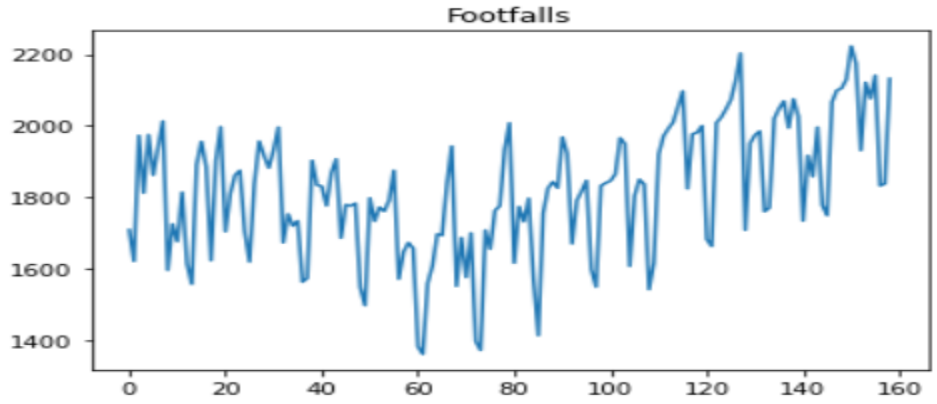
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from statsmodels.tsa.seasonal import seasonal_decompose
from statsmodels.tsa.holtwinters import SimpleExpSmoothing,Holt,ExponentialSmoothing
import statsmodels.graphics.tsaplots as tsa
import statsmodels.formula.api as smf

data=pd.read_csv('Downloads/footfalls.csv')
data
```

	Month	Footfalls	t	log_footfalls	t_square	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	Jan-91	1709	1	7.443664	1	1	0	0	0	0	0	0	0	0	0	0	0
1	Feb-91	1621	2	7.390799	4	0	1	0	0	0	0	0	0	0	0	0	0
2	Mar-91	1973	3	7.587311	9	0	0	1	0	0	0	0	0	0	0	0	0
3	Apr-91	1812	4	7.502186	16	0	0	0	1	0	0	0	0	0	0	0	0
4	May-91	1975	5	7.588324	25	0	0	0	0	1	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
154	Nov-03	2076	155	7.638198	24025	0	0	0	0	0	0	0	0	0	0	1	0
155	Dec-03	2141	156	7.669028	24336	0	0	0	0	0	0	0	0	0	0	0	1
156	Jan-04	1832	157	7.513164	24649	1	0	0	0	0	0	0	0	0	0	0	0
157	Feb-04	1838	158	7.516433	24964	0	1	0	0	0	0	0	0	0	0	0	0
158	Mar-04	2132	159	7.664816	25281	0	0	1	0	0	0	0	0	0	0	0	0

159 rows × 17 columns

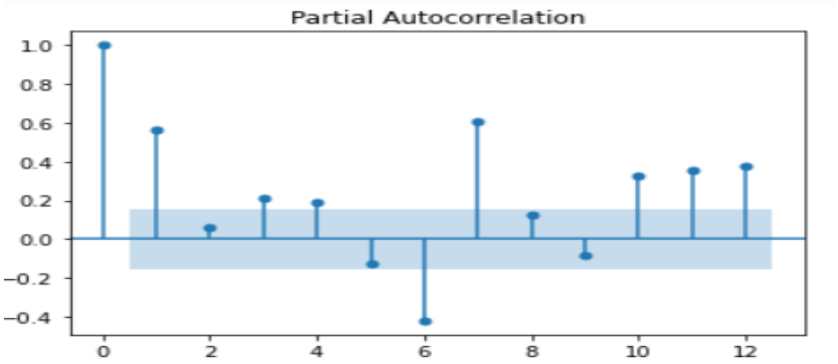
```
plt.plot(data['Footfalls'])
plt.title('Footfalls')
```

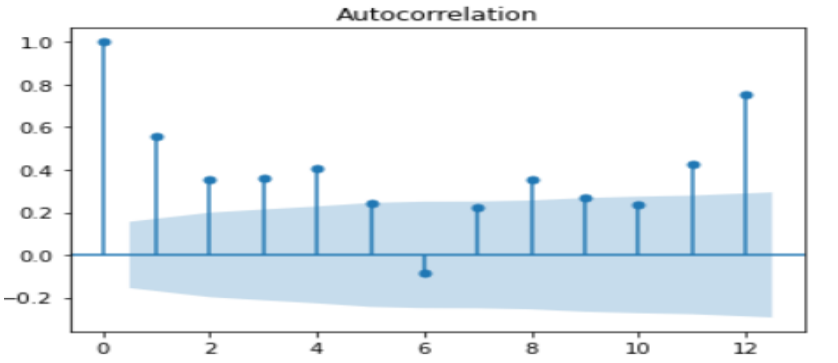
```
Text(0.5, 1.0, 'Footfalls')
```

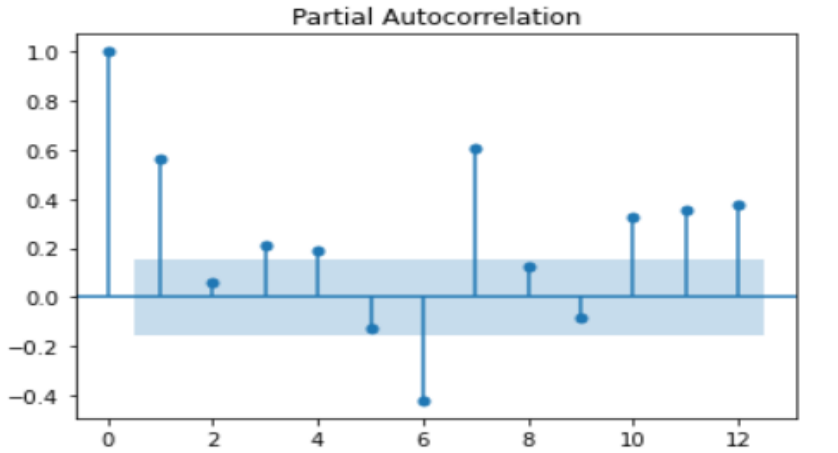



```
decompose=seasonal_decompose(data['Footfalls'],period=12)
plt.plot(decompose)
```

```
plt.title('Decomposition plot')

tsa.plot_acf(data['Footfalls'],lags=12)
tsa.plot_pacf(data['Footfalls'],lags=12)
```








```
def MAPE(predict,org):
    temp=np.abs((predict-org)/org)*100
    return np.mean(temp)

model=SimpleExpSmoothing(data['Footfalls']).fit(smoothing_level=0.6)
predict=model.predict(start=data.index[0],end=data.index[-1])
MAPE(predict,data['Footfalls'])
```

```
6.871923579558813
```

```
model=Holt(data['Footfalls']).fit(smoothing_level=0.6,smoothing_slope=0.3)
predict=model.predict(start=data.index[0],end=data.index[-1])
MAPE(predict,data['Footfalls'])
```

```
7.157115182706222
```

```
model=ExponentialSmoothing(data['Footfalls'],seasonal='add',trend='add',seasonal_periods=12)
.fit()
predict=model.predict(start=data.index[0],end=data.index[-1])
MAPE(predict,data['Footfalls'])
```

```
2.5698916977399024
```

```
model.forecast(10)
```

```
159    2159.049612
160    2184.181287
161    2175.047623
162    2259.531412
163    2274.782926
164    1973.579880
165    2149.808584
166    2125.710663
167    2174.849726
168    1909.325993
dtype: float64
```

```
train=data.head(149)
test=data.tail(10)

model=smf.ols('Footfalls~t',data=train).fit()
predict=pd.Series(model.predict(pd.DataFrame(test['t'])))
x=np.sqrt(np.mean(np.array(test['Footfalls'])-np.array(predict))**2)
x
```

```
148.84576455650432
```

```
model=smf.ols('Footfalls~t',data=train).fit()
predict=pd.Series(model.predict(pd.DataFrame(test['t'])))
x=np.sqrt(np.mean(np.array(test['Footfalls'])-np.array(np.exp(predict))**2))
x
```