Imports

In [ ]:
```
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns
```

Reading data

In [ ]:
```
data_path = "../data/lab_2/car_crashes.xlsx"
```

In [ ]:
```
df = pd.read_excel(data_path)
df
```

Out[ ]:

	ID	Source	TMC	Severity	Start_Time	End_Time	Distance(mi)	Description	Street	Side	...	N
0	A-1	MapQuest	201.0	3	2016-02-08 05:46:00	2016-02-08 11:00:00	0.01	Right lane blocked due to accident on I-70 Eas...	I-70 E	R	...	
1	A-2	MapQuest	201.0	2	2016-02-08 06:07:59	2016-02-08 06:37:59	0.01	Accident on Brice Rd at Tussing Rd. Expect del...	Brice Rd	L	...	
2	A-3	MapQuest	201.0	2	2016-02-08 06:49:27	2016-02-08 07:19:27	0.01	Accident on OH-32 State Route 32 Westbound at ...	State Route 32	R	...	
3	A-4	MapQuest	201.0	3	2016-02-08 07:23:34	2016-02-08 07:53:34	0.01	Accident on I-75 Southbound at Exits 52 52B US...	I-75 S	R	...	
4	A-5	MapQuest	201.0	2	2016-02-08 07:39:07	2016-02-08 08:09:07	0.01	Accident on McEwen Rd at OH-725 Miamisburg Cen...	Miamisburg Centerville Rd	R	...	
...	...	...	...	...	...	...	...	...	...	...	...	
4995	A-4996	MapQuest	201.0	2	2016-08-01 11:35:41	2016-08-01 12:05:41	0.00	Accident on Cold Springs Rd at Middletown Rd.	Cold Springs Rd	R	...	
4996	A-4997	MapQuest	201.0	2	2016-08-01 11:41:23	2016-08-01 12:26:23	0.00	Accident on Travis Blvd at Holiday Ln.	Travis Blvd	R	...	
4997	A-4998	MapQuest	201.0	2	2016-08-01 11:57:27	2016-08-01 12:42:27	0.00	Accident on River Rd at Orchard Rd.	River Rd	L	...	
4998	A-4999	MapQuest	201.0	2	2016-08-01 12:00:54	2016-08-01 12:30:54	0.00	Accident on Marconi Ave at Bell St.	Bell St	R	...	

	ID	Source	TMC	Severity	Start_Time	End_Time	Distance(mi)	Description	Street	Side	...	N
4999	A-5000	MapQuest	201.0	2	2016-08-01 11:59:44	2016-08-01 12:29:44	0.00	Accident on Madison Ave Westbound at I-80.	I-80 W	R	...	

5000 rows × 37 columns

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

Out[ ]:
```
Index(['ID', 'Source', 'TMC', 'Severity', 'Start_Time', 'End_Time',
       'Distance(mi)', 'Description', 'Street', 'Side', 'City', 'State',
       'Zipcode', 'Weather_Timestamp', 'Temperature(F)', 'Wind_Chill(F)',
       'Humidity(%)', 'Pressure(in)', 'Visibility(mi)', 'Wind_Direction',
       'Wind_Speed(mph)', 'Precipitation(in)', 'Weather_Condition', 'Bump',
       'Crossing', 'Give_Way', 'Junction', 'No_Exit', 'Railway', 'Roundabout',
       'Station', 'Stop', 'Traffic_Calming', 'Traffic_Signal', 'Turning_Loop',
       'Sunrise_Sunset', 'Civil_Twilight'],
      dtype='object')
```

Data types:

Nominal:

ID, Source, Description, Street, City, State, Zipcode, Wind_Direction, Weather_Condition

Binary:

Side, Bump, Crossing, Give_Way, Junction, No_Exit, Railway, Roundabout, Station, Stop, Traffic_Calming, Traffic_Signal, Turning_Loop, Sunrise_Sunset, Civil_Twilight

Ordinal:

Severity

Discrete:

TMC

Continuous:

Start_Time, End_Time, Distance(mi), Weather_Timestamp, Temperature(F), Wind_Chill(F), Humidity(%), Pressure(in), Visibility(mi), Wind_Speed(mph), Precipitation(in)

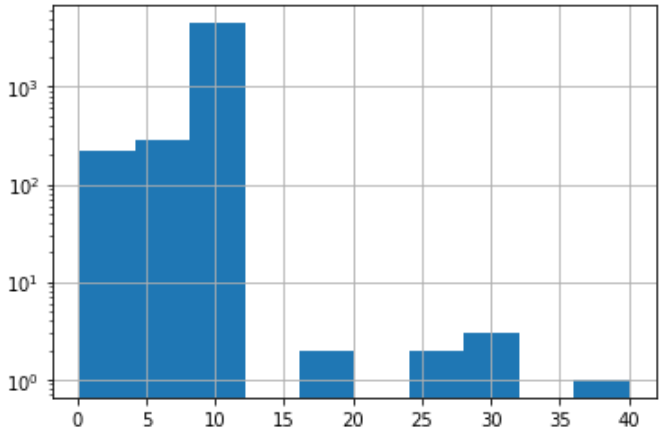
Visibility

In [ ]:
```
visibility = df.loc[:, "Visibility(mi)"].dropna()
visibility.describe()
```

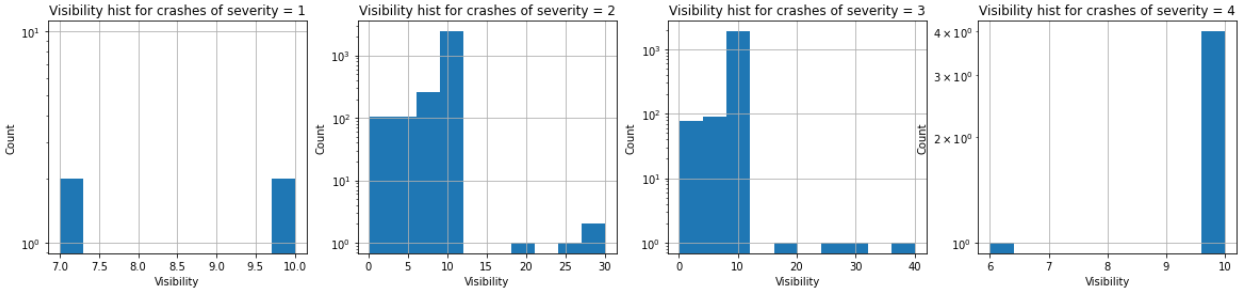
Out[ ]:
```
count    4958.000000
mean        9.465611
std         1.886629
min         0.200000
25%        10.000000
50%        10.000000
75%        10.000000
max        40.000000
Name: Visibility(mi), dtype: float64
```

In [ ]:
```
visibility.hist(log=True)
```

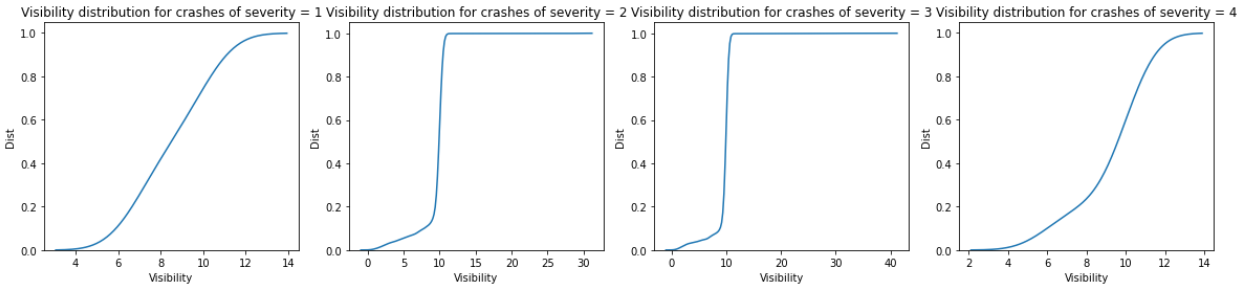
Out[ ]:
```
<AxesSubplot:>
```



In [ ]:
```
fig, axs = plt.subplots(1, 4)
fig.set_size_inches(20,4)
for i in range(4):
    axs[i].set_xlabel("Visibility")
    axs[i].set_ylabel("Count")
    axs[i].set_title(f"Visibility hist for crashes of severity = {i + 1}")
    df.loc[df.Severity == i + 1,"Visibility(mi)"].dropna().hist(ax=axs[i], log=True)
```



In [ ]:
```
fig, axs = plt.subplots(1, 4)
fig.set_size_inches(20,4)
for i in range(4):
    axs[i].set_xlabel("Visibility")
    axs[i].set_ylabel("Dist")
    axs[i].set_title(f"Visibility distribution for crashes of severity = {i + 1}")
    sns.kdeplot(df.loc[df.Severity == i + 1,"Visibility(mi)"].dropna(),
                ax=axs[i], cumulative=True)
```



Temperature

In [ ]:
```
temperature = df.loc[:, "Temperature(F)"]
temperature.describe()
```

Out[ ]:
```
count    4978.000000
mean       69.849900
std        18.308741
min         3.900000
25%        60.800000
50%        71.100000
75%        82.400000
```

```
max       106.000000
Name: Temperature(F), dtype: float64
```

Variation series

In [ ]:
```
var_series = sorted(temperature)
var_series[:15]
```

Out[ ]:
```
[3.9,
 5.0,
 6.1,
 7.0,
 7.0,
 7.0,
 7.5,
 7.5,
 8.1,
 9.0,
 10.0,
 10.0,
 10.4,
 10.9,
 10.9]
```

Statistical series

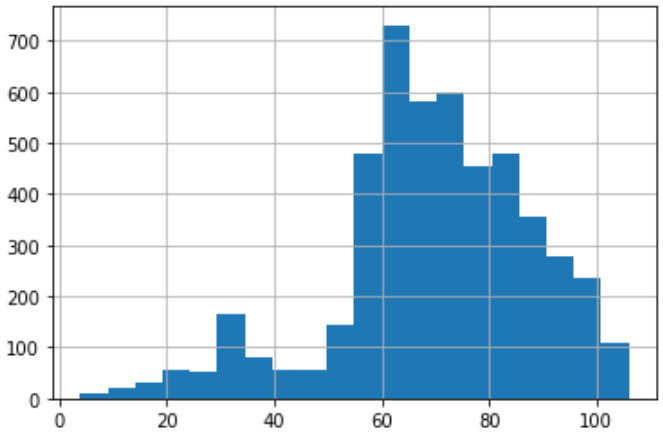
In [ ]:
```
stat_series = temperature.value_counts().sort_index()
stat_series
```

Out[ ]:
```
3.9       1
5.0       1
6.1       1
7.0       3
7.5       2
         ..
102.6     1
102.9    14
103.6     1
104.0    24
106.0     2
Name: Temperature(F), Length: 238, dtype: int64
```

Grouped statistical series

In [ ]:
```
temperature.hist(bins=20)
```

Out[ ]:
```
<AxesSubplot:>
```



Highest number of accidents

In [ ]:
```
most_accident_cities = df.City.value_counts(sort=True)[:5]
most_accident_cities
```

Out[ ]:
```
Sacramento    555
Dayton        321
San Jose      251
Columbus      170
Oakland       158
Name: City, dtype: int64
```

Road distance distributions in listed cities

In [ ]:
```python
fig, axs = plt.subplots(1, 5)
fig.set_size_inches(25,4)
for i in range(5):
    axs[i].set_xlabel("Distance")
    axs[i].set_ylabel("Dist")
    axs[i].set_title(f"Distance distribution for crashes in {most_accident_cities.index[i]}")
    sns.kdeplot(df.loc[df.City == most_accident_cities.index[i], "Distance(mi)"],
                ax=axs[i], cumulative=True)
```

```
/mnt/f/Code/linux-home/miniconda3/envs/vscode_py38/lib/python3.8/site-packages/seaborn/distribu
tions.py:316: UserWarning: Dataset has 0 variance; skipping density estimate. Pass `warn_singul
ar=False` to disable this warning.
  warnings.warn(msg, UserWarning)
/mnt/f/Code/linux-home/miniconda3/envs/vscode_py38/lib/python3.8/site-packages/seaborn/distribu
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  warnings.warn(msg, UserWarning)
/mnt/f/Code/linux-home/miniconda3/envs/vscode_py38/lib/python3.8/site-packages/seaborn/distribu
tions.py:316: UserWarning: Dataset has 0 variance; skipping density estimate. Pass `warn_singul
ar=False` to disable this warning.
  warnings.warn(msg, UserWarning)
```

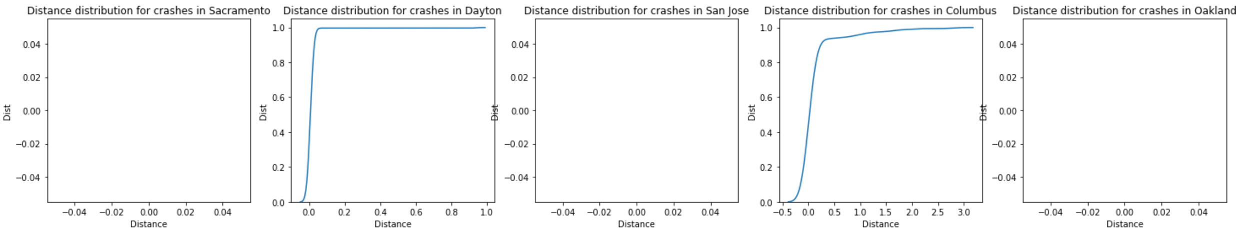

In [ ]: