```
import pandas as pd
import numpy as np
from statistics import quantiles

def getQuartiles(data):
  quartiles = quantiles(data, n=4) # n=4 for quartiles, n=10 for deciles, n=100 for percent
  return quartiles

filepath = '/content/asteroidData.csv'
data = pd.read_csv(filepath)

# Changing the column names of the dataset for better clarity of data presentation.
data.rename(columns={'neo': 'NEO'}, inplace=True) # Stands for Near-Earth Objects.
data.rename(columns={'diameter': 'Diameter'}, inplace=True)
data.rename(columns={'eccentricity': 'Eccentricity'}, inplace=True) # Unitless measure of c
data.rename(columns={'semiMajorAxis': 'Semi-Major Axis'}, inplace=True) # Average orbital d
data.rename(columns={'perihelionDistance': 'Perihelion Distance'}, inplace=True) # Closeest
data.rename(columns={'inclination': 'Inclination'}, inplace=True) # Angle between orbit and
data.rename(columns={'period': 'Period'}, inplace=True) # Orbital Period (one full revoluti

county = data['NEO'].value_counts().get('Y', 0)
countn = data['NEO'].value_counts().get('N', 0)

# Exploratory Data Analysis using Descriptive Statistics, with Measures of Central Tendency

print("ASTEROID ORBITAL ELEMENTS & NEAR-EARTH OBJECT TAGGING DATASET")
print("Variables Considered: NEO, Eccentricity, S-M Axis, Perihelion Distance, Inclination,
print("Number of Recorded NEOs:", len(data), "Records Found")
print(f"Number of Verified NEOs (Y): {county}")
print(f"Number of Unverified NEOs (N): {countn}")
print("\nGeneral Data Regarding Near-Earth Objects (NEOs):")
print("Mean Diameter of NEOs:", np.mean(data['Diameter']), "kms.")
print("Median Diameter of NEOs:", np.median(data['Diameter']), "kms.")
print("Least Diameter of Recorded NEO:", np.min(data['Diameter']), "kms.")
print("Greatest Diameter of Recorded NEO:", np.max(data['Diameter']), "kms.")
print("Range of Diameters of Recorded NEOs:", np.max(data['Diameter']) - np.min(data['Diame
print("Standard Deviation of Diameters:", np.std(data['Diameter']), "kms.")
print("Variance of Diameters:", np.std(data['Diameter'])**2, "kms.")
print("Quartiles of Diameters:", getQuartiles(data['Diameter']), "kms.")

print("\nGeneral Data Regarding Eccentricity:")
print("Mean Asteroid Eccentricity:", np.mean(data['Eccentricity']))
print("Median Diameter of Eccentricity:", np.median(data['Eccentricity']))
print("Least Astroid Eccentricity:", np.min(data['Eccentricity']))
print("Greatest Asteroid Eccentricity:", np.max(data['Eccentricity']))
print("Range of Eccentricity of Recorded NEOs:", np.max(data['Eccentricity']) - np.min(data
print("Standard Deviation of Eccentricity:", np.std(data['Eccentricity']))
print("Variance of Eccentricity:", np.std(data['Eccentricity'])**2, "kms.")
print("Quartiles of Eccentricity:", getQuartiles(data['Eccentricity']))
```

```
print("\nGeneral Data Regarding Semi-Major Axis:")
print("Mean Asteroid Semi-Major Axis:", np.mean(data['Semi-Major Axis']), "AU")
print("Median Diameter of Semi-Major Axis:", np.median(data['Semi-Major Axis']), "AU")
print("Least Astroid Semi-Major Axis:", np.min(data['Semi-Major Axis']), "AU")
print("Greatest Asteroid Semi-Major Axis:", np.max(data['Semi-Major Axis']), "AU")
print("Range of Semi-Major Axes of Recorded NEOs:", np.max(data['Semi-Major Axis']) - np.m
print("Standard Deviation of Semi-Major Axes:", np.std(data['Semi-Major Axis']), "AU")
print("Variance of Semi-Major Axes:", np.std(data['Semi-Major Axis'])**2, "AU")
print("Quartiles of Semi-Major Aess:", getQuartiles(data['Semi-Major Axis']), "AU")

print("\nGeneral Data Regarding Perihelion Distance:")
print("Mean Asteroid Perihelion Distance:", np.mean(data['Semi-Major Axis']), "AU")
print("Median Diameter of Perihelion Distance:", np.median(data['Perihelion Distance']), "A
print("Least Astroid Perihelion Distance:", np.min(data['Semi-Major Axis']), "AU")
print("Greatest Asteroid Perihelion Distance:", np.max(data['Semi-Major Axis']), "AU")
print("Range of Perihelion Distances of Recorded NEOs:", np.max(data['Perihelion Distance'
print("Standard Deviation of Perihelion Distance:", np.std(data['Perihelion Distance']), "A
print("Variance of Perihelion Distance:", np.std(data['Perihelion Distance'])**2, "AU")
print("Quartiles of Perihelion Distance:", getQuartiles(data['Perihelion Distance']), "AU"

print("\nGeneral Data Regarding Inclination:")
print("Mean Asteroid Inclination:", np.mean(data['Inclination']), "°")
print("Median Diameter of Inclination:", np.median(data['Inclination']), "°")
print("Least Astroid Inclination:", np.min(data['Inclination']), "°")
print("Greatest Asteroid Inclination:", np.max(data['Inclination']), "°")
print("Range of Inclinations of Recorded NEOs:", np.max(data['Inclination']) - np.min(data
print("Standard Deviation of Inclination:", np.std(data['Inclination']), "°")
print("Variance of Inclination:", np.std(data['Inclination'])**2, "°")
print("Quartiles of Inclination:", getQuartiles(data['Inclination']), "°")

print("\nGeneral Data Regarding Period:")
print("Mean Asteroid Period:", np.mean(data['Period']), "Days")
print("Median Diameter of Period:", np.median(data['Period']), "Days")
print("Least Astroid Period:", np.min(data['Period']), "Days")
print("Greatest Asteroid Period:", np.max(data['Period']), "Days")
print("Range of Periods of Recorded NEOs:", np.max(data['Period']) - np.min(data['Period']
print("Standard Deviation of Period:", np.std(data['Period']), "Days")
print("Variance of Period:", np.std(data['Period'])**2, "Days")
print("Quartiles of Period:", getQuartiles(data['Period']), "Days")

print("\n")
data
```

```
ASTEROID ORBITAL ELEMENTS & NEAR-EARTH OBJECT TAGGING DATASET
Variables Considered: NEO, Eccentricity, S-M Axis, Perihelion Distance, Inclination,
Number of Recorded NEOs: 1819 Records Found
Number of Verified NEOs (Y): 220
Number of Unverified NEOs (N): 1599

General Data Regarding Near-Earth Objects (NEOs):
```

```
Mean Diameter of NEOs: 2.6830753161077516 kms.
Median Diameter of NEOs: 2.639 kms.
Least Diameter of Recorded NEO: 0.008 kms.
Greatest Diameter of Recorded NEO: 26.0 kms.
Range of Diameters of Recorded NEOs: 25.992 kms.
Standard Deviation of Diameters: 1.3890961380115647 kms.
Variance of Diameters: 1.929588080638644 kms.
Quartiles of Diameters: [2.018, 2.639, 3.367] kms.

General Data Regarding Eccentricity:
Mean Asteroid Eccentricity: 0.23368686091258933
Median Diameter of Eccentricity: 0.1892
Least Astroid Eccentricity: 0.0017
Greatest Asteroid Eccentricity: 0.9679
Range of Eccentricity of Recorded NEOs: 0.9662
Standard Deviation of Eccentricity: 0.17061336986560313
Variance of Eccentricity: 0.029108921976897094 kms.
Quartiles of Eccentricity: [0.1311, 0.1892, 0.2625]

General Data Regarding Semi-Major Axis:
Mean Asteroid Semi-Major Axis: 2.9289327652556354 AU
Median Diameter of Semi-Major Axis: 3.065 AU
Least Astroid Semi-Major Axis: 0.706 AU
Greatest Asteroid Semi-Major Axis: 26.09 AU
Range of Semi-Major Axes of Recorded NEOs: 25.384 AU
Standard Deviation of Semi-Major Axes: 0.8700860465707736 AU
Variance of Semi-Major Axes: 0.7570497284371585 AU
Quartiles of Semi-Major Aess: [2.728, 3.065, 3.154] AU

General Data Regarding Perihelion Distance:
Mean Asteroid Perihelion Distance: 2.9289327652556354 AU
Median Diameter of Perihelion Distance: 2.408 AU
Least Astroid Perihelion Distance: 0.706 AU
Greatest Asteroid Perihelion Distance: 26.09 AU
Range of Perihelion Distances of Recorded NEOs: 4.789000000000001 AU
Standard Deviation of Perihelion Distance: 0.6300544829194304 AU
Variance of Perihelion Distance: 0.3969686514468709 AU
Quartiles of Perihelion Distance: [2.04, 2.408, 2.659] AU

General Data Regarding Inclination:
Mean Asteroid Inclination: 15.911814183617373 °
Median Diameter of Inclination: 14.45 °
Least Astroid Inclination: 0.69 °
Greatest Asteroid Inclination: 162.49 °
Range of Inclinations of Recorded NEOs: 161.8 °
Standard Deviation of Inclination: 9.687260310413464 °
Variance of Inclination: 93.84301232171197 °
Quartiles of Inclination: [9.87, 14.45, 21.53] °

General Data Regarding Period:
Mean Asteroid Period: 1875.7146783947223 Days
Median Diameter of Period: 1960.0 Days
Least Astroid Period: 217 Days
Greatest Asteroid Period: 48700 Days
Range of Periods of Recorded NEOs: 48483 Days
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```
Range of Periods of Recorded NEOs: 48483 Days
Standard Deviation of Period: 1438.035081839618 Days
Variance of Period: 2067944.8966014767 Days
Quartiles of Period: [1650.0, 1960.0, 2050.0] Days
```

	NEO	Diameter	Eccentricity	Semi-Major Axis	Perihelion Distance	Inclination	Period
0	N	2.143	0.1779	2.606	2.142	10.01	1540
1	N	3.117	0.1529	2.735	2.317	12.05	1650
2	N	2.233	0.1726	2.739	2.266	13.16	1660
3	N	1.814	0.2167	2.546	1.995	17.45	1480
4	N	2.460	0.2122	3.137	2.472	10.02	2030
...	...	...	...	...	...	...	...
1814	Y	1.600	0.6938	3.475	1.064	13.61	2370
1815	Y	2.000	0.6655	3.208	1.073	5.70	2100
1816	Y	26.000	0.9632	26.090	0.960	113.45	48700
1817	Y	11.600	0.9289	13.810	0.983	19.19	18800
1818	Y	12.060	0.9053	13.306	0.924	69.35	17700

Next steps: Generate code with data | View recommended plots

```
import pandas as pd
import matplotlib.pyplot as plt

filepath = '/content/asteroidData.csv'
data = pd.read_csv(filepath)

x_column = 'period'
y_column = 'perihelionDistance'

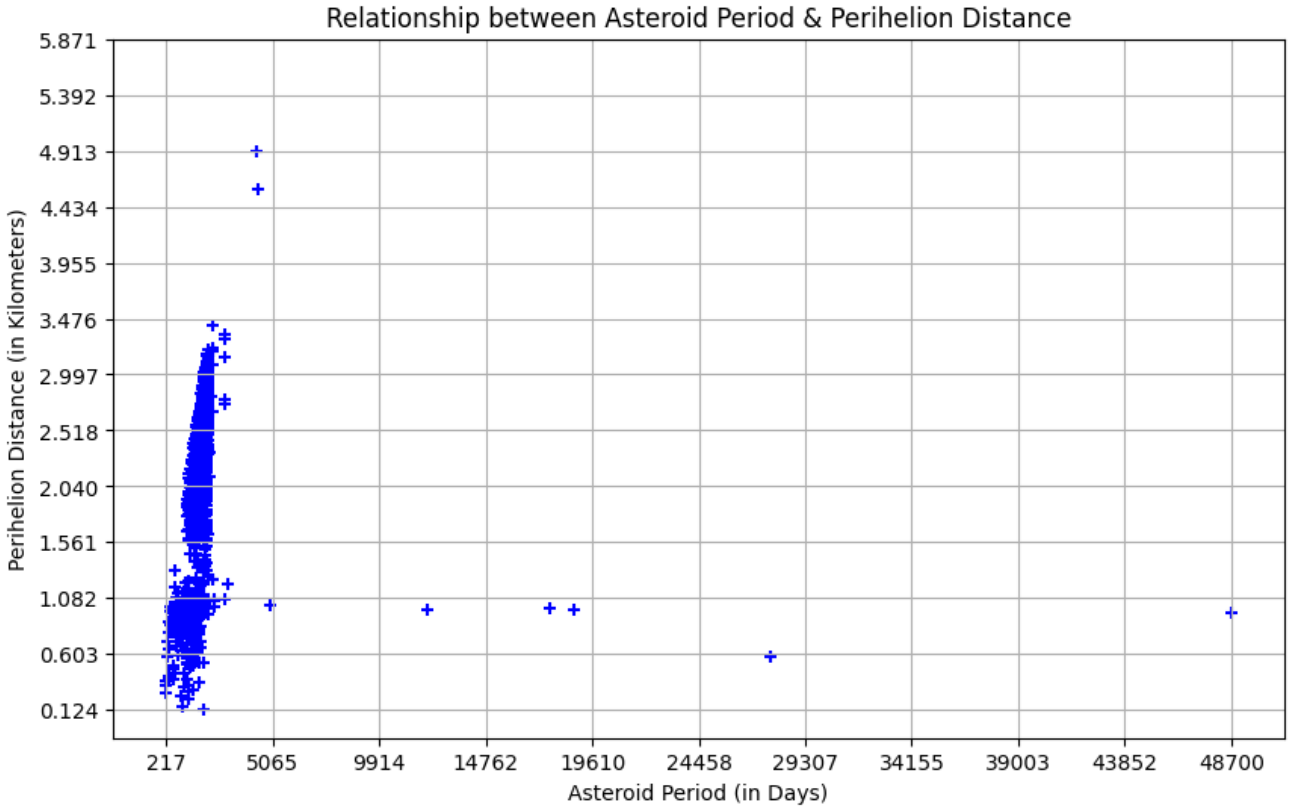
x = data[x_column]
y = data[y_column]

plt.figure(figsize=(10, 6))
plt.scatter(x, y, color='blue', marker='+')

plt.xticks(np.arange(min(x), max(x)+1, (max(x)-min(x))/10)) # Start, Stop, Step. Minimum,
plt.yticks(np.arange(min(y), max(y)+1, (max(y)-min(y))/10))

plt.title('Relationship between Asteroid Period & Perihelion Distance')
plt.xlabel('Asteroid Period (in Days)')
plt.ylabel('Perihelion Distance (in Kilometers)')
```

```
plt.grid(True)
plt.show()
```




```
import pandas as pd
import matplotlib.pyplot as plt

filepath = '/content/asteroidData.csv'
data = pd.read_csv(filepath)

x_column = 'diameter'
y_column = 'eccentricity'

x = data[x_column]
y = data[y_column]

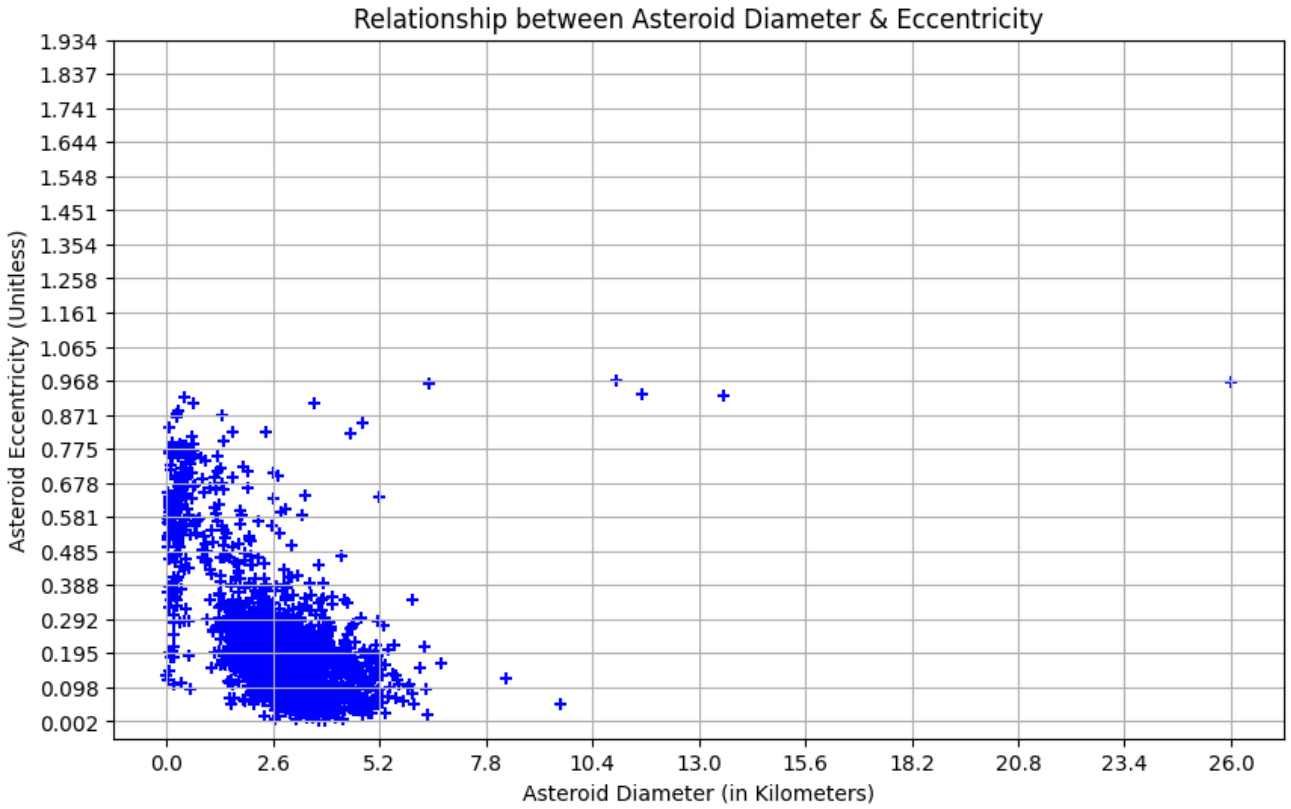
plt.figure(figsize=(10, 6))
plt.scatter(x, y, color='blue', marker='+')

plt.xticks(np.arange(min(x), max(x)+1, (max(x)-min(x))/10))
```

```
plt.xticks(np.arange(min(x), max(x)+1, (max(x)-min(x))/10))
plt.yticks(np.arange(min(y), max(y)+1, (max(y)-min(y))/10))

plt.title('Relationship between Asteroid Diameter & Eccentricity')
plt.xlabel('Asteroid Diameter (in Kilometers)')
plt.ylabel('Asteroid Eccentricity (Unitless)')

plt.grid(True)
plt.show()
```




```
import pandas as pd
import matplotlib.pyplot as plt

filepath = '/content/asteroidData.csv'
data = pd.read_csv(filepath)

x_column = 'inclination'
y_column = 'semiMajorAxis'

x = data[x_column]
```

```
y = data[y_column]

plt.figure(figsize=(10, 6))
plt.scatter(x, y, color='blue', marker='+')

plt.xticks(np.arange(min(x), max(x)+1, (max(x)-min(x))/10))
plt.yticks(np.arange(min(y), max(y)+1, (max(y)-min(y))/10))

plt.title('Relationship between Asteroid Inclination & Semi-Major Axis')
plt.xlabel('Asteroid Inclination (in Angular Degrees)')
plt.ylabel('Asteroid Semi-Major Axis (in AU)')

plt.grid(True)
plt.show()
```