Data Loading and Cleaning

```
CHUNK_SIZE = 40960
DATA_SOURCE_MAPPING = 'pakistan-traffic-accident-dataset:https%3A%2F
%2Fstorage.googleapis.com%2Fkaggle-data-sets
%2F1405690%2F2328706%2Fbundle%2Farchive.zip%3FX-Goog-Algorithm
%3DGOOG4-RSA-SHA256%26X-Goog-Credential%3Dgcp-kaggle-com%2540kaggle-
161607.iam.gserviceaccount.com%252F20240719%252Fauto%252Fstorage
%252Fgoog4_request%26X-Goog-Date%3D20240719T175652Z%26X-Goog-Expires
%3D259200%26X-Goog-SignedHeaders%3Dhost%26X-Goog-Signature
%3D3c6d9caf3c4e1215c5cf4a2c940edb2573a85b4774508d847f88505d8726435b73a
4658eb85f66c4b57be73a3c0b67aca294c91edf5956c08621a05a7ffe97fe23468628c
fa1a31e10a76be5739af75e00f0484ac01f12fd0dc8fc86d6da2ee5d0888c230980c2e
06152f7bbbcf744abe9fafd66759e1d15e4b03ecaf2f40fe84d5d6091d30c9e10c0c64
c62dc975384694742f6aeee730cabedcb82de88184a8f310f04b97bc35e2c8a6222bd4
21c33f3f72324a755a4086b952fd50341bdd8d098dddc6e5d05b453098f1ee10b1b44e
68a4b41cc9fd360088af41bd7cbe0dd7ea4f3d9984eaef6d79d1a4b14ab3b372a2ff6f
bd513acaf4741ea07e2418a32'

KAGGLE_INPUT_PATH='/kaggle/input'
KAGGLE_WORKING_PATH='/kaggle/working'
KAGGLE_SYMLINK='kaggle'

!umount /kaggle/input/ 2> /dev/null
shutil.rmtree('/kaggle/input', ignore_errors=True)
os.makedirs(KAGGLE_INPUT_PATH, 0o777, exist_ok=True)
os.makedirs(KAGGLE_WORKING_PATH, 0o777, exist_ok=True)

try:
  os.symlink(KAGGLE_INPUT_PATH, os.path.join("..", 'input'),
target_is_directory=True)
except FileExistsError:
  pass
try:
  os.symlink(KAGGLE_WORKING_PATH, os.path.join("..", 'working'),
target_is_directory=True)
except FileExistsError:
  pass

for data_source_mapping in DATA_SOURCE_MAPPING.split(','):
    directory, download_url_encoded = data_source_mapping.split(':')
    download_url = unquote(download_url_encoded)
    filename = urlparse(download_url).path
    destination_path = os.path.join(KAGGLE_INPUT_PATH, directory)
    try:
        with urlopen(download_url) as fileres, NamedTemporaryFile() as
tfile:
            total_length = fileres.headers['content-length']
```

```
            print(f'Downloading {directory}, {total_length} bytes
compressed')
            dl = 0
            data = fileres.read(CHUNK_SIZE)
            while len(data) > 0:
                dl += len(data)
                tfile.write(data)
                done = int(50 * dl / int(total_length))
                sys.stdout.write(f"\r[{'=' * done}{' ' * (50-done)}]
{dl} bytes downloaded")
                sys.stdout.flush()
                data = fileres.read(CHUNK_SIZE)
            if filename.endswith('.zip'):
              with ZipFile(tfile) as zfile:
                zfile.extractall(destination_path)
            else:
              with tarfile.open(tfile.name) as tarfile:
                tarfile.extractall(destination_path)
            print(f'\nDownloaded and uncompressed: {directory}')
    except HTTPError as e:
        print(f'Failed to load (likely expired) {download_url} to path
{destination_path}')
        continue
    except OSError as e:
        print(f'Failed to load {download_url} to path
{destination_path}')
        continue

print('Data source import complete.')
```

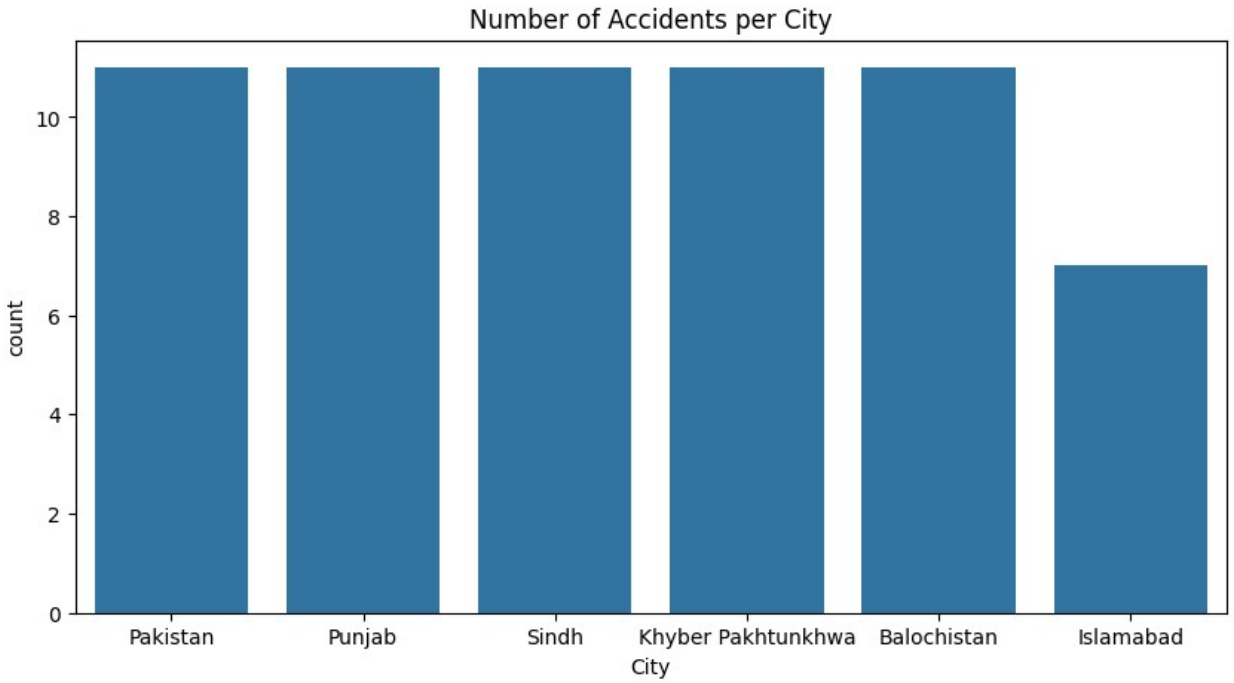
```
Downloading pakistan-traffic-accident-dataset, 1502 bytes compressed
 [==================================================] 1502 bytes
downloaded
Downloaded and uncompressed: pakistan-traffic-accident-dataset
Data source import complete.
```

```
import os
import sys
from tempfile import NamedTemporaryFile
from urllib.request import urlopen
from urllib.parse import unquote, urlparse
from urllib.error import HTTPError
from zipfile import ZipFile
import tarfile
import shutil
import numpy as np
import pandas as pd
import seaborn as sns
from matplotlib import pyplot as plt
import plotly.express as px
```

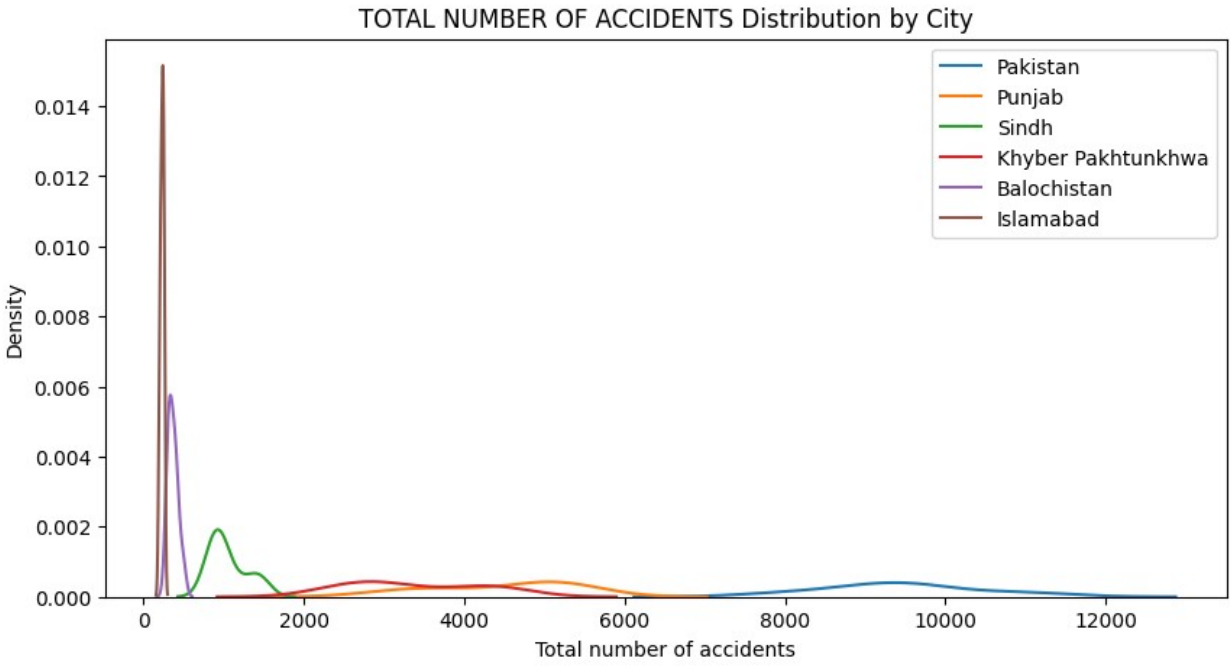
```
# Load and clean data
df =
pd.read_csv('/kaggle/input/pakistan-traffic-accident-dataset/traffic-
accidents-annual-.csv')
df = df[1:]
df.columns = ["City", "Year", "Total number of accidents", "Fatal
Accidents", "Non-Fatal Accidents",
            "Killed", "Injured", "Total number of vehicles involved"]

np.random.seed(0)
df['Road_Conditions'] = np.random.choice(['Dry', 'Wet', 'Snowy',
'Icy'], size=len(df))
df['Weather'] = np.random.choice(['Clear', 'Rain', 'Snow', 'Fog'],
size=len(df))
df['Time_of_Day'] = np.random.choice(['Morning', 'Afternoon',
'Evening', 'Night'], size=len(df))

# Convert columns to numeric types
df["Year"] = df["Year"].astype(str).str[:4].astype(int)
df["Total number of accidents"] = pd.to_numeric(df["Total number of
accidents"])
df["Fatal Accidents"] = pd.to_numeric(df["Fatal Accidents"])
df["Non-Fatal Accidents"] = pd.to_numeric(df["Non-Fatal Accidents"])
df["Killed"] = pd.to_numeric(df["Killed"])
df["Injured"] = pd.to_numeric(df["Injured"])
df["Total number of vehicles involved"] = pd.to_numeric(df["Total
number of vehicles involved"])

# Calculate fatal rate
df["Fatal rate"] = df["Fatal Accidents"] / df["Total number of
accidents"]
```

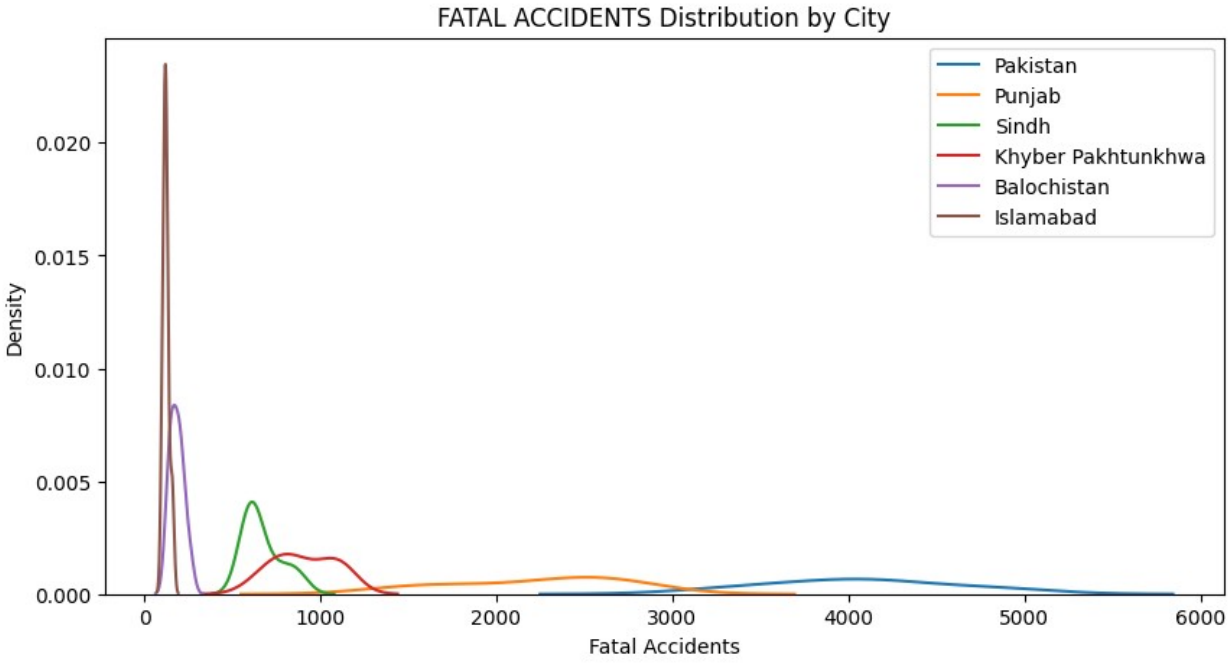
Exploratory Data Analysis

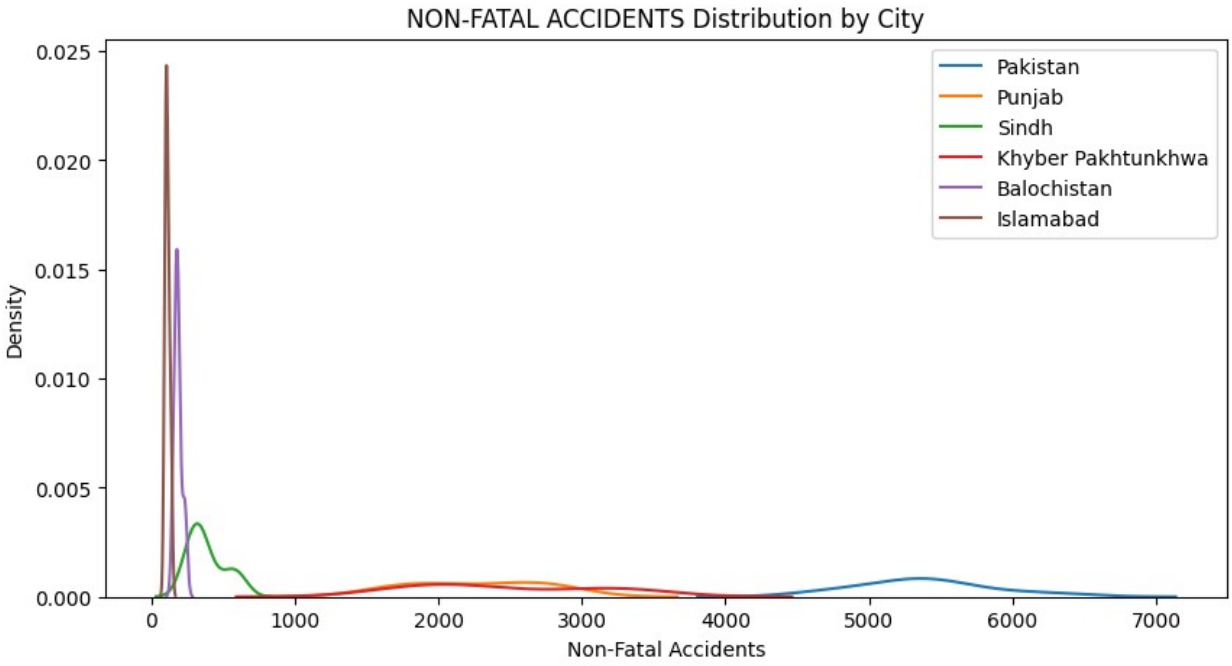
```
# Exploratory Data Analysis
plt.figure(figsize=(10,5))
sns.countplot(data=df, x="City")
plt.title('Number of Accidents per City')
plt.show()
```

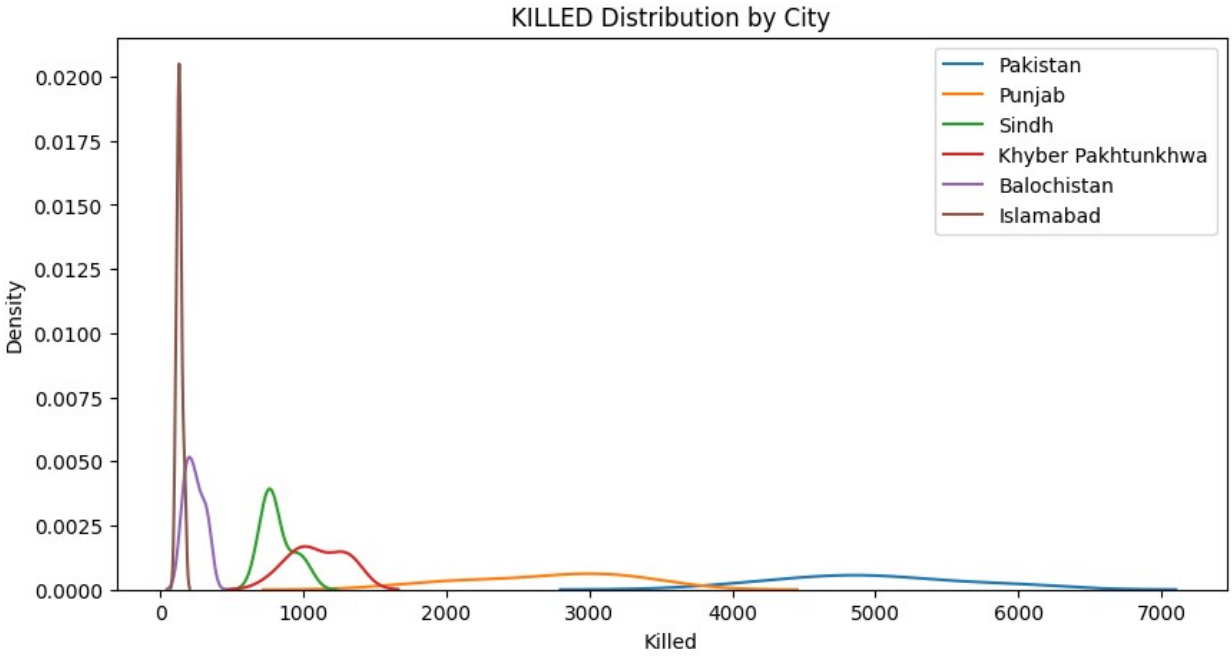


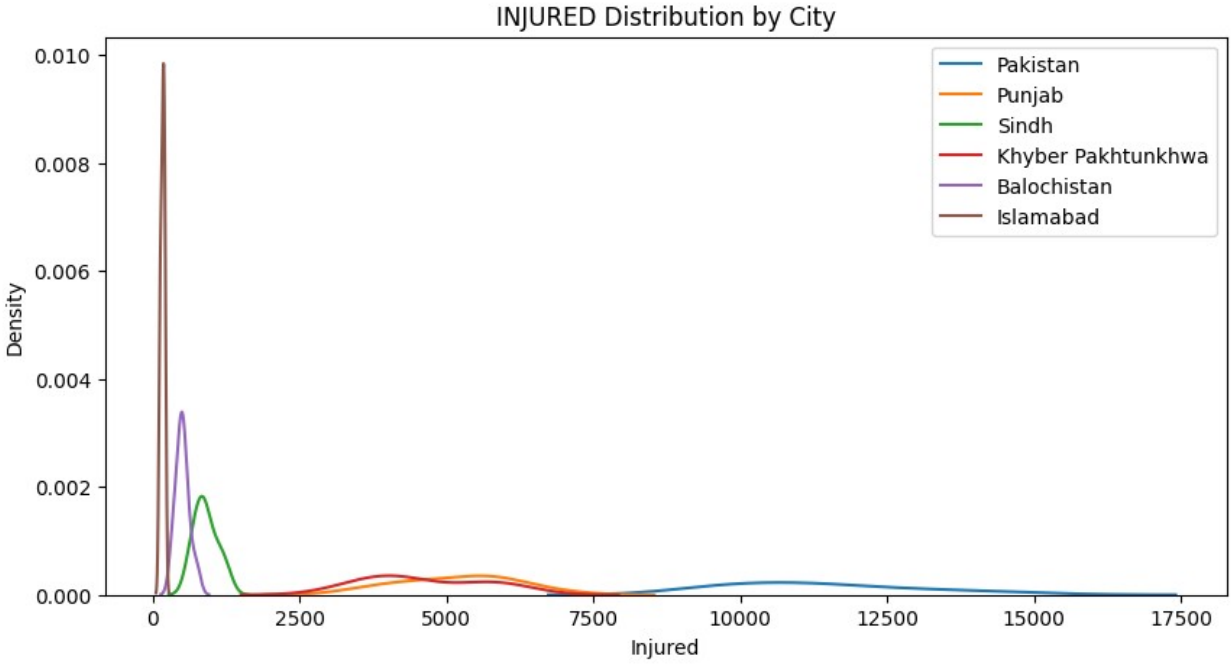

```
# KDE Plots for different features by city
features = ["Total number of accidents", "Fatal Accidents", "Non-Fatal
Accidents", "Killed", "Injured", "Total number of vehicles involved",
"Fatal rate"]
for feature in features:
    plt.figure(figsize=(10,5))
    for c in df.City.unique():
        sns.kdeplot(df[df["City"]==c][feature], label=c)
    plt.legend()
    plt.title(f'{feature.upper()} Distribution by City')
    plt.show()
```

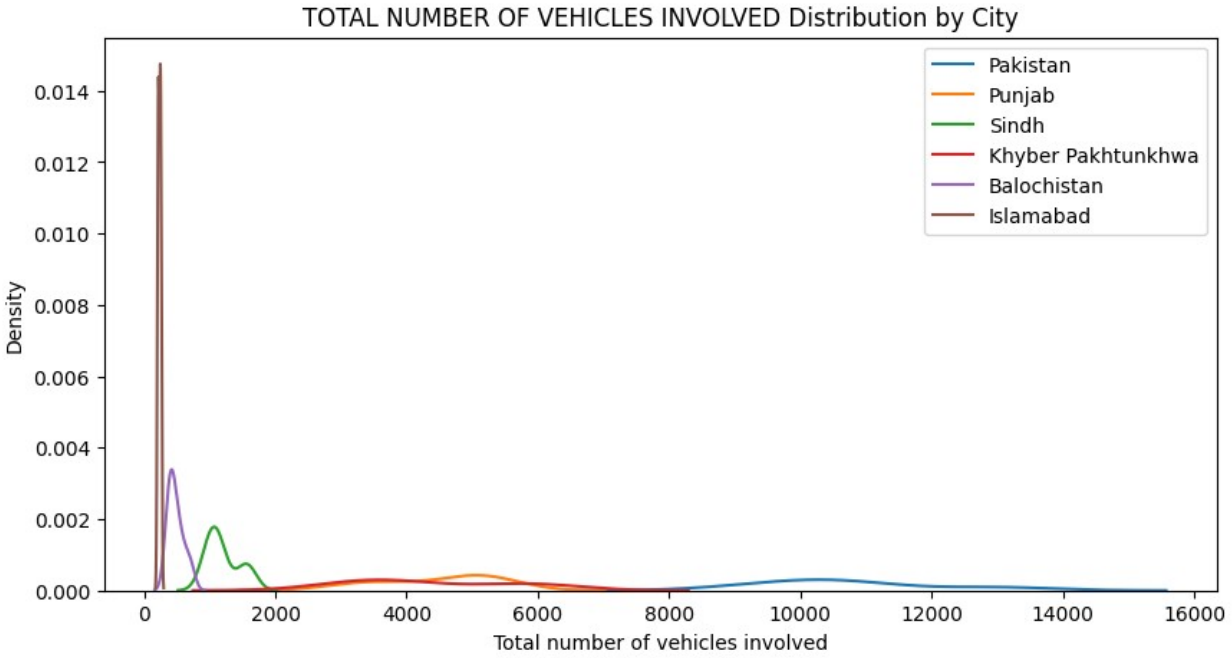

TOTAL NUMBER OF ACCIDENTS Distribution by City
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
Density
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
2000
4000
6000
8000
10000
12000
Total number of accidents

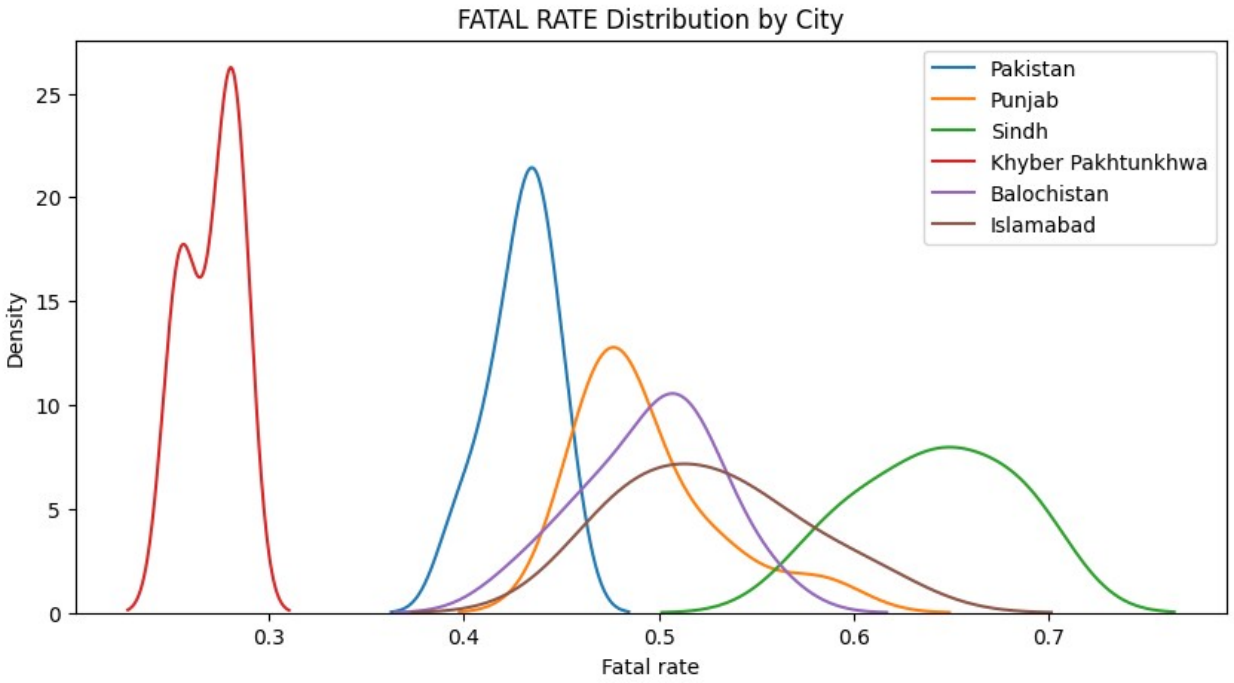

FATAL ACCIDENTS Distribution by City
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
Density
0.020
0.015
0.010
0.005
0.000
0
1000
2000
3000
4000
5000
6000
Fatal Accidents


NON-FATAL ACCIDENTS Distribution by City
Density
Non-Fatal Accidents
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
0.025
0.020
0.015
0.010
0.005
0.000
0
1000
2000
3000
4000
5000
6000
7000


KILLED Distribution by City
Density
Killed
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0
1000
2000
3000
4000
5000
6000
7000

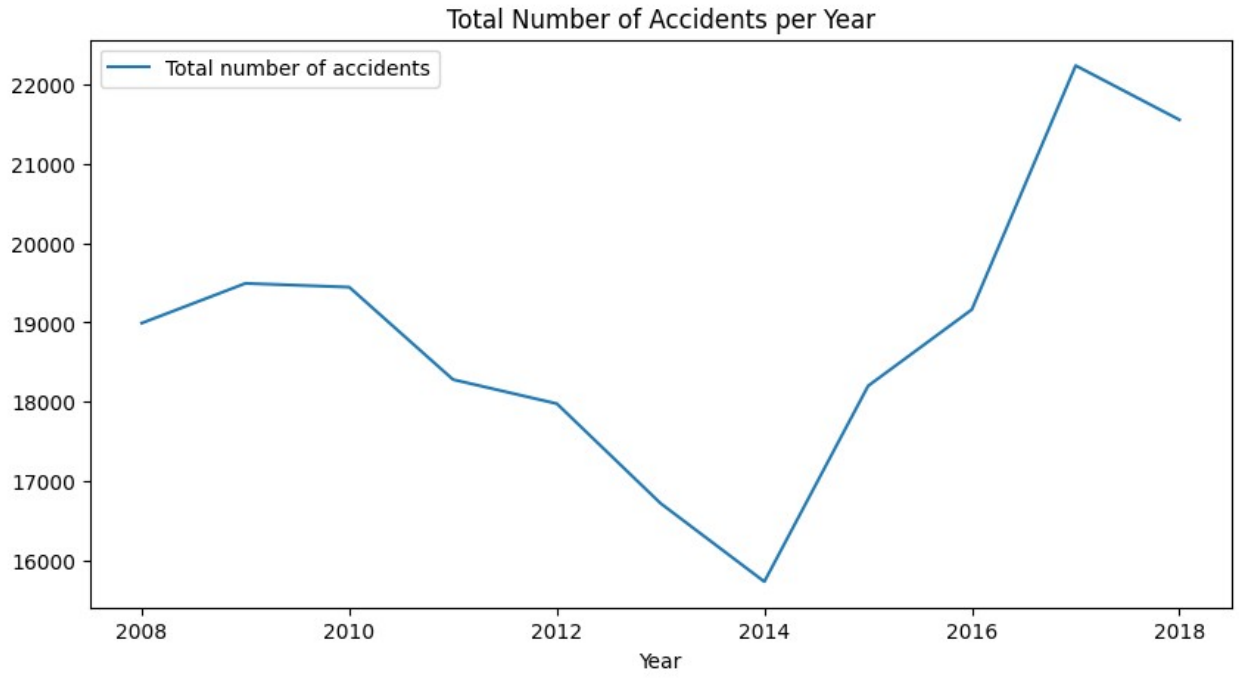

INJURED Distribution by City
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
Density
0.010
0.008
0.006
0.004
0.002
0.000
0
2500
5000
7500
10000
12500
15000
17500
Injured


TOTAL NUMBER OF VEHICLES INVOLVED Distribution by City
Pakistan
Punjab
Sindh
Khyber Pakhtunkhwa
Balochistan
Islamabad
Density
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
2000
4000
6000
8000
10000
12000
14000
16000
Total number of vehicles involved

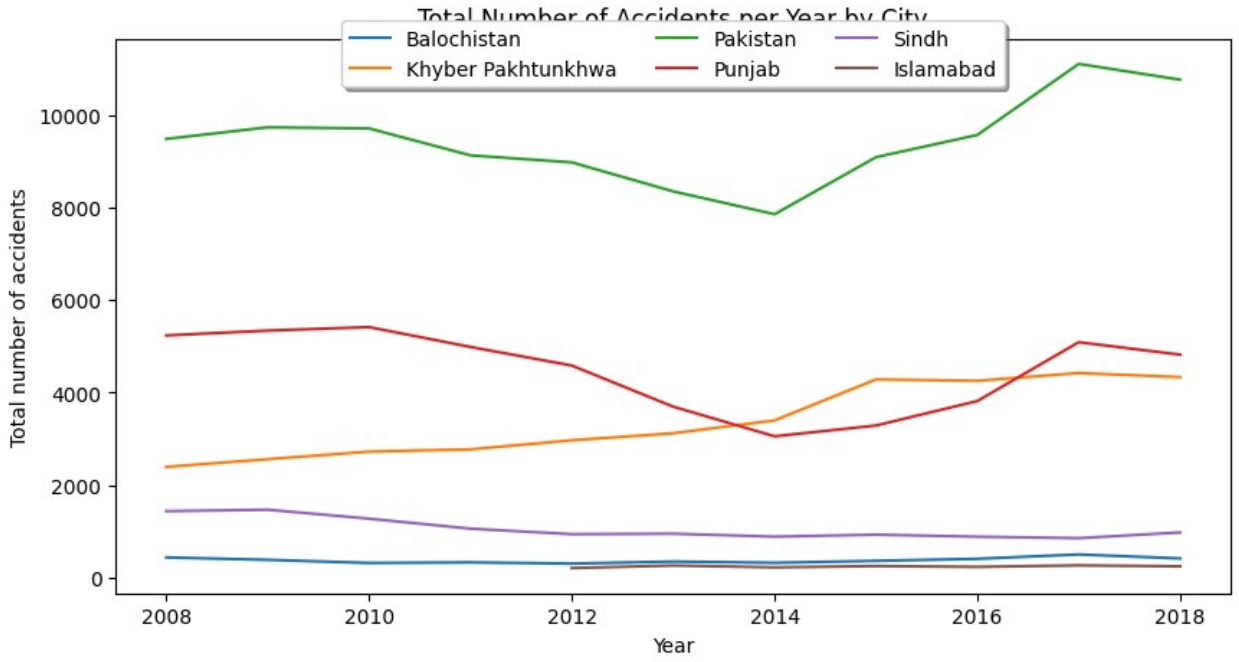


Analyzing and Visualizing

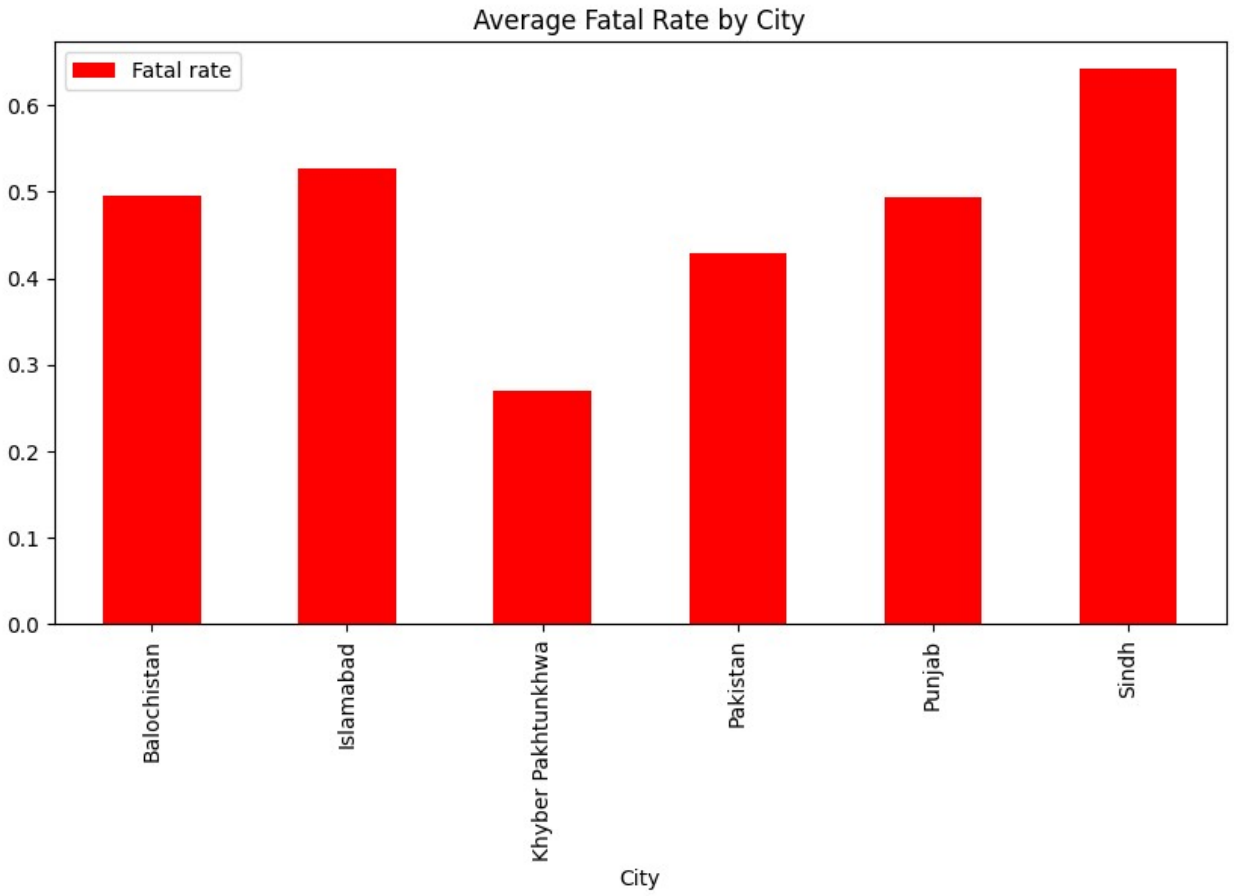
```
# Yearly trends
df.groupby("Year")["Total number of
accidents"].sum().reset_index().set_index("Year").plot(figsize=(10,
5))
plt.title('Total Number of Accidents per Year')
plt.show()
```



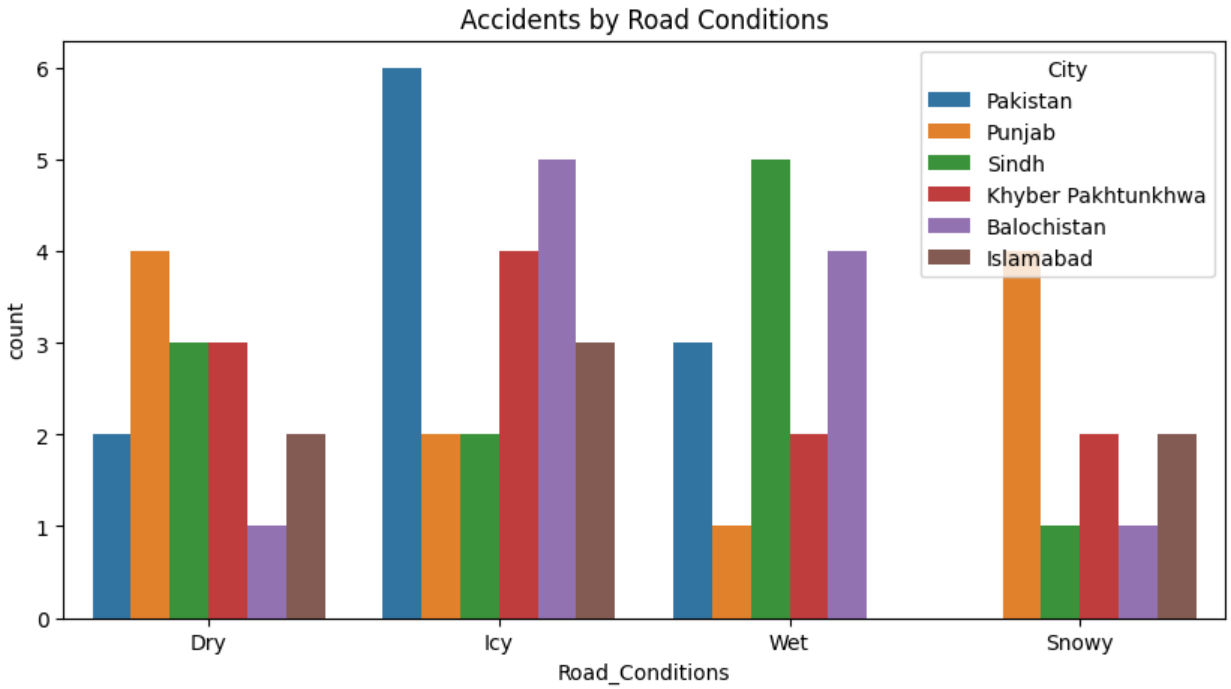

```
# Accident trends by city over the years
ax = df.groupby(["Year", "City"])["Total number of
accidents"].sum().reset_index().set_index("Year")
plt.figure(figsize=(10,5))
sns.lineplot(data=ax, x="Year", y="Total number of accidents",
hue="City")
plt.legend(loc='upper center', bbox_to_anchor=(0.5, 1.05), ncol=3,
fancybox=True, shadow=True)
plt.title('Total Number of Accidents per Year by City')
plt.show()
```



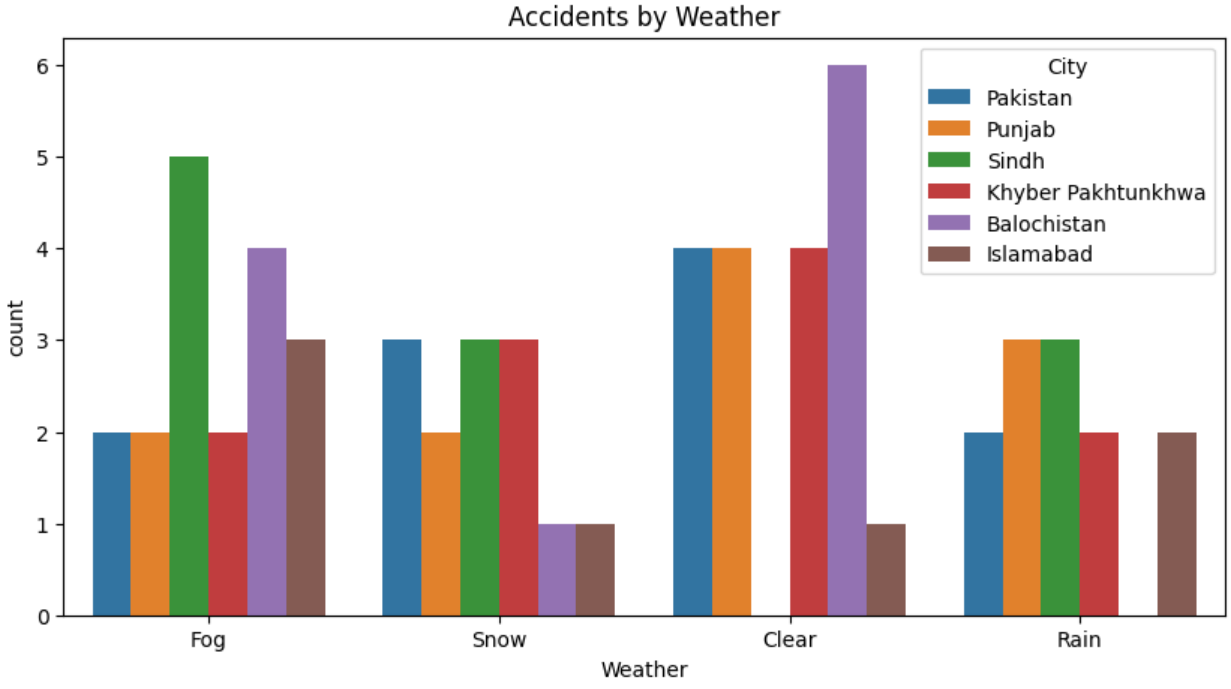

```
# Visualizing Fatal rate
df.groupby("City")["Fatal
rate"].mean().reset_index().set_index("City").plot(kind='bar',
figsize=(10, 5), color='red')
plt.title('Average Fatal Rate by City')
plt.show()
```




```
# Analysis of contributing factors
plt.figure(figsize=(10,5))
sns.countplot(data=df, x="Road_Conditions", hue="City")
plt.title('Accidents by Road Conditions')
plt.show()
```




```
plt.figure(figsize=(10,5))
sns.countplot(data=df, x="Weather", hue="City")
plt.title('Accidents by Weather')
plt.show()
```



```
plt.figure(figsize=(10,5))
sns.countplot(data=df, x="Time_of_Day", hue="City")
plt.title('Accidents by Time of Day')
plt.show()
```