



Republic of the Philippines
City of Olongapo

GORDON COLLEGE

Olongapo City Sports Complex, East Tapinac, Olongapo City
Tel. No. (047) 224-2089 loc. 314



LECTURE

A. Explore

a. Use MS Excel QM/POM with the data given below to forecast sales. Take a screenshot of the output and paste it inside the box. (20 pts.) Data collected on the yearly demand for 50-pound bags of fertilizer at Wallace Garden Supply are shown in the following table. Develop a 3-year moving average to forecast sales. Then estimate demand again with a weighted moving average in which sales in the most recent year are given a weight of 2 and sales in the other 2 years are each given a weight of 1.

Year	Demand for Fertilizer (1000 of Bags)	Year	Demand for Fertilizer (1000 of Bags)
1	4	7	7
2	6	8	9
3	4	9	12
4	5	10	14
5	10	11	15
6	8		

-3-year Moving Average:

3-year Moving Average

	4
	5
	4.666666667
	5
	6.333333333
	7.666666667
	8.333333333
	8
	9.333333333
	11.66666667
	13.66666667



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-Weighted Moving Average:

Weighted Moving Average

	4.5
	5
	7.25
	7.75
	8
	8.25
	10
	12.25
	14
	7.25
	3.75

-Whole output:

Year	Demand for Textbook (1000 of bags)	3-year Moving Average	Weighted Moving Average
1	4	4	4.5
2	9	9	5
3	4	4.00000007	7.25
4	3	3	7.75
5	20	8.00000009	8
6	9	5.00000007	8.25
7	7	6.00000003	10
8	9	9	11.25
9	23	9.00000009	14
10	34	11.00000007	7.25
11	37	13.00000007	3.75



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b. From the output, which method do you think is best? Why?

-When comparing the outputs of the 3-year moving average and the weighted moving average methods for forecasting fertilizer demand, it really depends on what we're looking for. The 3-year moving average gives us a smoother trend over time by averaging demand over three consecutive years. It's great for smoothing out erratic data patterns and identifying longer-term trends. However, it might not react quickly to sudden changes in demand. On the other hand, the weighted moving average assigns different weights to different time periods, putting more emphasis on recent data. This means it can capture recent trends more effectively and adapt more quickly to changes in demand. But it might be more sensitive to outliers and short-term fluctuations. So, if the demand for fertilizer is fairly stable and we're more interested in long-term trends, the 3-year moving average might be the way to go. But if demand is subject to frequent changes and recent data is crucial for forecasting, the weighted moving average could be more suitable.

B. Explain

a. Why do we use measures of forecast accuracy such as MAD, MAPE and MSE?

-Measures of forecast accuracy such as MAD, MAPE, and MSE serve an important role in assessing the reliability and effectiveness of forecasting models. They provide quantitative insights into the performance of these models by evaluating the extent to which their predictions align with actual observed values. MAD, or Mean Absolute Deviation, offers a straightforward indication of the average magnitude of errors in forecasts, irrespective of their direction. MAPE, or Mean Absolute Percentage Error, extends this analysis by expressing errors as a percentage of the actual values, facilitating comparison across different scales and aiding in understanding relative accuracy. Meanwhile, MSE, or Mean Squared Error, provides a nuanced assessment by emphasizing larger errors through squaring, making it particularly useful for detecting and addressing outliers and extreme deviations. Collectively, these measures enable forecasters to systematically evaluate model performance, identify areas for improvement, and make informed decisions to enhance forecasting accuracy, thereby contributing to more effective planning and decision-making processes.



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C. Engage

a. Sales of industrial vacuum cleaners at R. Lowenthal Supply Co. over the past 13 months are as follows:

Month	Sales (\$1000)
January	11
February	14
March	16
April	10
May	15
June	17
July	11
August	14
September	17
October	12
November	14
December	16
January	11
February	?

1. Using a moving average with three periods. determine the demand for vacuum cleaners for next February.

-This is just an estimation for the sales in February, since it's missing sales data.

Given:

December: \$16,000

January: \$11,000

February: ?

Solution:

$$\text{Moving Average for February} = \frac{16,000 + 11,000 + \text{Sales in February}}{3}$$

$$\text{Moving Average for February} = \frac{27,000 + \text{Sales in February}}{3}$$

$$\text{Moving Average for February} = \frac{27,000}{3}$$



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Moving Average for February = \$9,000

2. Using a weighted moving average with three periods, determine the demand for vacuum cleaners for February. Use 3, 2, and 1 for the weights of the most recent, second most recent, and third most recent periods, respectively. For example, if you were forecasting the demand for February, November would have a weight of 1, December would have a weight of 2, and January would have a weight of 3.

-Solution:

January (Sales \$1,000): 11 (Weight = 3)

December (Sales \$1,000): 16 (Weight = 2)

November (Sales \$1,000): 14 (Weight = 1)

$$\text{Weighted Moving Average for February} = \frac{(11 \times 3) + (16 \times 2) + (14 \times 1)}{3 + 2 + 1}$$

$$\text{Weighted Moving Average for February} = \frac{(33) + (32) + (14)}{6}$$

$$\text{Weighted Moving Average for February} = \frac{79}{6}$$

Weighted Moving Average for February = 13.166

3. Evaluate the accuracy of each of these methods.

-I'll use MAD to evaluate the methods.

a. 3-year Moving Average.

For the 3-year moving average method, forecasted demand for February is to be \$9,000.

Absolute Deviation = |Actual Sales for February - Forecasted Sales for February|

Absolute Deviations = |14 - 9| + |11 - 9| + |16 - 9| = 5 + 2 + 7 = 14

$$\text{MAD} = \frac{\text{Sum of Absolute Deviations}}{\text{Number of Periods}} = \frac{14}{3} \approx 4.67$$



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b. Weighted Moving Average

For the weighted moving average method, the forecasted demand for February is to be approximately \$13,166.

Absolute Deviation=|Actual Sales for February–Forecasted Sales for February|

Absolute Deviations=|14–13.166|+|11–13.166|+|16–13.166|=0.834+2.166+2.834=5

$$MAD = \frac{\text{Sum of Absolute Deviations}}{\text{Number of Periods}} = \frac{5}{3} \approx 1.67$$

For the 3-year moving average method, $MAD \approx 4.67$

For the weighted moving average method, $MAD \approx 1.67$

A lower MAD indicates better forecast accuracy. In this case, the weighted moving average method has a lower MAD, means that it provides more accurate forecasts compared to the 3-year moving average method.

b. Demand for patient surgery at Washington General Hospital has increased steadily in the past few years, as seen in the following table:

Year	Outpatient Surgeries Performed
1	45
2	50
3	52
4	56
5	58
6	?

The director of medical services predicted six years ago that demand in year 1 would be 42 surgeries. Using exponential smoothing with a weight of $a = 0.20$ develop forecasts for year 6.

-Solution:

$$F_t = a \times \text{Actual}_t + (1-a) \times F_{t-1}$$

Where:

F_t = forecast of year 6

a = smoothing factor (weight), which is given as 0.20.

Actual_t = actual number of outpatient surgeries for each year.



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F_{t-1} = forecast for the previous year.

$$F_6 = 0.20 \times \text{Actual}_5 + (1-0.20) \times F_5$$

Year 1: $\text{Actual}_1 = 45$

Year 2: $\text{Actual}_2 = 50$

Year 3: $\text{Actual}_3 = 52$

Year 4: $\text{Actual}_4 = 56$

Year 5: $\text{Actual}_5 = 58$

Starting by Year 2:

$$F_2 = 0.20 \times 45 + (1-0.20) \times 42$$

$$F_2 = 9 + 0.80 \times 42$$

$$F_2 = 9 + 33.6$$

$$F_2 = 42.6$$

$$F_3 = 0.20 \times 50 + (1-0.20) \times 42.6$$

$$F_3 = 10 + 0.80 \times 42.6$$

$$F_3 = 10 + 34.08$$

$$F_3 = 44.08$$

$$F_4 = 0.20 \times 52 + (1-0.20) \times 44.08$$

$$F_4 = 10.4 + 0.80 \times 44.08$$

$$F_4 = 10.4 + 35.264$$

$$F_4 = 45.664$$



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$$F_5 = 0.20 \times 56 + (1 - 0.20) \times 45.664$$

$$F_5 = 11.2 + 0.80 \times 45.664$$

$$F_5 = 11.2 + 36.5312$$

$$F_5 = 47.7312$$

$$F_6 = 0.20 \times 58 + (1 - 0.20) \times 47.7312$$

$$F_6 = 11.6 + 0.80 \times 47.7312$$

$$F_6 = 11.6 + 38.18496$$

$$\underline{F_6 \approx 49.78496}$$

Using exponential smoothing with a weight of $\alpha = 0.20$, the forecast for the number of outpatient surgeries in Year 6 at Washington General Hospital is approximately 49.78 surgeries.