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Assignment 5

Problem Statement:

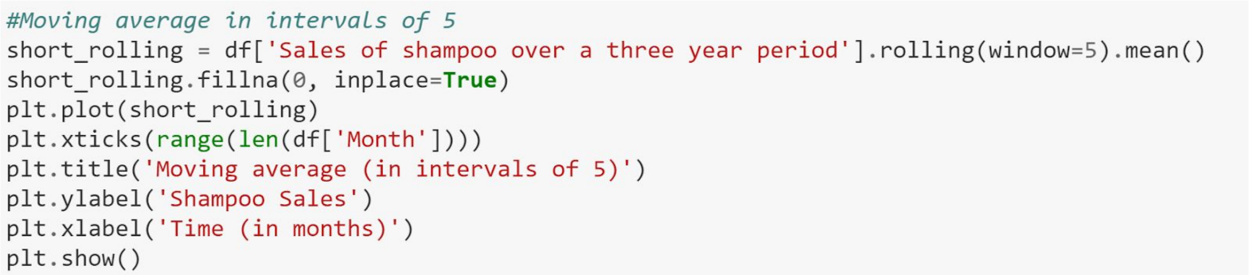
On a chosen dataset, perform the time series model functions by calculating the moving average, single and double exponential smoothing.

Dataset:

Sales of shampoo dataset

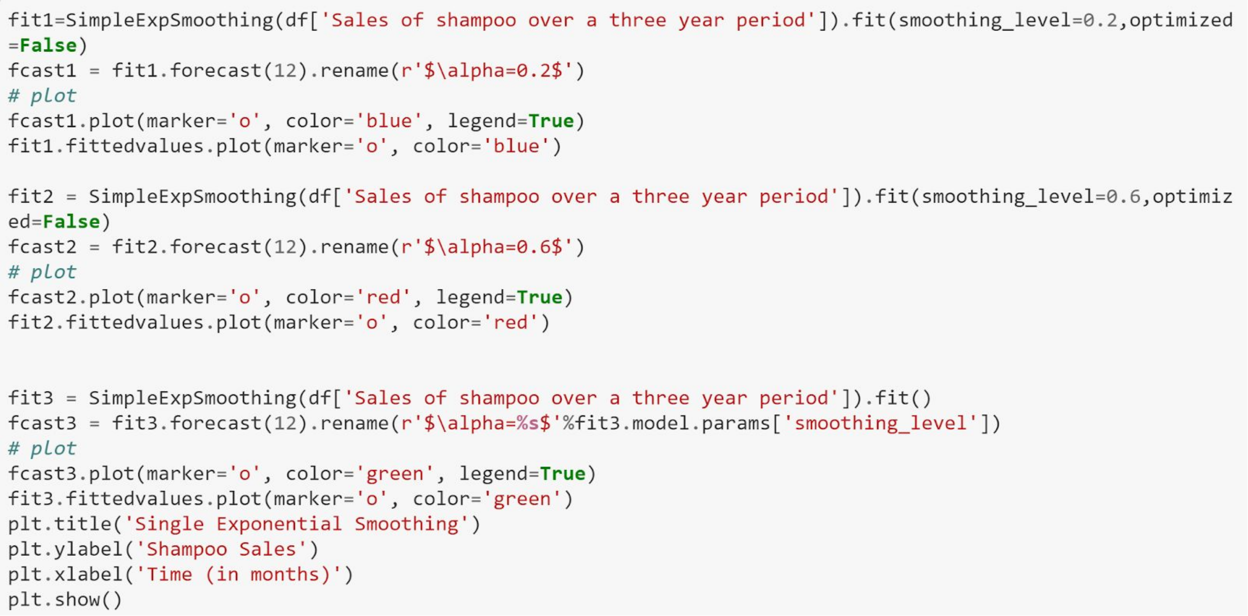
Code:

#1 Moving Average (MA)



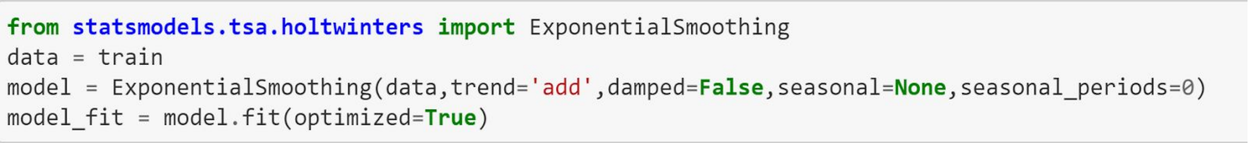
```
#Moving average in intervals of 5
short_rolling = df['Sales of shampoo over a three year period'].rolling(window=5).mean()
short_rolling.fillna(0, inplace=True)
plt.plot(short_rolling)
plt.xticks(range(len(df['Month'])))
plt.title('Moving average (in intervals of 5)')
plt.ylabel('Shampoo Sales')
plt.xlabel('Time (in months)')
plt.show()
```

#2 Single Exponential Smoothing (SES)

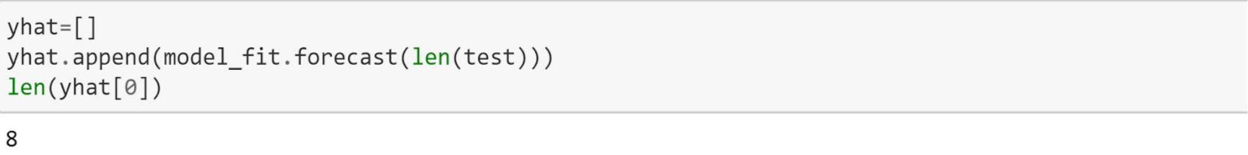


```
fit1=SimpleExpSmoothing(df['Sales of shampoo over a three year period']).fit(smoothing_level=0.2,optimized
=False)
fcast1 = fit1.forecast(12).rename(r'$\alpha=0.2$')
# plot
fcast1.plot(marker='o', color='blue', legend=True)
fit1.fittedvalues.plot(marker='o', color='blue')

fit2 = SimpleExpSmoothing(df['Sales of shampoo over a three year period']).fit(smoothing_level=0.6,optimiz
ed=False)
fcast2 = fit2.forecast(12).rename(r'$\alpha=0.6$')
# plot
fcast2.plot(marker='o', color='red', legend=True)
fit2.fittedvalues.plot(marker='o', color='red')


fit3 = SimpleExpSmoothing(df['Sales of shampoo over a three year period']).fit()
fcast3 = fit3.forecast(12).rename(r'$\alpha=%s$'%fit3.model.params['smoothing_level'])
# plot
fcast3.plot(marker='o', color='green', legend=True)
fit3.fittedvalues.plot(marker='o', color='green')
plt.title('Single Exponential Smoothing')
plt.ylabel('Shampoo Sales')
plt.xlabel('Time (in months)')
plt.show()
```

#3 Double Exponential Smoothing and Root Mean Square

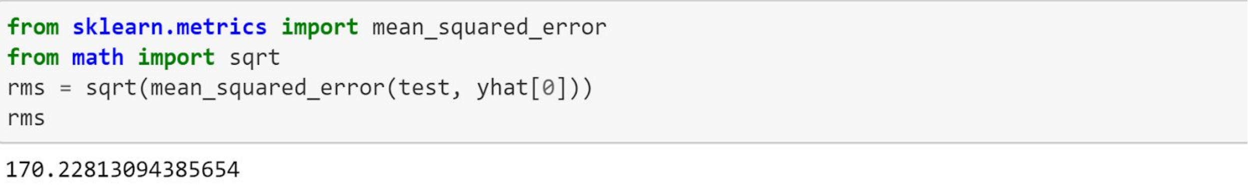


```
from statsmodels.tsa.holtwinters import ExponentialSmoothing
data = train
model = ExponentialSmoothing(data,trend='add',damped=False,seasonal=None,seasonal_periods=0)
model_fit = model.fit(optimized=True)
```



```
yhat=[]
yhat.append(model_fit.forecast(len(test)))
len(yhat[0])
```

```
8
```

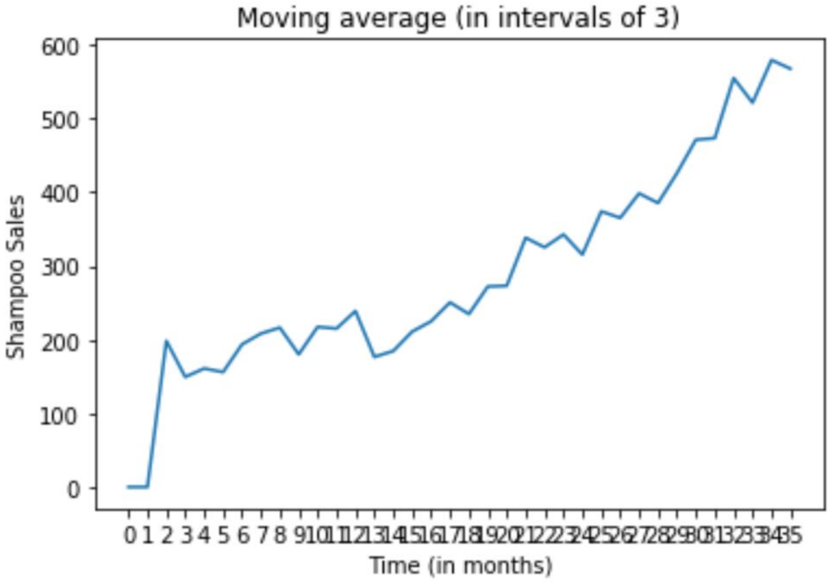


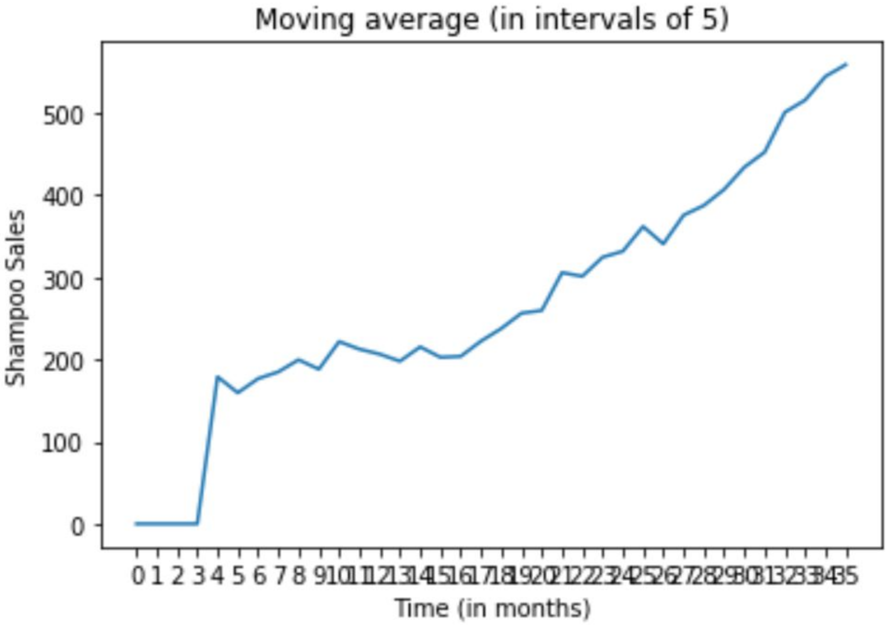
```
from sklearn.metrics import mean_squared_error
from math import sqrt
rms = sqrt(mean_squared_error(test, yhat[0]))
rms
```

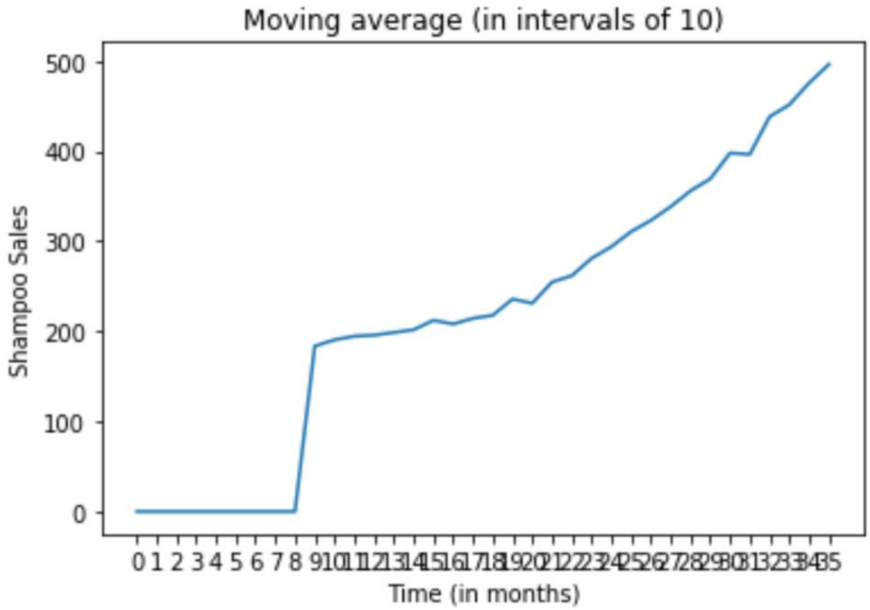
```
170.22813094385654
```

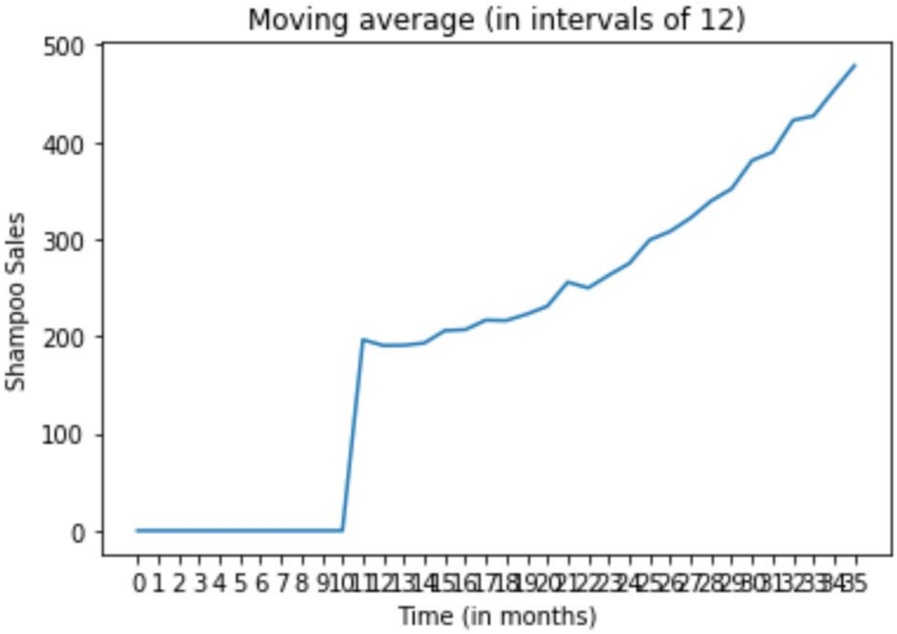
Results:

#1 MA

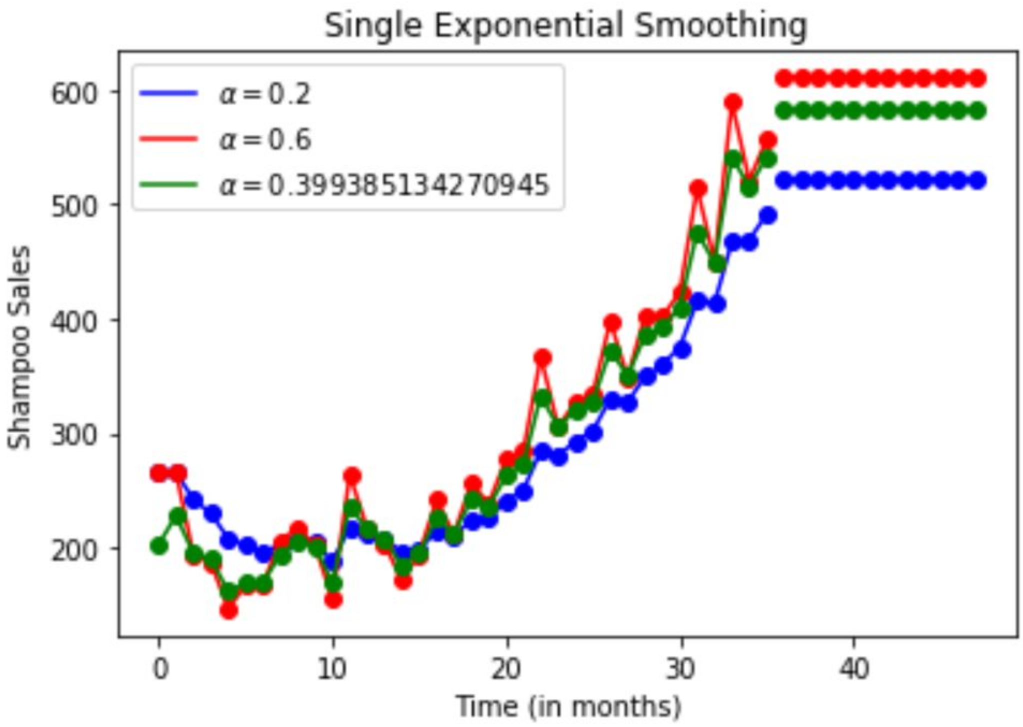

Moving average (in intervals of 3)
Shampoo Sales
0
100
200
300
400
500
600
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Time (in months)


Moving average (in intervals of 5)
Shampoo Sales
0
100
200
300
400
500
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Time (in months)

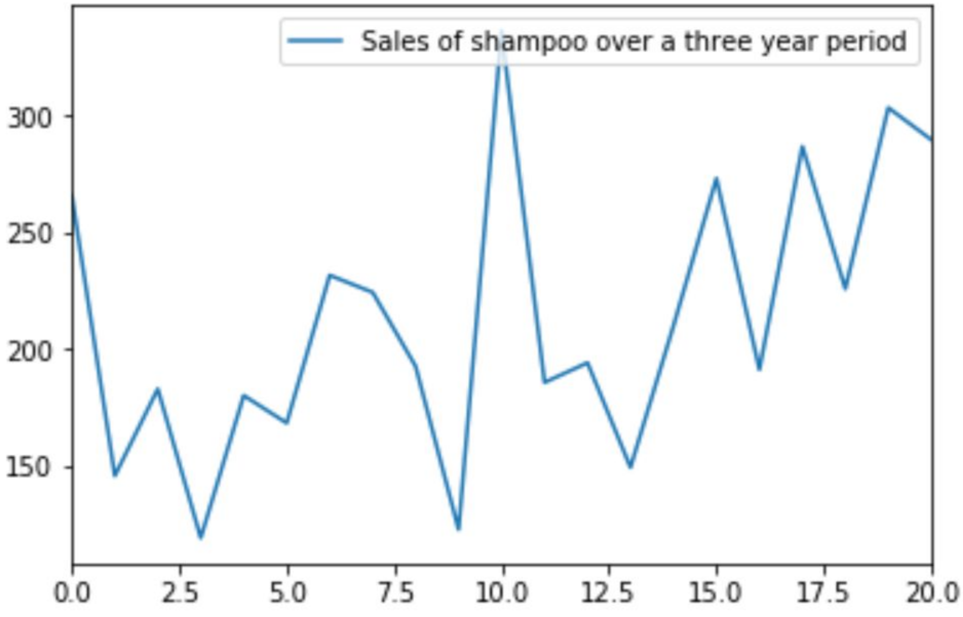

Moving average (in intervals of 10)
Shampoo Sales
0
100
200
300
400
500
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Time (in months)


Moving average (in intervals of 12)
Shampoo Sales
0
100
200
300
400
500
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Time (in months)

#2 SES


Single Exponential Smoothing
$\alpha = 0.2$
$\alpha = 0.6$
$\alpha = 0.399385134270945$
Shampoo Sales
600
500
400
300
200
0
10
20
30
40
Time (in months)

#3


Sales of shampoo over a three year period
300
250
200
150
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0