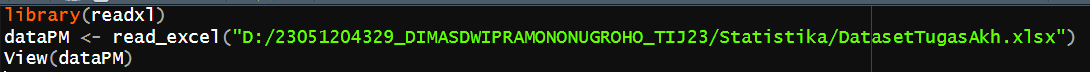
**Pengerjaan ARIMA**

* **R Studio**
* Melakukan import dataset



A screenshot of a black and white table

AI-generated content may be incorrect.

* Menghapus kolom ke-1



A screenshot of a graph

AI-generated content may be incorrect.

* Membuat data time series

A black background with white text

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

* Melakukan plotting data

A graph with numbers and lines

AI-generated content may be incorrect.

* Melakukan uji Augment Dickey-Fuller

A black background with purple letters

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

* Melakukan uji Augmented Dickey-Fuller Test dengan difference



A screenshot of a computer

AI-generated content may be incorrect.

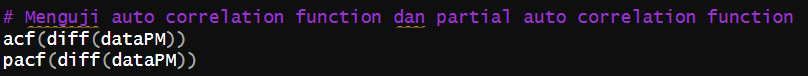
Setelah dilakukan difference sekali, data telah dianggap stasioner.

* Membuat canvas menjadi 2 baris dengan 1 kolom

A black background with purple and yellow text

AI-generated content may be incorrect.

* Melakukan Auto Correlation Function dan Partial Auto Correlation Function

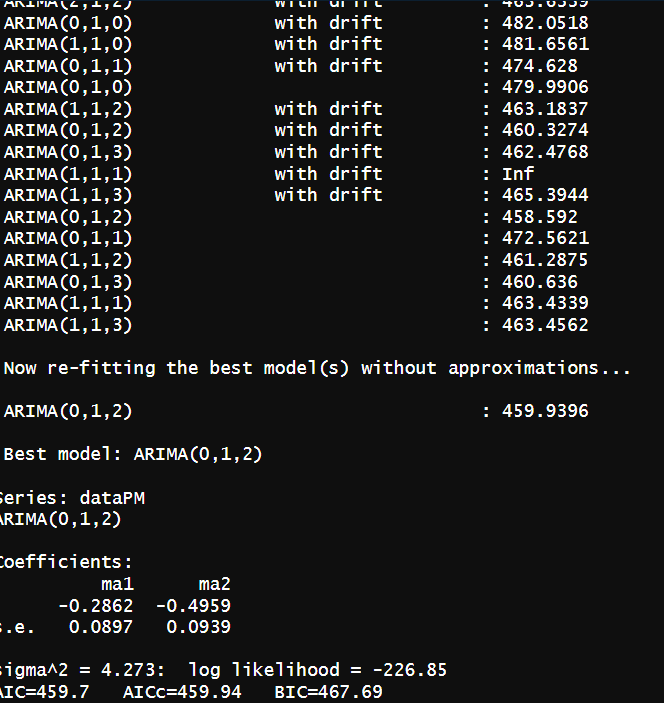


A graph of a graph

AI-generated content may be incorrect.

* Mengidentifikasi model ARIMA yang cocok untuk diterapkan





* Menerapkan model ARIMA (0,1,2) berdasarkan identifikasi

A black background with purple letters

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

* Melakukan uji coefficient



A screen shot of a computer

AI-generated content may be incorrect.

* Mengukur metrik Akaike Information Criterion (AIC)





* Melakukan peramalan 16 hari ke depan (print ouput dan plotting)

A purple text on a black background

AI-generated content may be incorrect.

A screen shot of a computer

AI-generated content may be incorrect.

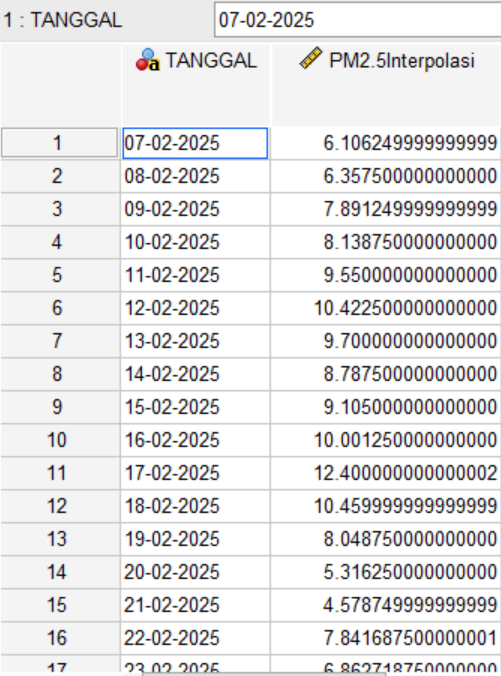
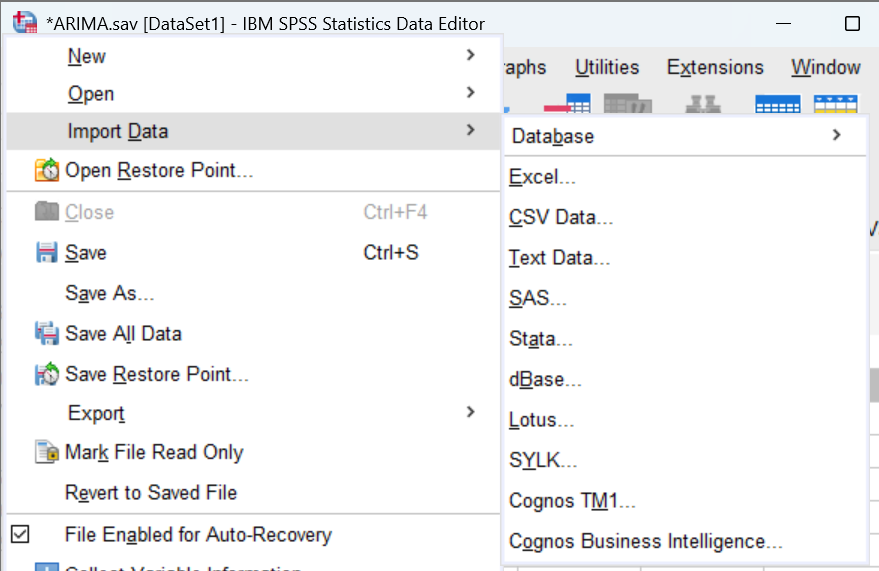
A hand holding a black screen

AI-generated content may be incorrect.

A graph with lines and numbers

AI-generated content may be incorrect.

* **Manual SPSS**
* Melakukan import data ke SPSS



* Membuat *object time series*

A screenshot of a computer

AI-generated content may be incorrect.

A screenshot of a computer

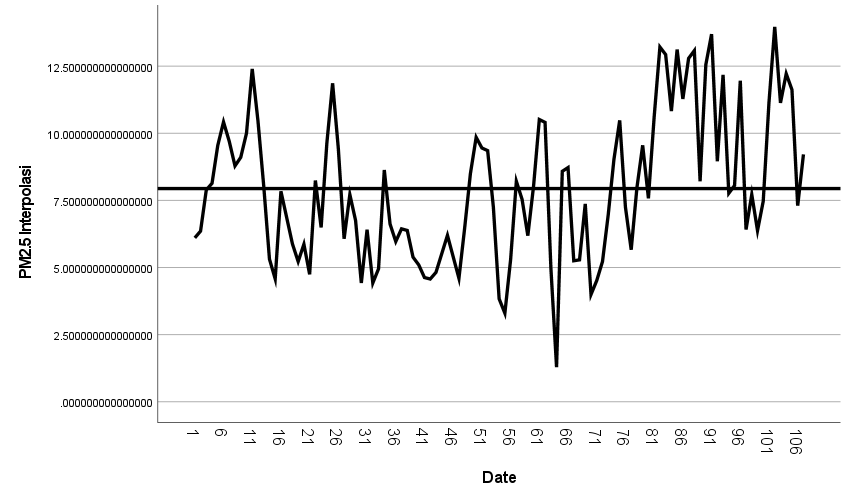
AI-generated content may be incorrect.

* Melakukan uji stasioneritas data (*Sequence Chart*)

A screenshot of a computer

AI-generated content may be incorrect.

|  |  |  |
| --- | --- | --- |
| **Model Description** | | |
| Model Name | | MOD\_1 |
| Series or Sequence | 1 | PM2.5 Interpolasi |
| Transformation | | None |
| Non-Seasonal Differencing | | 0 |
| Seasonal Differencing | | 0 |
| Length of Seasonal Period | | No periodicity |
| Horizontal Axis Labels | | Date\_ |
| Intervention Onsets | | None |
| Reference Lines | | Overall mean |
| Area Below the Curve | | Not filled |
| Applying the model specifications from MOD\_1 | | |



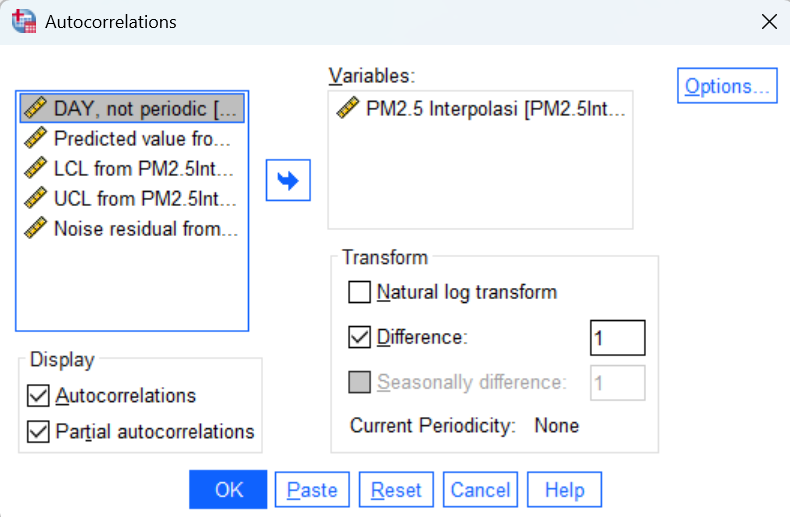
Dilakukan difference dan uji stasioneritas lagi

A graph showing a number of numbers and a line

AI-generated content may be incorrect.

Berdasarkan plotting, data tersebut telah dianggap stasioner.

* Melakukan correlogram ACF (MA) dan PACF (AR)



A graph with blue squares and black lines

AI-generated content may be incorrect.

A graph with blue squares and black lines

AI-generated content may be incorrect.

* Melakukan *overfitting* yang terdiri dari Error terendah (RMSE, MAPE, N-BIC), Variabel Signifikan, Variabel Tidak Signifikan, *White-Noise* (Ljung-Box Q test)

Dimulai dari (0,0,0) sampai (2,1,2)

A screenshot of a computer

AI-generated content may be incorrect.

Sehingga hasil analisis dengan SPSS disimpan ke tabel berikut:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model ARIMA** | **Error** | | | **Variabel Signifikan** | **Variabel Non-Signifikan** | **Ujung Box Q-Test** | |  |
| **MAPE** | **RMSE** | **N-BIC** | **P Value** | **White-Noise** |  |
| (0,1,1**)** | **27.709** | **2.243** | **1.703** | **1** | **0** | **0.049** | **White-Noise** |  |
| (0,1,2**)** | **25.004** | **2.078** | **1.595** | **1** | **0** | **0.542** | **Tidak** | **Terpilih** |
| (1,1,0**)** | **27.397** | **2.308** | **1.761** | **0** | **1** | **0.002** | **White-Noise** |  |
| (1,1,1**)** | **26.76** | **2.124** | **1.638** | **2** | **1** | **0.114** | **Tidak** |  |
| (1,1,2**)** | **25.028** | **2.087** | **1.647** | **1** | **2** | **0.545** | **Tidak** |  |
| (2,1,0**)** | **26.165** | **2.167** | **1.679** | **0** | **2** | **0.297** | **Tidak** |  |
| (2,1,1**)** | **26.418** | **2.17** | **1.725** | **1** | **2** | **0.285** | **Tidak** |  |
| (2,1,2**)** | **26.427** | **2.118** | **1.721** | **2** | **2** | **0.117** | **Tidak** |  |

Berfasarkan table di atas, dapat ditentukan bahawa model terbaik ialah model 0,1,2.

* Melakukan peramalan (*forecasting*)

Melakukan peramalan 16 hari ke depan

A screenshot of a computer

AI-generated content may be incorrect.

|  |  |  |  |
| --- | --- | --- | --- |
| **Model Description** | | | |
|  | | | Model Type |
| Model ID | PM2.5 Interpolasi | Model\_1 | ARIMA(0,1,2) |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Fit** | | | | | | | | | | | |
| Fit Statistic | Mean | SE | Minimum | Maximum | Percentile | | | | | | |
| 5 | 10 | 25 | 50 | 75 | 90 | 95 |
| Stationary R-squared | .224 | . | .224 | .224 | .224 | .224 | .224 | .224 | .224 | .224 | .224 |
| R-squared | .425 | . | .425 | .425 | .425 | .425 | .425 | .425 | .425 | .425 | .425 |
| RMSE | 2.078 | . | 2.078 | 2.078 | 2.078 | 2.078 | 2.078 | 2.078 | 2.078 | 2.078 | 2.078 |
| MAPE | 25.004 | . | 25.004 | 25.004 | 25.004 | 25.004 | 25.004 | 25.004 | 25.004 | 25.004 | 25.004 |
| MaxAPE | 317.459 | . | 317.459 | 317.459 | 317.459 | 317.459 | 317.459 | 317.459 | 317.459 | 317.459 | 317.459 |
| MAE | 1.656 | . | 1.656 | 1.656 | 1.656 | 1.656 | 1.656 | 1.656 | 1.656 | 1.656 | 1.656 |
| MaxAE | 5.048 | . | 5.048 | 5.048 | 5.048 | 5.048 | 5.048 | 5.048 | 5.048 | 5.048 | 5.048 |
| Normalized BIC | 1.595 | . | 1.595 | 1.595 | 1.595 | 1.595 | 1.595 | 1.595 | 1.595 | 1.595 | 1.595 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ARIMA Model Parameters** | | | | | | | | |
|  | | | | | Estimate | SE | t | Sig. |
| PM2.5 Interpolasi-Model\_1 | PM2.5 Interpolasi | No Transformation | Constant | | .022 | .045 | .496 | .621 |
| Difference | | 1 |  |  |  |
| MA | Lag 1 | .290 | .086 | 3.364 | .001 |
| Lag 2 | .501 | .087 | 5.793 | .000 |

A graph with red and blue lines

AI-generated content may be incorrect.

Dengan hasil peramalan sebagai berikut:

A screenshot of a computer

AI-generated content may be incorrect.