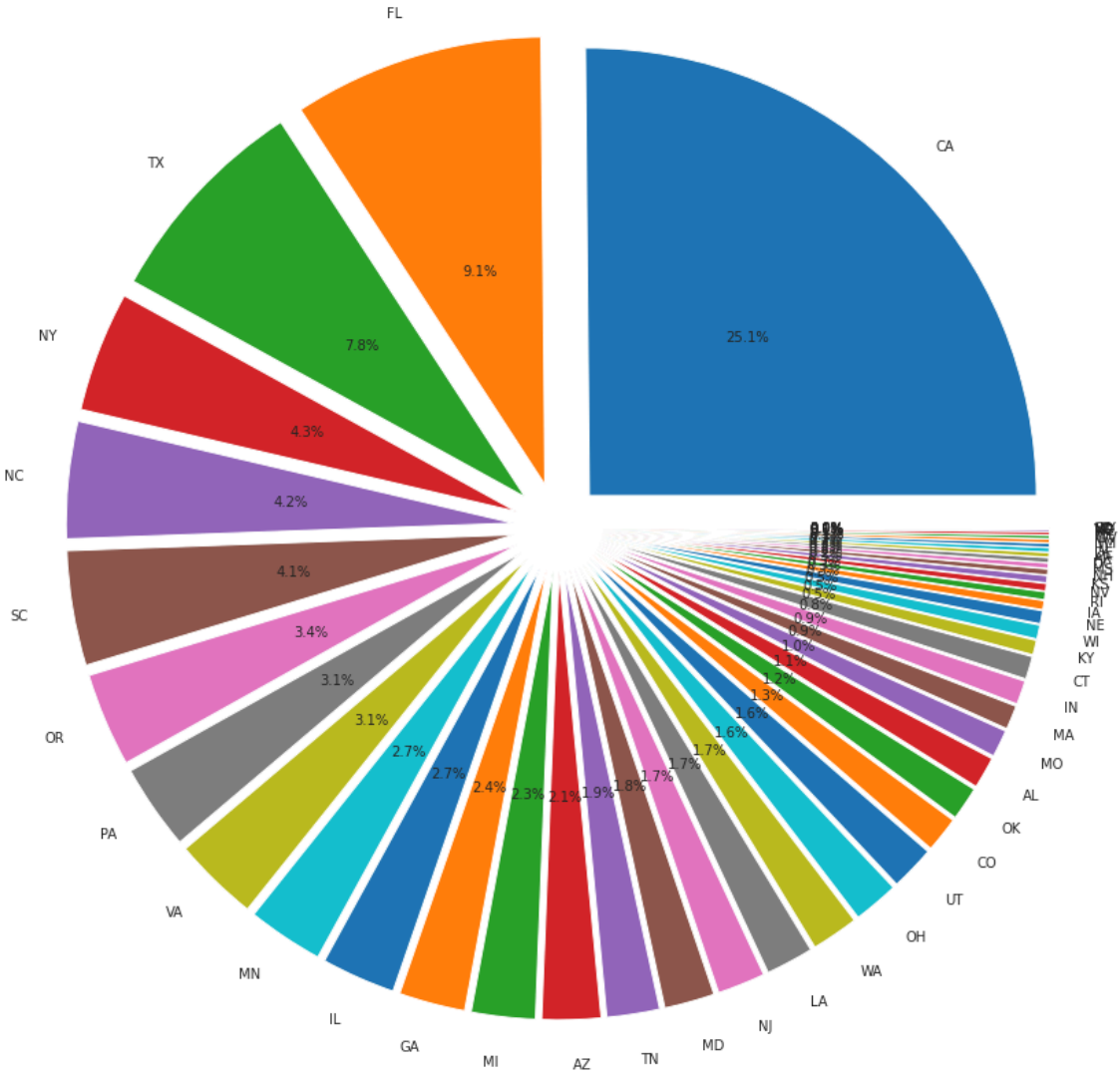
Out[61]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6e572e0d0>
```



In [62]:
```
df.State.value_counts()[:25]
```

Out[62]:
```
CA    730744
FL    263300
TX    226640
NY    126176
NC    122797
SC    120462
OR     98352
PA     89745
VA     89730
MN     79712
IL     77626
GA     69536
MI     67073
AZ     61707
TN     55495
MD     52755
NJ     50214
LA     50103
WA     49455
OH     47836
UT     46897
CO     37280
OK     35105
AL     33290
MO     28674
Name: State, dtype: int64
```

In [63]:
```
pie, ax = plt.subplots(figsize=[15,15])
labels = df.State.value_counts().keys()
plt.pie(x=df.State.value_counts(), autopct="%.1f%%", explode=[0.1]*len(df.S
plt.show();
```



In [64]:
```
# Segregating accidents on the basis of severity
severe_accidents_4 = df[df.Severity==4].State.value_counts()
severe_accidents_3 = df[df.Severity==3].State.value_counts()
severe_accidents_2 = df[df.Severity==2].State.value_counts()
severe_accidents_1 = df[df.Severity==1].State.value_counts()
```

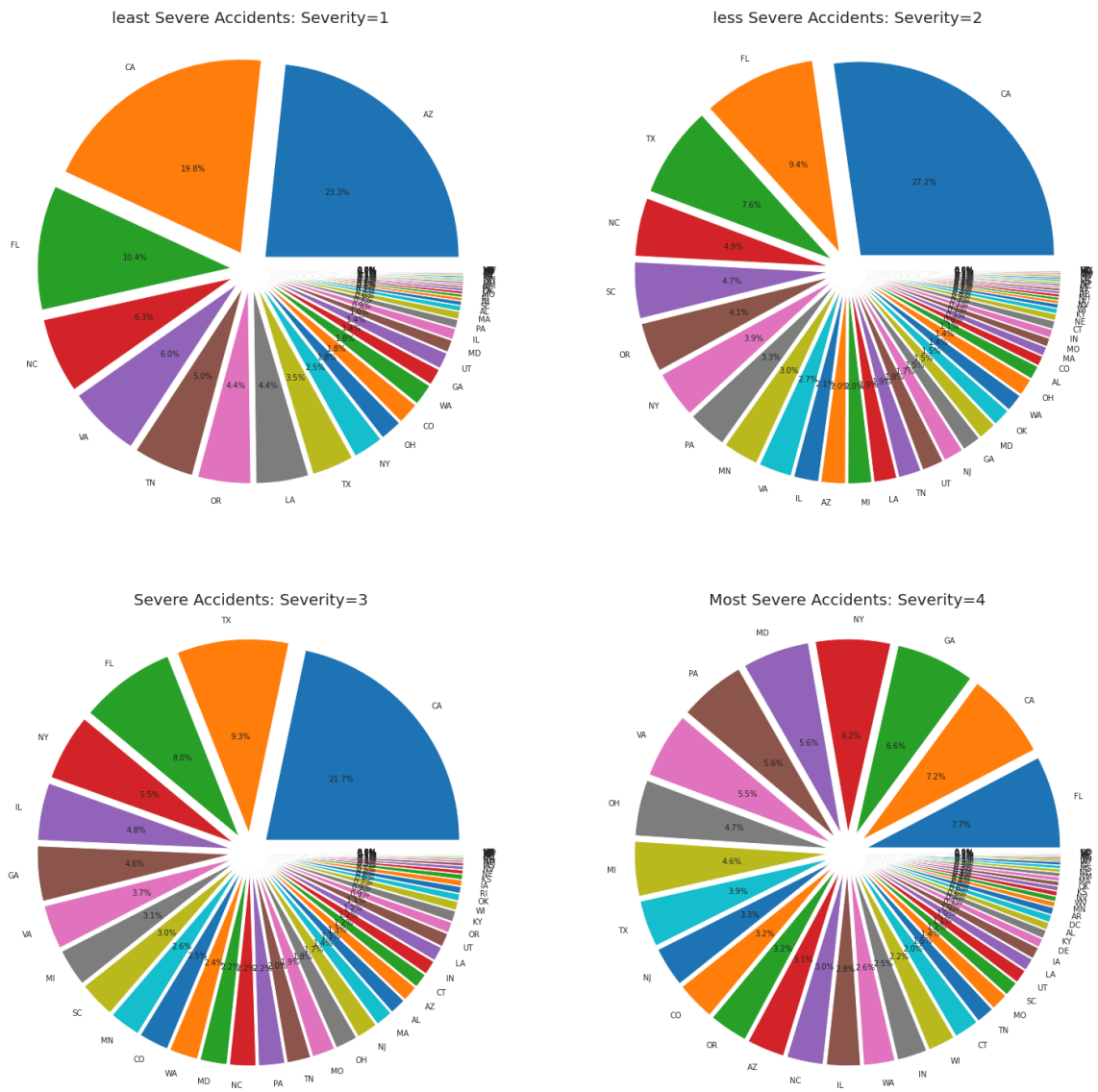
In [65]:
```
fig, ax1 = plt.subplots(figsize=[25,25])
ax1 = plt.subplot2grid((2,2),(0,0))
labels = severe_accidents_1.keys()
plt.pie(x=severe_accidents_1, autopct="%.1f%%", explode=[0.1]*len(severe_ac
plt.title("least Severe Accidents: Severity=1", fontsize=20)

ax1 = plt.subplot2grid((2,2),(0,1))
labels = severe_accidents_2.keys()
plt.pie(x=severe_accidents_2, autopct="%.1f%%", explode=[0.1]*len(severe_ac
plt.title("less Severe Accidents: Severity=2", fontsize=20)

ax1 = plt.subplot2grid((2,2),(1,0))
labels = severe_accidents_3.keys()
plt.pie(x=severe_accidents_3, autopct="%.1f%%", explode=[0.1]*len(severe_ac
plt.title("Severe Accidents: Severity=3", fontsize=20)

ax1 = plt.subplot2grid((2,2),(1,1))
labels = severe_accidents_4.keys()
plt.pie(x=severe_accidents_4, autopct="%.1f%%", explode=[0.1]*len(severe_ac
plt.title("Most Severe Accidents: Severity=4", fontsize=20)
```

Out[65]: Text(0.5, 1.0, 'Most Severe Accidents: Severity=4')



Inferences from the above plot

- California generally seems to have the most accidents (in all categories)

In [67]:
```
list(zip(list(df.Start_Lat), list(df.Start_Lng)))
```

Out[67]:
```
[(34.808868, -82.26915699999998),
 (35.09008, -80.74556),
 (37.14573, -121.985052),
 (39.11039, -119.773781),
 (26.102942, -80.265091),
 (35.34824000000001, -80.84722099999998),
 (39.52397, -107.777),
 (34.034017, -118.026972),
 (35.86349000000001, -86.83168),
 (34.42633, -118.5851),
 (28.021709, -82.203583),
 (40.91221, -73.875099),
 (32.86693, -96.66617),
 (32.265141, -110.90358700000002),
 (41.05982, -74.25092),
 (29.723339000000006, -95.497337),
 (34.103172, -118.249969),
 (34.186595000000004, -117.439427),
 (42.501929, -82.918056),
```

In [69]:
```
import random
```

In [70]:
```
df_sample = df.sample(10000)
```

In [71]:
```
df_sample.Start_Lat
```

Out[71]:
```
668907     41.938133
448021     33.385742
4511       30.272743
1371228    35.863110
2211536    33.553101
               ...
1029356    38.697596
1149812    42.525455
1018798    43.118233
175231     34.088684
1985548    32.632549
Name: Start_Lat, Length: 10000, dtype: float64
```

In [72]:
```
df.columns
```

Out[72]:
```
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')
```

In [112]:
```
df['Visibility(mi)']
```

Out[112]:
```
0          10.0
1          10.0
2          10.0
3          10.0
4          10.0
           ...
2906605     9.0
2906606    10.0
2906607    10.0
2906608    10.0
2906609    10.0
Name: Visibility(mi), Length: 2906610, dtype: float64
```

In [113]:
```
df['Visibility(mi)'].value_counts()
```

Out[113]:
```
10.0     2260327
7.0        87566
9.0        75270
8.0        60090
5.0        56646
           ...
3.2            1
19.0           1
54.0           1
101.0          1
130.0          1
Name: Visibility(mi), Length: 81, dtype: int64
```

In [74]:
```
df[(df.Severity == 4) & (df['Visibility(mi)'] <=10)]  # data when severity
```

Out[74]:

	ID	Severity	Start_Time	End_Time	Start_Lat	Start_Lng	End_Lat	End
6	A-7	4	2019-12-12 09:48:52	2019-12-12 10:18:05	39.523970	-107.777000	39.565780	-107.5
40	A-41	4	2020-10-26 00:38:00	2020-10-26 02:41:25	40.428002	-79.926779	40.426058	-79.8
146	A-147	4	2016-08-20 01:31:43	2016-08-20 07:31:43	40.645250	-75.425760	40.630360	-75.4
167	A-168	4	2019-07-13 16:14:30	2019-07-13 16:42:44	43.849180	-84.020810	43.737277	-84.0
196	A-197	4	2018-07-09 01:08:19	2018-07-09 07:08:19	32.719830	-117.117570	32.716810	-117.1
...	...	...	...	...	...	...	...	
2906549	A-2906550	4	2018-08-26 00:25:54	2018-08-26 02:25:53	25.941730	-80.189260	25.950490	-80.1
2906554	A-2906555	4	2020-04-23 19:18:22	2020-04-23 19:47:31	39.144030	-84.559830	39.137680	-84.5
2906568	A-2906569	4	2019-11-09 03:55:18	2019-11-09 04:22:55	29.182560	-82.184640	29.191010	-82.1
2906577	A-2906578	4	2017-03-07 16:01:38	2017-03-07 22:01:38	36.573645	-79.847221	36.559341	-79.8
2906591	A-2906592	4	2020-12-24 08:23:00	2020-12-24 11:25:20	41.785073	-86.139762	41.785570	-86.1

114602 rows × 47 columns

In [106]:
```
(len(df[df['Visibility(mi)'] <=2]) / len(df) )* 100. # total percentage of
```

Out[106]:
```
4.375578422973843
```

In [107]:
```
(len(df[(df['Visibility(mi)'] <=2) & (df['Severity'] ==4)]) / len(df) ) * 1
```

Out[107]:
```
0.21203395020315763
```

In [78]:
```
weather = df.Weather_Condition.value_counts()
```

In [79]:
```
weather[weather > 1000]  # Kind of weather when no. of accidents were great
```

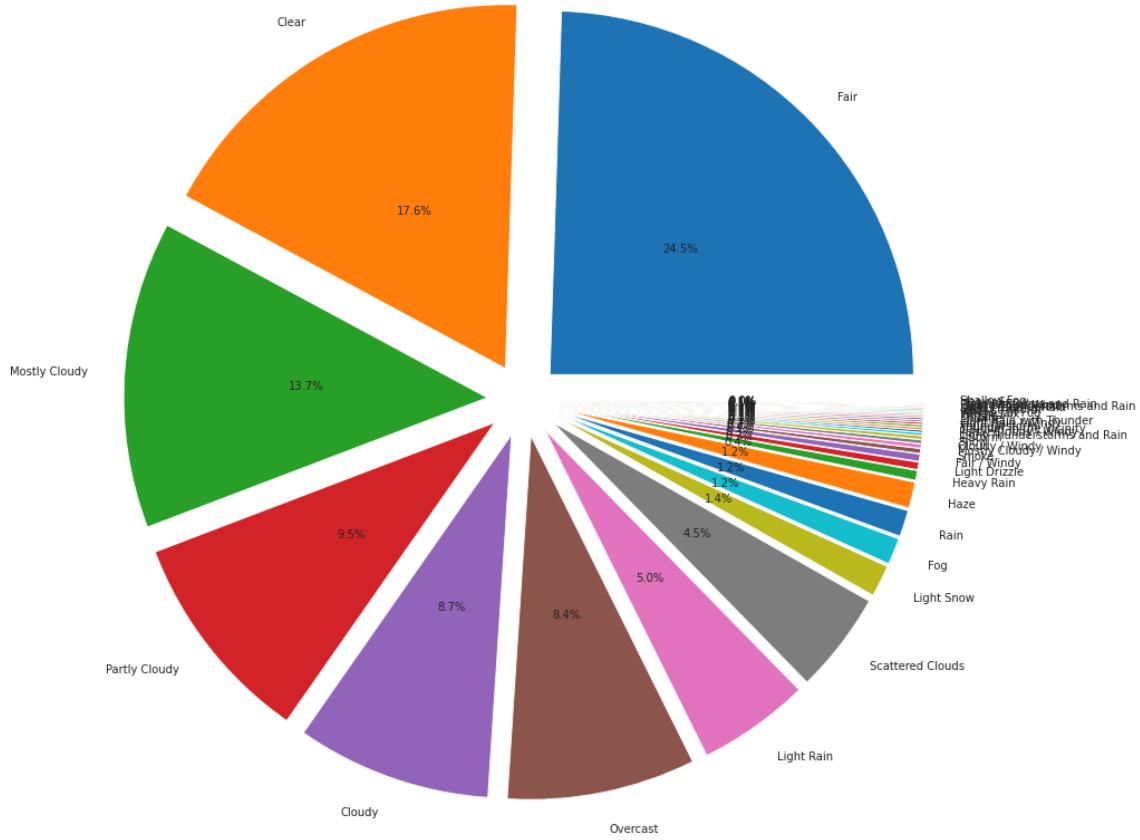
Out[79]:

Fair	692680
Clear	498925
Mostly Cloudy	386122
Partly Cloudy	268851
Cloudy	245054
Overcast	237068
Light Rain	140946
Scattered Clouds	127090
Light Snow	39941
Fog	33424
Rain	33383
Haze	32993
Heavy Rain	12340
Light Drizzle	9484
Fair / Windy	9121
Smoke	6037
Mostly Cloudy / Windy	5100
Cloudy / Windy	4773
Snow	4589
T-Storm	3313
Light Thunderstorms and Rain	3089
Partly Cloudy / Windy	3054
Thunder in the Vicinity	2829
Thunderstorm	2801
Light Rain / Windy	2653
Light Rain with Thunder	2595
Thunder	2314
Drizzle	2025
Wintry Mix	1875
Patches of Fog	1854
Mist	1757
Heavy T-Storm	1748
Light Freezing Rain	1489
Heavy Thunderstorms and Rain	1475
Light Snow / Windy	1418
Thunderstorms and Rain	1415
Heavy Snow	1232
Shallow Fog	1150

Name: Weather_Condition, dtype: int64

In [80]:
```
import matplotlib.pyplot as plt
```

In [81]:
```
pie, ax = plt.subplots(figsize=[15,15])
labels = weather[weather > 1000].keys()
plt.pie(x=weather[weather > 1000], autopct="%.1f%%", explode=[0.1]*len(weat
plt.show();
```



In [111]:
```
df['Temperature(F)']
```

Out[111]:
```
0          76.0
1          76.0
2          51.0
3          53.6
4          84.2
           ...
2906605    84.2
2906606    46.9
2906607    76.0
2906608    27.0
2906609    51.1
Name: Temperature(F), Length: 2906610, dtype: float64
```

In [119]:
```
df['Temperature(F)'].value_counts()
```

Out[119]:
```
 68.0     62008
 59.0     60192
 77.0     59625
 73.0     57029
 63.0     56585
          ...
 132.6        1
 1.6          1
-19.3         1
-5.4          1
-21.5         1
Name: Temperature(F), Length: 822, dtype: int64
```

In [83]:
```
temperature = df['Temperature(F)'].value_counts()
```

In [120]:
```
temperature.index
```

Out[120]:
```
Float64Index([ 68.0,  59.0,  77.0,  73.0,  63.0,  64.0,  72.0,  70.0,  61.
0,
               75.0,
              ...
              170.6, -12.1, 161.6, 203.0, -15.2, 132.6,   1.6, -19.3,  -5.
4,
              -21.5],
             dtype='float64', length=822)
```

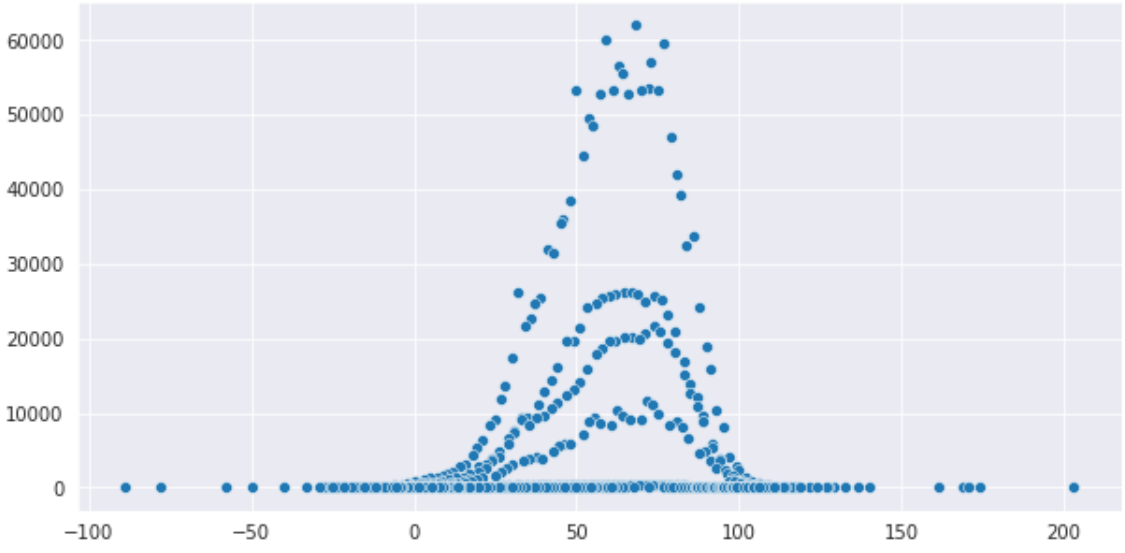
In [121]:
```
temperature.values
```

Out[121]:
```
array([62008, 60192, 59625, 57029, 56585, 55573, 53610, 53400, 53399,
       53394, 53284, 52807, 52794, 49587, 48477, 46922, 44543, 42121,
       39295, 38519, 36097, 35541, 33786, 32382, 32046, 31512, 26320,
       26300, 26291, 26010, 25873, 25714, 25709, 25532, 25471, 25108,
       25064, 24747, 24625, 24278, 24151, 23135, 22800, 21793, 21706,
       21325, 20935, 20869, 20661, 20270, 20094, 20004, 19785, 19661,
       19660, 19570, 19424, 18874, 18686, 18266, 18049, 17393, 16880,
       16052, 15940, 15820, 15213, 14382, 14228, 13897, 13690, 13164,
       12810, 12601, 12519, 12234, 11984, 11655, 11443, 11261, 11085,
       10824, 10676, 10471, 10287,  9912,  9741,  9671,  9557,  9516,
        9458,  9339,  9331,  9252,  9178,  9144,  9062,  9010,  8895,
        8848,  8755,  8504,  8413,  8356,  8302,  8248,  8132,  7652,
        7462,  7089,  6676,  6514,  6487,  5933,  5853,  5769,  5764,
        5515,  5457,  5381,  4860,  4819,  4767,  4755,  4355,  4248,
        4222,  4190,  4000,  3848,  3770,  3768,  3623,  3581,  3559,
        3504,  3226,  3121,  3072,  2933,  2868,  2811,  2722,  2683,
        2612,  2476,  2317,  2160,  2048,  2037,  1875,  1827,  1803,
        1728,  1640,  1579,  1470,  1384,  1309,  1290,  1286,  1254,
        1140,  1127,  1086,  1058,  1033,   990,   985,   964,   912,
         903,   844,   838,   815,   791,   634,   631,   625,   601,
         594,   588,   568,   524,   506,   503,   498,   490,   443,
         435,   435,   434,   416,   409,   407,   407,   400,   391,
         386,   379,   362,   362,   357,   355,   353,   352,   350,
         350,   349,   347,   345,   345,   343,   331,   331,   330,
         328,   328,   325,   325,   323,   322,   321,   317,   317,
         315,   315,   315,   314,   311,   310,   310,   309,   309,
         308,   308,   307,   306,   306,   305,   304,   301,   298,
         298,   298,   298,   297,   297,   295,   293,   293,   293,
         292,   292,   292,   290,   290,   289,   289,   289,   289,
         286,   286,   286,   285,   285,   284,   284,   281,   280,
         278,   278,   278,   277,   277,   275,   274,   274,   273,
         272,   272,   271,   271,   268,   267,   267,   266,   265,
         264,   262,   262,   261,   260,   260,   259,   258,   257,
         257,   257,   255,   254,   253,   253,   253,   252,   252,
         250,   250,   250,   250,   249,   248,   248,   248,   247,
         246,   245,   244,   244,   244,   243,   243,   242,   242,
         242,   241,   241,   240,   238,   238,   237,   236,   234,
         234,   234,   234,   232,   231,   230,   230,   229,   228,
         226,   226,   226,   225,   225,   225,   224,   224,   224,
         224,   223,   223,   222,   222,   222,   222,   221,   221,
         220,   219,   219,   219,   218,   218,   217,   217,   217,
         216,   215,   214,   214,   214,   213,   212,   212,   212,
         211,   211,   210,   209,   209,   208,   207,   206,   206,
         206,   206,   204,   204,   204,   204,   203,   201,   200,
         199,   199,   199,   196,   196,   195,   192,   192,   192,
         191,   190,   190,   190,   189,   189,   188,   188,   187,
         187,   186,   185,   184,   183,   183,   183,   182,   181,
         179,   179,   178,   175,   174,   173,   173,   170,   170,
         170,   170,   169,   168,   167,   166,   166,   165,   165,
         164,   164,   163,   163,   162,   161,   160,   159,   158,
         156,   156,   156,   154,   153,   151,   149,   148,   147,
         146,   145,   144,   144,   143,   143,   141,   138,   138,
         136,   136,   135,   134,   131,   131,   130,   129,   126,
         126,   126,   123,   122,   122,   120,   119,   119,   118,
         118,   114,   114,   112,   112,   108,   106,   105,   105,
         103,    99,    98,    98,    98,    95,    94,    94,    92,
          92,    91,    89,    88,    87,    84,    84,    84,    82,
          80,    77,    76,    75,    75,    72,    72,    72,    72,
          72,    71,    71,    69,    69,    69,    68,    68,    67,
          67,    67,    65,    64,    64,    61,    61,    60,    59,
          56,    56,    56,    55,    55,    55,    54,    53,    53,
```

```
52,  52,  52,  51,  51,  50,  49,  46,  44,
44,  42,  41,  41,  41,  40,  40,  39,  39,
39,  38,  37,  37,  36,  36,  36,  35,  35,
35,  35,  34,  33,  33,  33,  32,  32,  32,
32,  32,  31,  31,  30,  29,  29,  29,  29,
28,  28,  28,  27,  27,  27,  27,  25,  25,
25,  25,  24,  24,  24,  24,  24,  23,  23,
23,  23,  23,  22,  22,  22,  21,  20,  19,
19,  19,  18,  18,  18,  18,  17,  17,  16,
16,  16,  15,  15,  15,  14,  14,  14,  14,
14,  14,  14,  14,  14,  14,  13,  13,  13,
13,  13,  13,  12,  12,  12,  12,  12,  12,
11,  11,  11,  11,  10,  10,  10,  10,  10,
10,   9,   9,   9,   9,   9,   9,   9,   9,
 8,   8,   8,   8,   8,   8,   8,   8,   8,
 8,   8,   7,   7,   7,   7,   7,   7,   7,
 7,   7,   7,   7,   7,   7,   7,   7,   7,
 6,   6,   6,   6,   6,   6,   6,   6,   6,
 6,   6,   5,   5,   5,   5,   5,   5,   5,
 4,   4,   4,   4,   4,   4,   4,   4,   4,
 4,   4,   3,   3,   3,   3,   3,   3,   3,
 3,   3,   3,   3,   3,   3,   3,   3,   3,
 3,   3,   3,   3,   3,   3,   3,   2,   2,
 2,   2,   2,   2,   2,   2,   2,   2,   2,
 2,   2,   2,   2,   2,   2,   2,   2,   2,
 2,   2,   2,   1,   1,   1,   1,   1,   1,
 1,   1,   1,   1,   1,   1,   1,   1,   1,
 1,   1,   1,   1,   1,   1,   1,   1,   1,
 1,   1,   1,   1,   1,   1,   1,   1,   1,
 1,   1,   1,   1,   1,   1,   1,   1,   1,
 1,   1,   1])
```

In [ ]:
```
import seaborn as sns
```

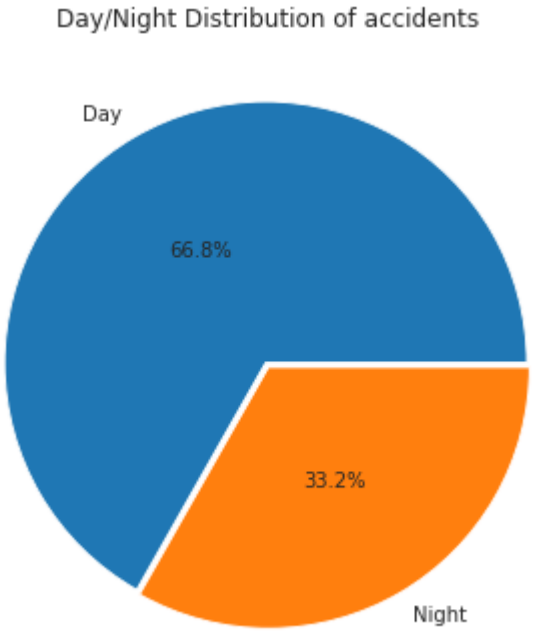
In [129]:
```
plt.figure(figsize=(10,5))
sns.scatterplot(x=temperature.index, y=temperature.values)
plt.show();
```



In [100]:
```
df.Sunrise_Sunset.value_counts()
```

Out[100]:
```
Day      1941068
Night     965432
Name: Sunrise_Sunset, dtype: int64
```

In [101]:
```
pie, ax = plt.subplots(figsize=[6,6])
labels = df.Sunrise_Sunset.value_counts().keys()
plt.pie(x=df.Sunrise_Sunset.value_counts(), autopct="%.1f%%", explode=[0.01
plt.title("Day/Night Distribution of accidents")
plt.show();
```



In [88]:
```
df.columns
```

Out[88]:
```
Index(['ID', 'Severity', 'Start_Time', 'End_Time', 'Start_Lat', 'Start_Ln
g',
       'End_Lat', 'End_Lng', 'Distance(mi)', 'Description', 'Number', 'Str
eet',
       'Side', 'City', 'County', 'State', 'Zipcode', 'Country', 'Timezon
e',
       'Airport_Code', 'Weather_Timestamp', 'Temperature(F)', 'Wind_Chill
(F)',
       'Humidity(%)', 'Pressure(in)', 'Visibility(mi)', 'Wind_Direction',
       'Wind_Speed(mph)', 'Precipitation(in)', 'Weather_Condition', 'Ameni
ty',
       'Bump', 'Crossing', 'Give_Way', 'Junction', 'No_Exit', 'Railway',
       'Roundabout', 'Station', 'Stop', 'Traffic_Calming', 'Traffic_Signa
l',
       'Turning_Loop', 'Sunrise_Sunset', 'Civil_Twilight', 'Nautical_Twili
ght',
       'Astronomical_Twilight'],
      dtype='object')
```

In [86]:
```
amenity = df.Amenity.groupby(df.Severity).value_counts()
amenity
```

Out[86]:
```
Severity  Amenity
1         False        28261
          True           490
2         False      2102046
          True         27217
3         False       627000
          True          2452
4         False       117933
          True          1211
Name: Amenity, dtype: int64
```

In [87]:
```
amenity.index
```

Out[87]:
```
MultiIndex([(1, False),
            (1,  True),
            (2, False),
            (2,  True),
            (3, False),
            (3,  True),
            (4, False),
            (4,  True)],
           names=['Severity', 'Amenity'])
```

In [89]:
```
no_exit = df.No_Exit.groupby(df.Severity).value_counts()
no_exit
```

Out[89]:
```
Severity  No_Exit
1         False        28631
          True           120
2         False      2126312
          True          2951
3         False       628809
          True           643
4         False       119000
          True           144
Name: No_Exit, dtype: int64
```

In [90]:
```
railway = df.Railway.groupby(df.Severity).value_counts()
railway
```

Out[90]:
```
Severity  Railway
1         False        28209
          True           542
2         False      2108779
          True         20484
3         False       625458
          True          3994
4         False       118237
          True           907
Name: Railway, dtype: int64
```

In [91]:
```
traffic_calming = df.Traffic_Calming.groupby(df.Severity).value_counts()
traffic_calming
```

Out[91]:
```
Severity  Traffic_Calming
1         False               28738
          True                   13
2         False             2128279
          True                  984
3         False              629186
          True                  266
4         False              119100
          True                   44
Name: Traffic_Calming, dtype: int64
```

In [92]:
```
stop = df.Stop.groupby(df.Severity).value_counts()
stop
```

Out[92]:
```
Severity  Stop
1         False      28251
          True         500
2         False    2088803
          True       40460
3         False     626761
          True        2691
4         False     117341
          True        1803
Name: Stop, dtype: int64
```

In [93]:
```
traffic_signal = df.Traffic_Signal.groupby(df.Severity).value_counts()
traffic_signal
```

Out[93]:
```
Severity  Traffic_Signal
1         False              16201
          True               12550
2         False            1742209
          True              387054
3         False              587341
          True               42111
4         False              107194
          True               11950
Name: Traffic_Signal, dtype: int64
```

In [94]:
```
give_way = df.Give_Way.groupby(df.Severity).value_counts()
give_way
```

Out[94]:
```
Severity  Give_Way
1         False         28658
          True             93
2         False       2122933
          True           6330
3         False        628086
          True           1366
4         False        118713
          True            431
Name: Give_Way, dtype: int64
```

In [95]:
```
bump = df.Bump.groupby(df.Severity).value_counts()
bump
```

Out[95]:
```
Severity  Bump
1         False      28741
          True          10
2         False    2128794
          True         469
3         False     629364
          True          88
4         False     119132
          True          12
Name: Bump, dtype: int64
```

In [96]:
```
crossing = df.Crossing.groupby(df.Severity).value_counts()
crossing
```

Out[96]:
```
Severity  Crossing
1         False         19673
          True           9078
2         False       1940027
          True         189236
3         False        614822
          True          14630
4         False        113159
          True           5985
Name: Crossing, dtype: int64
```

In [97]:
```
df.Turning_Loop.value_counts()
```

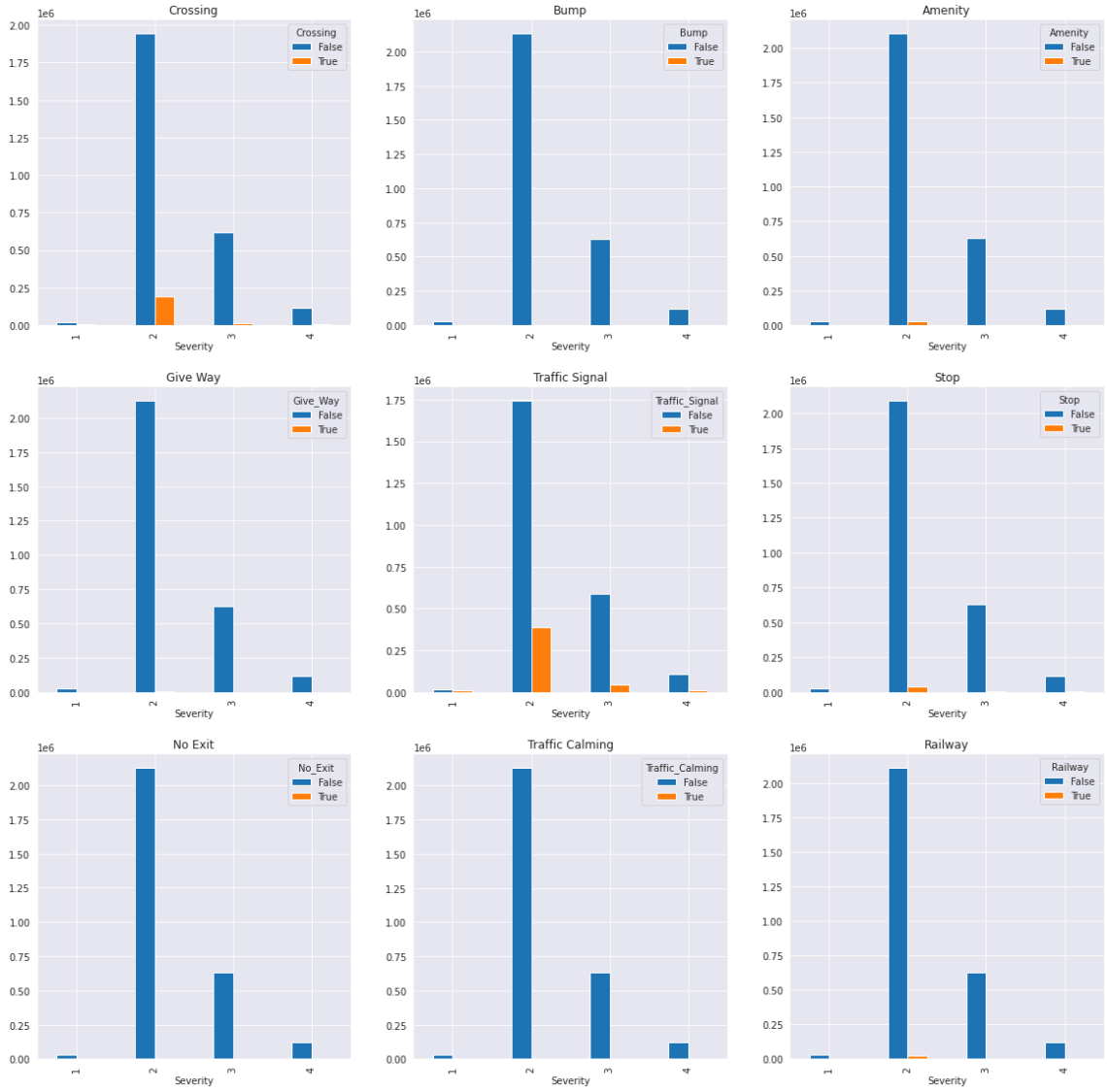
Out[97]:
```
False    2906610
Name: Turning_Loop, dtype: int64
```

Plotting all the values

In [99]:
```
fig, ax = plt.subplots(3,3, figsize=(20, 20))

crossing.unstack().plot(kind='bar', ax=ax[0,0], title="Crossing")
bump.unstack().plot(kind='bar', ax=ax[0,1], title="Bump")
amenity.unstack().plot(kind='bar', ax=ax[0,2], title="Amenity")
give_way.unstack().plot(kind='bar', ax=ax[1,0], title="Give Way")
traffic_signal.unstack().plot(kind='bar', ax=ax[1,1], title="Traffic Signal
stop.unstack().plot(kind='bar', ax=ax[1,2], title="Stop")
no_exit.unstack().plot(kind='bar', ax=ax[2,0], title="No Exit")
traffic_calming.unstack().plot(kind='bar', ax=ax[2,1], title="Traffic Calmi
railway.unstack().plot(kind='bar', ax=ax[2,2], title="Railway")
```

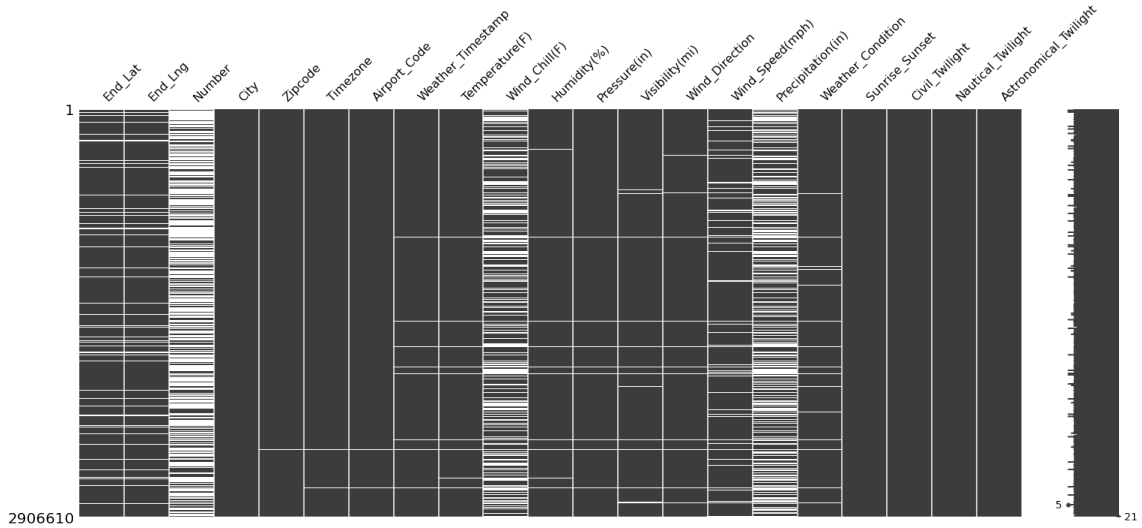
Out[99]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fd6ca355590>
```



In [16]:
```
null_cols = [i for i in data.columns if data[i].isnull().any()]
print(null_cols)
```

```
['End_Lat', 'End_Lng', 'Number', 'City', 'Zipcode', 'Timezone', 'Airport_C
ode', 'Weather_Timestamp', 'Temperature(F)', 'Wind_Chill(F)', 'Humidity
(%)', 'Pressure(in)', 'Visibility(mi)', 'Wind_Direction', 'Wind_Speed(mp
h)', 'Precipitation(in)', 'Weather_Condition', 'Sunrise_Sunset', 'Civil_Tw
ilight', 'Nautical_Twilight', 'Astronomical_Twilight']
```

In [17]:
```
mn.matrix(data[null_cols]);
```



In [19]:
```
new_data_a = data.drop(columns=["End_Lng", "End_Lat", "Number"], axis=0)
```

In [20]:
```
new_data_b = new_data_a.dropna(subset = ['Visibility(mi)','Weather_Conditio
```

In [21]:
```
new_data_b.isnull().sum()
```

Out[21]:
```
ID                          0
Severity                    0
Start_Time                  0
End_Time                    0
Start_Lat                   0
Start_Lng                   0
Distance(mi)                0
Description                 0
Street                      0
Side                        0
City                        0
County                      0
State                       0
Zipcode                     0
Country                     0
Timezone                    0
Airport_Code                0
Weather_Timestamp           0
Temperature(F)              0
Wind_Chill(F)         1090741
Humidity(%)                 0
Pressure(in)                0
Visibility(mi)              0
Wind_Direction              0
Wind_Speed(mph)        229916
Precipitation(in)     1228285
Weather_Condition           0
Amenity                     0
Bump                        0
Crossing                    0
Give_Way                    0
Junction                    0
No_Exit                     0
Railway                     0
Roundabout                  0
Station                     0
Stop                        0
Traffic_Calming             0
Traffic_Signal              0
Turning_Loop                0
Sunrise_Sunset              0
Civil_Twilight              0
Nautical_Twilight           0
Astronomical_Twilight       0
dtype: int64
```

In [22]:
```
final_data = new_data_b.drop(columns = 'ID', axis=0)
```

In [23]:
```
final_data.isnull().sum()
```

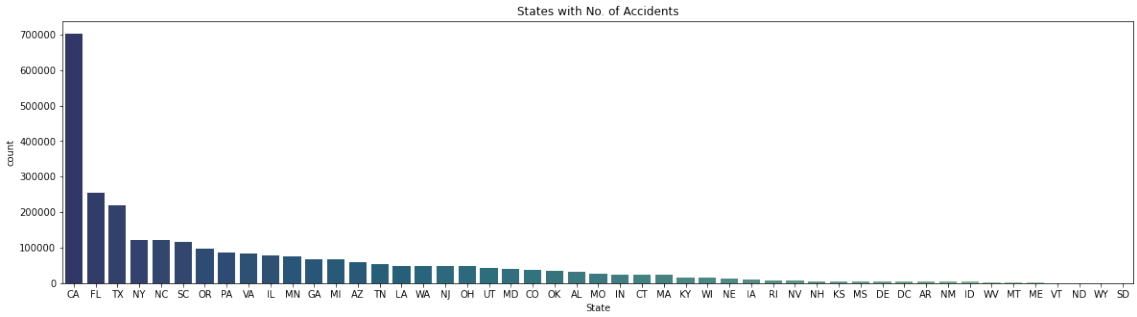
Out[23]:
```
Severity                    0
Start_Time                  0
End_Time                    0
Start_Lat                   0
Start_Lng                   0
Distance(mi)                0
Description                 0
Street                      0
Side                        0
City                        0
County                      0
State                       0
Zipcode                     0
Country                     0
Timezone                    0
Airport_Code                0
Weather_Timestamp           0
Temperature(F)              0
Wind_Chill(F)         1090741
Humidity(%)                 0
Pressure(in)                0
Visibility(mi)              0
Wind_Direction              0
Wind_Speed(mph)        229916
Precipitation(in)     1228285
Weather_Condition           0
Amenity                     0
Bump                        0
Crossing                    0
Give_Way                    0
Junction                    0
No_Exit                     0
Railway                     0
Roundabout                  0
Station                     0
Stop                        0
Traffic_Calming             0
Traffic_Signal              0
Turning_Loop                0
Sunrise_Sunset              0
Civil_Twilight              0
Nautical_Twilight           0
Astronomical_Twilight       0
dtype: int64
```

In [26]:
```
state_counts = final_data["State"].value_counts()
fig = go.Figure(data=go.Choropleth(locations=state_counts.index, z=state_co
fig.update_layout(title_text="Number of Accidents for each State", geo_scop
fig.show()
```

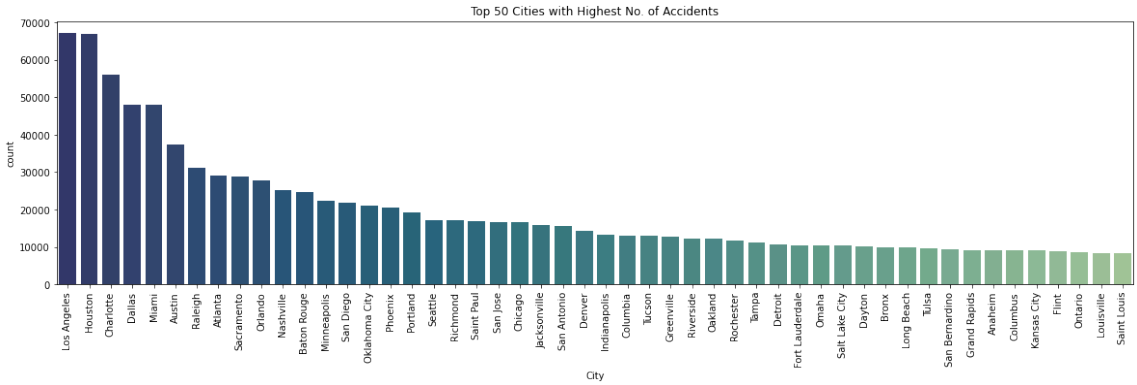
In [27]:
```
print("State Code: ", final_data.State.unique())
print("Total No. of State in Dataset: ", len(final_data.State.unique()))
```

```
State Code:  ['SC' 'NC' 'CA' 'NV' 'FL' 'CO' 'TN' 'NY' 'TX' 'AZ' 'NJ' 'MI'
'GA' 'VA'
 'IN' 'LA' 'PA' 'MN' 'OH' 'CT' 'IL' 'MD' 'MO' 'OR' 'NE' 'OK' 'UT' 'WA'
 'AL' 'WI' 'MA' 'DC' 'MS' 'KY' 'ME' 'IA' 'KS' 'WV' 'AR' 'ID' 'RI' 'WY'
 'NM' 'MT' 'NH' 'DE' 'ND' 'SD' 'VT']
Total No. of State in Dataset:  49
```

In [28]:
```
fig, ax = plt.subplots(figsize = (20,5))
c = sns.countplot(x="State", data=final_data, orient = 'v', palette = "cres
c.set_title("States with No. of Accidents");
```



In [30]:
```
fig, ax = plt.subplots(figsize = (20,5))
c = sns.countplot(x="City", data=final_data, order=final_data.City.value_co
c.set_title("Top 50 Cities with Highest No. of Accidents")
c.set_xticklabels(c.get_xticklabels(), rotation=90)
plt.show()
```

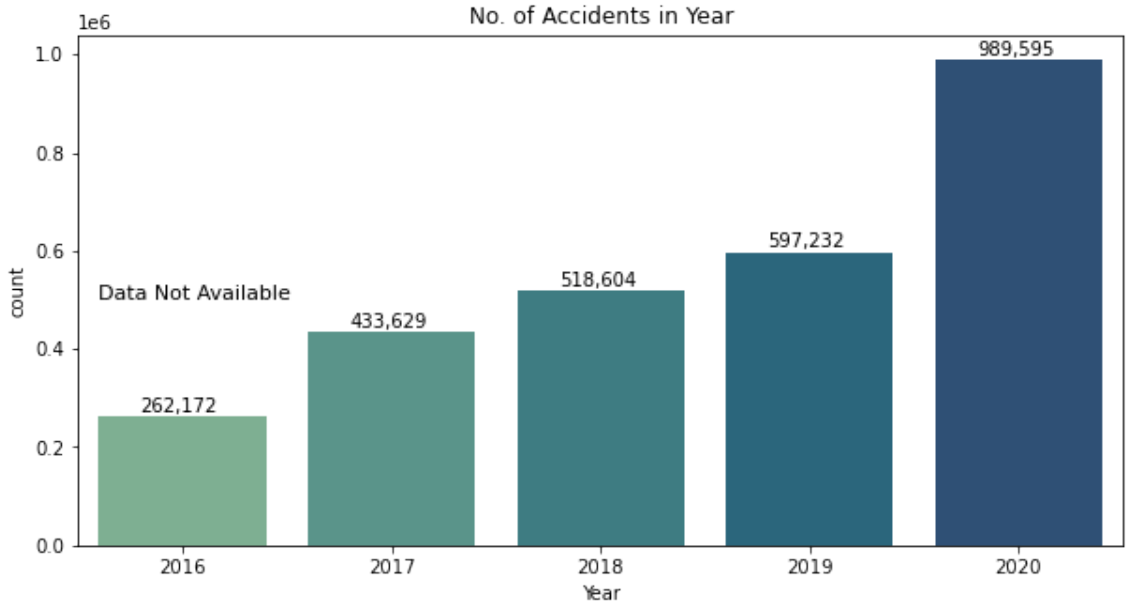


In [31]:
```
final_data.Start_Time = pd.to_datetime(final_data.Start_Time)
final_data.Start_Time[0]
```

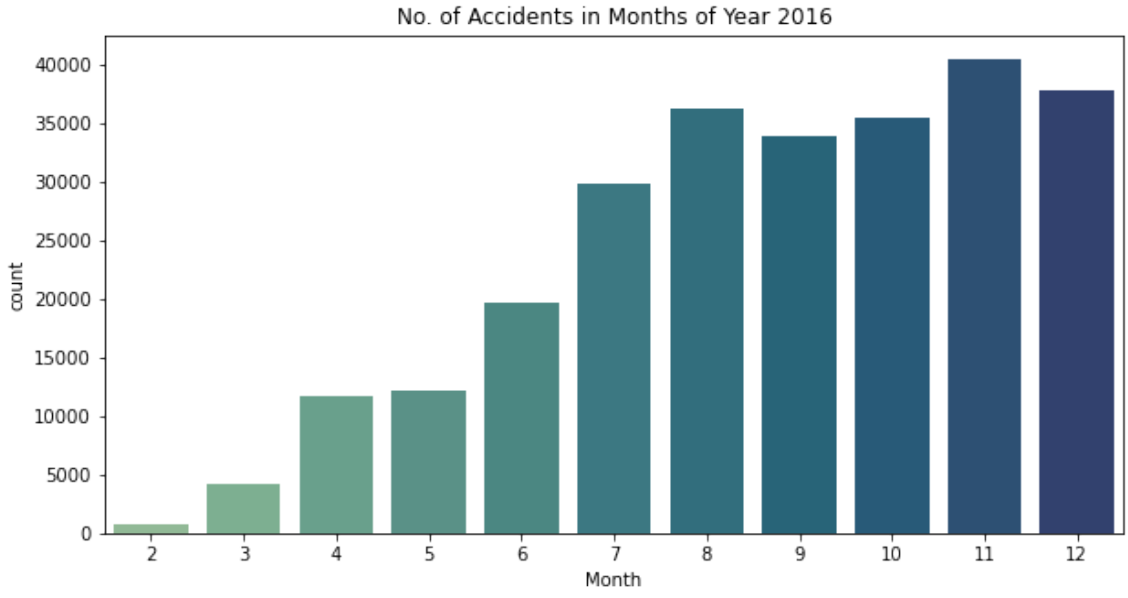
Out[31]:
```
Timestamp('2019-05-21 08:29:55')
```

In [32]:
```
final_data['Month'] = final_data['Start_Time'].dt.month
final_data['Year'] = final_data['Start_Time'].dt.year
final_data['Hour'] = final_data['Start_Time'].dt.hour
final_data['Weekday'] = final_data['Start_Time'].dt.weekday
#yearly data subset
data_2016 = final_data[final_data.Start_Time.dt.year == 2016]
data_2017 = final_data[final_data.Start_Time.dt.year == 2017]
data_2018 = final_data[final_data.Start_Time.dt.year == 2018]
data_2019 = final_data[final_data.Start_Time.dt.year == 2019]
data_2020 = final_data[final_data.Start_Time.dt.year == 2020]
data_2017_2019 = final_data[(final_data["Year"] >= 2017) & (final_data["Yea
```

In [33]:
```
fig, ax = plt.subplots(figsize = (10,5))
c = sns.countplot(x="Year", data=final_data, orient = 'v', palette = "crest
plt.annotate('Data Not Available',xy=(-0.4,500000), fontsize=11)
c.set_title("No. of Accidents in Year")
for i in ax.patches:
    count = '{:,.0f}'.format(i.get_height())
    x = i.get_x()+i.get_width()-0.60
    y = i.get_height()+10000
    ax.annotate(count, (x, y))
plt.show()
```



In [34]:
```
fig, ax = plt.subplots(figsize = (10,5))
c = sns.countplot(x="Month", data=data_2016, orient = 'v', palette = "crest
plt.annotate('Data Not Available',xy=(2,50000), fontsize=11)
c.set_title("No. of Accidents in Months of Year 2016")
plt.show()
```



In [34]:
```
fig, ax = plt.subplots(figsize = (10,5))
c = sns.countplot(x="Month", data=data_2016, orient = 'v', palette = "crest
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plt.show()
```

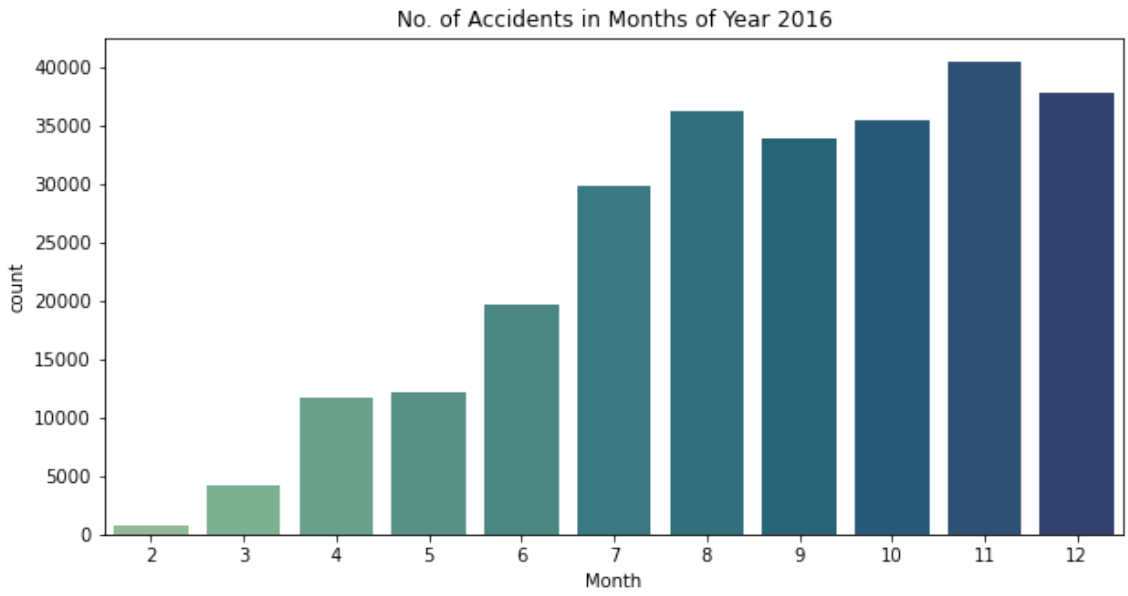

In [36]:
```
fig, ax = plt.subplots(figsize = (10,5))
c = sns.countplot(x="Month", data=data_2020, orient = 'v', palette = "crest
plt.annotate('Covid-19 Pandemic',xy=(2,150000), fontsize=12)
plt.annotate("[",xy=(0,0),xytext=(1.9,150000),arrowprops={'arrowstyle':'-|>
plt.annotate("]",xy=(10,0),xytext=(4.5,150000),arrowprops={'arrowstyle':'-|
c.set_title("No. of Accidents in Month of Year 2020")
plt.show()
```