In [1]:

```python
import pandas as pd
import numpy as np
import warnings
warnings.filterwarnings("ignore")
```

## Q7 Cars: Calculate Mean, Median, Mode, Variance, Standard Deviation & Range

In [2]:

```python
cars = pd.read_csv("Q7.csv")
cars.head()
```

Out[2]:

| | Cars | Points | Score | Weigh |
|---|---|---|---|---|
| **0** | Mazda RX4 | 3.90 | 2.620 | 16.46 |
| **1** | Mazda RX4 Wag | 3.90 | 2.875 | 17.02 |
| **2** | Datsun 710 | 3.85 | 2.320 | 18.61 |
| **3** | Hornet 4 Drive | 3.08 | 3.215 | 19.44 |
| **4** | Hornet Sportabout | 3.15 | 3.440 | 17.02 |

In [3]:

```python
cars.drop('Cars',inplace=True,axis=1)
Label = pd.DataFrame([cars.mean().values,
                        cars.median().values,
                        cars.mode().values[0],
                        cars.var().values,
                        cars.std().values,
                        (cars.max()-cars.min()).values],
                        columns=cars.columns)
Label.insert(0,column ='Label',value=np.array(['Mean',
                                              'Median',
                                              'Mode',
                                               'Variance',
                                               'Standard Deviation',
                                               'Range']).reshape(6,1))
Label
```

Out[3]:

| | Label | Points | Score | Weigh |
|---|---|---|---|---|
| **0** | Mean | 3.596563 | 3.217250 | 17.848750 |
| **1** | Median | 3.695000 | 3.325000 | 17.710000 |
| **2** | Mode | 3.070000 | 3.440000 | 17.020000 |
| **3** | Variance | 0.285881 | 0.957379 | 3.193166 |
| **4** | Standard Deviation | 0.534679 | 0.978457 | 1.786943 |
| **5** | Range | 2.170000 | 3.911000 | 8.400000 |

## Q9 Cars’ speed and distance. Calculate Skewness, Kurtosis

## a) Calculate Skewness

In [4]:

```
cars = pd.read_csv("Q9_a.csv")
cars.head()
```

Out[4]:

| | Index | speed | dist |
|---|---|---|---|
| **0** | 1 | 4 | 2 |
| **1** | 2 | 4 | 10 |
| **2** | 3 | 7 | 4 |
| **3** | 4 | 7 | 22 |
| **4** | 5 | 8 | 16 |

In [5]:

```
cars = pd.read_csv('Q9_a.csv')
cars.drop('Index',axis=1,inplace=True)
Label = pd.DataFrame([cars.skew().values,
                        cars.kurt().values],
                        columns = cars.columns)
Label.insert(0,column='Moments',value=np.array(['Skew',
                                                  'Kurtosis']).reshape(2,1))
Label
```

Out[5]:

| | Moments | speed | dist |
|---|---|---|---|
| **0** | Skew | -0.117510 | 0.806895 |
| **1** | Kurtosis | -0.508994 | 0.405053 |

## b) Calculate Kurtosis

In [6]:

```
cars = pd.read_csv('Q9_b.csv')
cars.drop('Unnamed: 0',axis=1,inplace=True)
Label = pd.DataFrame([cars.skew().values,
                        cars.kurt().values],
                        columns = cars.columns)
Label.insert(0,column='Moments',value=np.array(['Skew',
                                                  'Kurtosis']).reshape(2,1))
Label
```

Out[6]:

| | Moments | SP | WT |
|---|---|---|---|
| **0** | Skew | 1.611450 | -0.614753 |
| **1** | Kurtosis | 2.977329 | 0.950291 |

## Q11 Calculate 94%, 98%, 96% Confidence Interval

In [7]:

```
import matplotlib.pyplot as plt
import scipy.stats as stats
```

In [8]:

```
# Avg. weight of Adult in Mexico with 94% CI
stats.norm.interval(0.94,200,30/(2000**0.5))
(198.738325292158, 201.261674707842)
```

Out[8]:

```
(198.738325292158, 201.261674707842)
```

In [9]:

```
# Avg. weight of Adult in Mexico with 98% CI
stats.norm.interval(0.98,200,30/(2000**0.5))
(198.43943840429978, 201.56056159570022)
```

Out[9]:

```
(198.43943840429978, 201.56056159570022)
```

In [10]:

```
# Avg. weight of Adult in Mexico with 96% CI
stats.norm.interval(0.96,200,30/(2000**0.5))
(198.62230334813333, 201.37769665186667)
```

Out[10]:

```
(198.62230334813333, 201.37769665186667)
```

# Q12

## 1) Find mean, median, variance, standard deviation

In [11]:

```
calc = [['Mean',np.mean],
        ['Median',np.median],
        ['Variance',np.var],
        ['Standard Deviation',np.std]]
scores = np.array([34,36,36,38,38,39,39,40,40,41,41,41,41,42,42,45,49,56])
Label = pd.DataFrame([[x[0],round(x[1](scores),2)] for x in calc],
                      columns=['Label','values'])
Label
```

Out[11]:

| | Label | values |
|---|---|---|
| **0** | Mean | 41.00 |
| **1** | Median | 40.50 |
| **2** | Variance | 24.11 |
| **3** | Standard Deviation | 4.91 |

# Q20 Calculate the probability of MPG of Cars for the below cases.

In [12]:

```
cars = pd.read_csv('Cars.csv')
cars.head()
```

Out[12]:

| | HP | MPG | VOL | SP | WT |
|---|---|---|---|---|---|
| **0** | 49 | 53.700681 | 89 | 104.185353 | 28.762059 |
| **1** | 55 | 50.013401 | 92 | 105.461264 | 30.466833 |
| **2** | 55 | 50.013401 | 92 | 105.461264 | 30.193597 |
| **3** | 70 | 45.696322 | 92 | 113.461264 | 30.632114 |
| **4** | 53 | 50.504232 | 92 | 104.461264 | 29.889149 |

In [13]:

```
cars = pd.read_csv('Cars.csv')

def cdf(x):
    return stats.norm.cdf(x,loc=cars.describe().loc['mean']['MPG'],
                          scale=cars.describe().loc['std']['MPG'])

cars = pd.DataFrame([['P(MPG) > 38',1-cdf(38)],
                     ['P(MPG) < 40',cdf(40)],
                     ['P(20', cdf(50) - cdf(20)]],
                     columns= ['condition','Probablity'])
cars
```

Out[13]:

| | condition | Probablity |
|---|---|---|
| **0** | P(MPG) > 38 | 0.347594 |
| **1** | P(MPG) < 40 | 0.729350 |
| **2** | P(20 | 0.898869 |

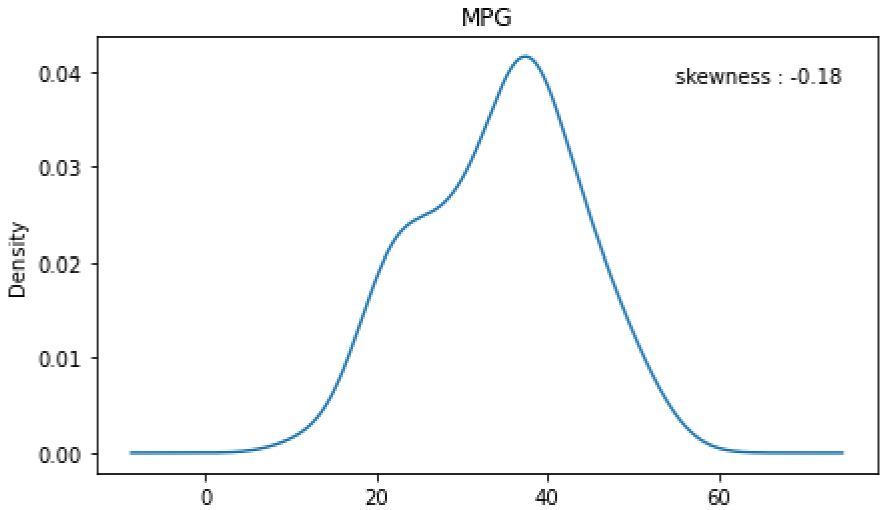
# Q21

## a) Check whether the MPG of Cars follows Normal Distribution

In [14]:

```
cars = pd.read_csv('Cars.csv')

mpg = cars.MPG
plt.figure(figsize=(7,4))
mpg.plot(kind='kde')
plt.figtext(0.7,0.8,f'skewness : {round(mpg.skew(),2)}')
plt.title('MPG')
plt.show()
# it can be inferred from visual
# as well as statical inspection
# that MPG dataset indeed
# follows normal distribution
```



## b) Check Whether the Adipose Tissue (AT) and Waist Circumference(Waist)

## from wc-at data set follows Normal Distribution

In [15]:

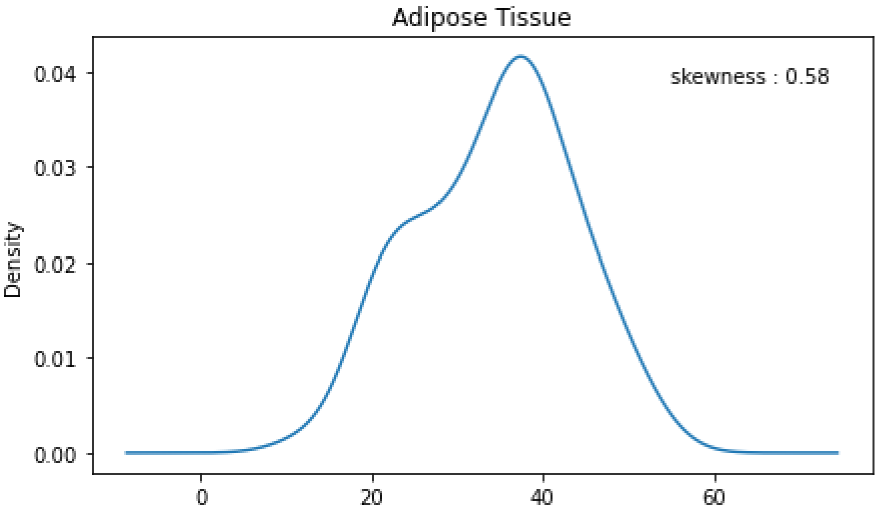
```
cars = pd.read_csv('Q20-21 wc-at.csv')
cars.head()
```

Out[15]:

|   | Waist | AT |
|---|---|---|
| **0** | 74.75 | 25.72 |
| **1** | 72.60 | 25.89 |
| **2** | 81.80 | 42.60 |
| **3** | 83.95 | 42.80 |
| **4** | 74.65 | 29.84 |

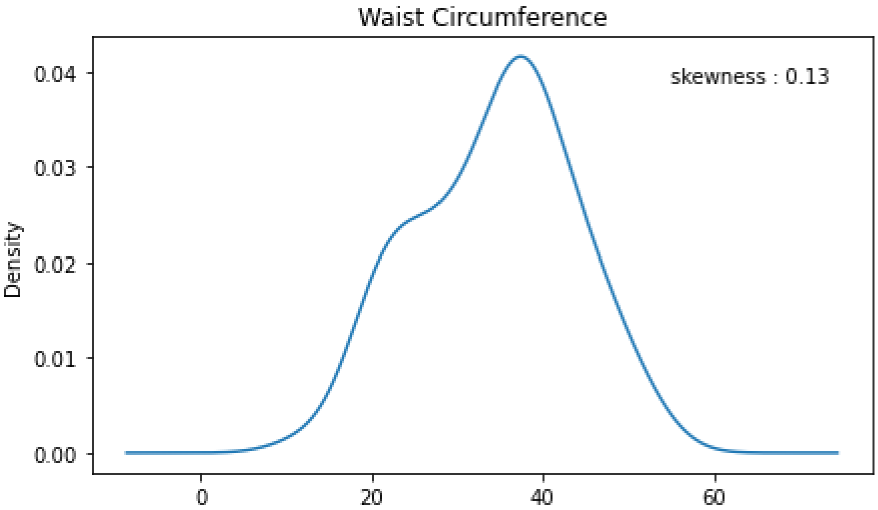
In [16]:

```
at = cars.AT
plt.figure(figsize=(7,4))
mpg.plot(kind='kde')
plt.figtext(0.7,0.8,f'skewness : {round(at.skew(),2)}')
plt.title('Adipose Tissue')
plt.show()
# it can be inferred from visual
# as well as statical inspection
# that Adipose tissue dataset indeed
# follows normal distribution
```



In [17]:

```
waist = cars.Waist
plt.figure(figsize=(7,4))
mpg.plot(kind='kde')
plt.figtext(0.7,0.8,f'skewness : {round(waist.skew(),2)}')
plt.title('Waist Circumference')
plt.show()
# it can be inferred from visual
# as well as statical inspection
# that Waist Circumference dataset indeed
# follows normal distribution
```



## Q22 Calculate the Z scores of 90%,94% & 60% confidence interval

In [18]:

```
def zScore(cl):
    return round(stats.norm.ppf((1+cl/100)/2),2)
CI = [60,95,96]
zscore = pd.DataFrame([[x, zScore(x)] for x in CI],
                      columns=['CI','Z-Score'])
zscore
```

Out[18]:

|   | CI | Z-Score |
|---|---|---|
| **0** | 60 | 0.84 |
| **1** | 95 | 1.96 |
| **2** | 96 | 2.05 |

## Q23 Calculate the T scores of 90%,94% & 60% confidence interval

In [19]:

```
sampleSize = 25
CI = [95,96,99]
def tScore(cl):
    global sampleSize
    return round(stats.t.ppf((1+cl/100)/2,df = sampleSize-1),2)
tscore = pd.DataFrame([[x, tScore(x)] for x in CI],
                      columns=['CI',f'T-Score for N = {sampleSize}'])
tscore
```

Out[19]:

|   | CI | T-Score for N = 25 |
|---|---|---|
| **0** | 95 | 2.06 |
| **1** | 96 | 2.17 |
| **2** | 99 | 2.80 |

## Q24 Probability that 18 randomly selected bulbs would have an average life of no more than 260 days

In [20]:

```
sampleSize = 18
xBar = 260
S = 90
prob = pd.DataFrame([['P(aveLife <= 260)',
                     stats.t.cdf(xBar,df=sampleSize-1,scale=S)]],
                   columns=['condition','Probability'])
prob
```

Out[20]:

|   | condition | Probability |
|---|---|---|
| **0** | P(aveLife <= 260) | 0.9949 |