# LAMPIRAN

**Data Laporan Kerja Praktik, Data Transformasi dan Data *Dideffencing***

| DATA CURAH HUJAN | TRANSFORMASI 1 | TRANSFORMASI 2 | DIFFERENCING NON MUSIMAN | DIFFERENCING MUSIMAN |
|---|---|---|---|---|
| 296,0 | 17,20465053 | 4,147848904 | * | * |
| 272,0 | 16,4924225 | 4,06108637 | -0,086762535 | * |
| 329,5 | 18,15213486 | 4,260532227 | 0,199445858 | * |
| 186,0 | 13,6381817 | 3,692990888 | -0,56754134 | * |
| 107,5 | 10,36822068 | 3,219972155 | -0,473018733 | * |
| 124,5 | 11,1579568 | 3,340352796 | 0,120380641 | * |
| 4,0 | 2,0000000 | 1,414213562 | -1,926139234 | * |
| 15,0 | 3,872983346 | 1,967989671 | 0,553776109 | * |
| 14,0 | 3,741657387 | 1,93433642 | -0,033653251 | * |
| 39,0 | 6,244997998 | 2,498999399 | 0,564662979 | * |
| 121,0 | 11,0000000 | 3,31662479 | 0,817625391 | * |
| 425,0 | 20,61552813 | 4,540432593 | 1,223807802 | * |
| 493,0 | 22,20360331 | 4,71206996 | 0,171637368 | * |
| 195,0 | 13,96424004 | 3,736875706 | -0,975194254 | -0,888431719 |
| 228,0 | 15,09966887 | 3,885829238 | 0,148953532 | -0,050492325 |
| 151,0 | 12,28820573 | 3,505453712 | -0,380375526 | 0,187165813 |
| 234,0 | 15,29705854 | 3,911145426 | 0,405691714 | 0,878710447 |
| 112,0 | 10,58300524 | 3,253153123 | -0,657992302 | -0,778372944 |
| 294,0 | 17,1464282 | 4,14082458 | 0,887671456 | 2,81381069 |
| 94,0 | 9,695359715 | 3,113737258 | -1,027087321 | -1,58086343 |
| 54,0 | 7,348469228 | 2,710806011 | -0,402931248 | -0,369277997 |
| 104,0 | 10,19803903 | 3,193436868 | 0,482630857 | -0,082032122 |
| 216,0 | 14,69693846 | 3,833658625 | 0,640221758 | -0,177403633 |
| 635,0 | 25,19920634 | 5,019881108 | 1,186222482 | -0,03758532 |
| 300,0 | 17,32050808 | 4,16179145 | -0,858089658 | -1,029727025 |
| 360,0 | 18,97366596 | 4,355877175 | 0,194085724 | 1,169279979 |
| 134,0 | 11,5758369 | 3,402328159 | -0,953549016 | -1,102502548 |
| 128,0 | 11,3137085 | 3,363585661 | -0,038742498 | 0,341633028 |
| 331,0 | 18,1934054 | 4,265372832 | 0,901787171 | 0,496095458 |
| 207,0 | 14,38749457 | 3,793085099 | -0,472287733 | 0,185704569 |
| 121,0 | 11,0000000 | 3,31662479 | -0,476460309 | -1,364131765 |
| 180,0 | 13,41640786 | 3,662841501 | 0,346216711 | 1,373304032 |
| 124,0 | 11,13552873 | 3,336993965 | -0,325847536 | 0,077083712 |
| 225,0 | 15,0000 | 3,872983346 | 0,535989381 | 0,053358524 |
| 274,0 | 16,55294536 | 4,068531106 | 0,195547759 | -0,444673999 |
| 300,0 | 17,32050808 | 4,16179145 | 0,093260345 | -1,092962138 |
| 426,0 | 20,63976744 | 4,543101082 | 0,381309632 | 1,239399289 |

Lanjutan

| DATA CURAH HUJAN | TRANSFORMASI 1 | TRANSFORMASI 2 | DIFFERENCING NON MUSIMAN | DIFFERENCING MUSIMAN |
|---|---|---|---|---|
| 274,0 | 16,55294536 | 4,068531106 | -0,474569976 | -0,668655701 |
| 269,0 | 16,40121947 | 4,049841906 | -0,018689199 | 0,934859816 |
| 252,0 | 15,87450787 | 3,984282604 | -0,065559303 | -0,026816805 |
| 59,0 | 7,681145748 | 2,771488002 | -1,212794601 | -2,114581773 |
| 72,0 | 8,485281374 | 2,91295063 | 0,141462628 | 0,613750361 |
| 34,0 | 5,830951895 | 2,414736403 | -0,498214227 | -0,021753919 |
| 14,0 | 3,741657387 | 1,93433642 | -0,480399982 | -0,826616694 |
| 4,0 | 2,0000 | 1,414213562 | -0,520122858 | -0,194275322 |
| 93,0 | 9,643650761 | 3,105422799 | 1,691209237 | 1,155219856 |
| 129,0 | 11,35781669 | 3,370136005 | 0,264713206 | 0,069165446 |
| 153,0 | 12,36931688 | 3,517003963 | 0,146867958 | 0,053607614 |
| 327,0 | 18,08314132 | 4,252427697 | 0,735423734 | 0,354114102 |
| 307,0 | 17,52141547 | 4,185858988 | -0,066568709 | 0,408001267 |
| 82,0 | 9,055385138 | 3,009216698 | -1,17664229 | -1,15795309 |
| 160,0 | 12,64911064 | 3,55655882 | 0,547342122 | 0,612901424 |
| 92,0 | 9,591663047 | 3,097041015 | -0,459517805 | 0,753276796 |
| 246,0 | 15,68438714 | 3,960351896 | 0,863310881 | 0,721848254 |
| 49,0 | 7,0000 | 2,645751311 | -1,314600585 | -0,816386358 |
| 71,0 | 8,426149773 | 2,902783108 | 0,257031797 | 0,73743178 |
| 20,0 | 4,472135955 | 2,114742527 | -0,788040581 | -0,267917723 |
| 85,0 | 9,219544457 | 3,036370277 | 0,92162775 | -0,769581487 |
| 121,0 | 11,0000 | 3,31662479 | 0,280254514 | 0,015541308 |
| 230,0 | 15,16575089 | 3,894322905 | 0,577698115 | 0,430830156 |
| 234,0 | 15,29705854 | 3,911145426 | 0,016822521 | -0,718601213 |
| 337,0 | 18,35755975 | 4,284572295 | 0,373426869 | 0,439995578 |
| 180,0 | 13,41640786 | 3,662841501 | -0,621730793 | 0,554911496 |
| 144,0 | 12,0000 | 3,464101615 | -0,198739886 | -0,746082008 |
| 43,0 | 6,557438524 | 2,560749602 | -0,903352013 | -0,443834208 |
| 51,0 | 7,141428429 | 2,672345118 | 0,111595516 | -0,751715366 |
| 49,0 | 7,0000 | 2,645751311 | -0,026593807 | 1,288006778 |
| 35,0 | 5,916079783 | 2,432299279 | -0,213452032 | -0,470483829 |
| 62,0 | 7,874007874 | 2,806066263 | 0,373766984 | 1,161807566 |
| 115,0 | 10,72380529 | 3,274722171 | 0,468655907 | -0,452971843 |
| 169,0 | 13,0000 | 3,605551275 | 0,330829105 | 0,050574591 |
| 257,0 | 16,03121954 | 4,003900541 | 0,398349265 | -0,179348849 |
| 456,0 | 21,3541565 | 4,621055778 | 0,571213872 | 0,197787002 |
| 451,0 | 21,23676058 | 4,608335988 | -0,01271979 | 0,609011004 |
| 169,0 | 13,0000 | 3,605551275 | -1,002784713 | -0,804044827 |

Lanjutan

| DATA CURAH HUJAN | TRANSFORMASI 1 | TRANSFORMASI 2 | DIFFERENCING NON MUSIMAN | DIFFERENCING MUSIMAN |
|---|---|---|---|---|
| 270,0 | 16,43167673 | 4,053600464 | 0,448049189 | 1,351401202 |
| 97,0 | 9,848857802 | 3,138288993 | -0,915311472 | -1,026906987 |
| 16,0 | 4,0000 | 2,0000 | -1,138288993 | -1,111695186 |
| 15,0 | 3,872983346 | 1,967989671 | -0,032010329 | 0,181441703 |
| 175,0 | 13,22875656 | 3,637135763 | 1,669146091 | 1,295379107 |
| 59,0 | 7,681145748 | 2,771488002 | -0,86564776 | -1,334303667 |
| 144,0 | 12,00000000 | 3,464101615 | 0,692613613 | 0,361784508 |
| 219,0 | 14,79864859 | 3,846901167 | 0,382799552 | -0,015549714 |

***Output Final Estimates Of Parameter* Model *Seasonal* ARIMA Dengan Cara *Trial and Error* Menggunakan *Software* Minitab 17**

1. Model ARIMA $(0,1,1)\ (0,1,1)^{12}$

```
Final Estimates of Parameters

Type          Coef  SE Coef      T      P
MA   1      0.8398   0.0670  12.53  0.000
SMA  12     0.8913   0.1038   8.59  0.000
Constant   -0.0187   0.5530  -0.03  0.973


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  608630 (backforecasts excluded)
              MS =  8950  DF = 68


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag             12     24     36     48
Chi-Square     6.6   11.6   21.6   28.4
DF               9     21     33     45
P-Value      0.676  0.950  0.937  0.974
```

## 2. Model ARIMA (0,1,1) $(1,1,0)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
SAR  12   -0.5549   0.1091  -5.09  0.000
MA   1     0.8222   0.0675  12.19  0.000
Constant   -0.317    2.283  -0.14  0.890


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  794054 (backforecasts excluded)
              MS =  11677  DF = 68


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    6.9   21.8   35.0   43.0
DF              9     21     33     45
P-Value     0.649  0.413  0.374  0.556
```

## 3. Model ARIMA (0,1,1) $(1,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
SAR  12   -0.0700   0.1542  -0.45  0.651
MA   1     0.8418   0.0668  12.61  0.000
SMA  12    0.8883   0.1170   7.59  0.000
Constant  -0.0049   0.3813  -0.01  0.990


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  606675 (backforecasts excluded)
              MS =  9055  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    7.0   12.1   22.1   30.2
DF              8     20     32     44
P-Value     0.538  0.913  0.905  0.945
```

## 4. Model ARIMA (0,1,1) $(2,1,0)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
SAR  12   -0.8801   0.1084  -8.12  0.000
SAR  24   -0.8838   0.1053  -8.39  0.000
MA   1     0.8711   0.0638  13.66  0.000
Constant    0.689    1.536   0.45  0.655


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  658844 (backforecasts excluded)
              MS =  9833  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    4.7   13.0   28.9   31.5
DF              8     20     32     44
P-Value     0.787  0.876  0.625  0.920
```

## 5. Model ARIMA (0,1,1) $(2,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
SAR  12   -0.1872   0.1434  -1.31  0.196
SAR  24   -0.4821   0.1361  -3.54  0.001
MA   1     0.8625   0.0632  13.66  0.000
SMA  12    0.7890   0.1617   4.88  0.000
Constant  -0.2251   0.3937  -0.57  0.570


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  553065 (backforecasts excluded)
              MS =  8380  DF = 66


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    9.0   12.7   29.0   37.4
DF              7     19     31     43
P-Value     0.252  0.856  0.568  0.712
```

## 6. Model ARIMA $(1,1,0)\ (0,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.4818   0.1050  -4.59  0.000
SMA  12    0.8984   0.0951   9.45  0.000
Constant   -1.492    2.862  -0.52  0.604


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  803047 (backforecasts excluded)
              MS =  11810  DF = 68


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square   14.4   20.7   28.6   37.6
DF              9     21     33     45
P-Value     0.110  0.478  0.688  0.774
```

## 7. Model ARIMA $(1,1,0)\ (1,1,0)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.5474   0.1005  -5.45  0.000
SAR  12   -0.5653   0.1062  -5.32  0.000
Constant    -1.92    14.20  -0.14  0.893


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  973729 (backforecasts excluded)
              MS =  14320  DF = 68


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square   17.0   36.1   44.3   56.9
DF              9     21     33     45
P-Value     0.048  0.021  0.090  0.111
```

## 8. Model ARIMA (1,1,0) $(1,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.4788   0.1062  -4.51  0.000
SAR  12   -0.0201   0.1528  -0.13  0.895
SMA  12    0.9001   0.1102   8.17  0.000
Constant   -1.259    2.556  -0.49  0.624


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  804364 (backforecasts excluded)
              MS =  12005  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square   14.6   20.7   28.9   38.1
DF              8     20     32     44
P-Value     0.067  0.413  0.627  0.722
```

## 9. Model ARIMA (1,1,0) $(2,1,0)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.5259   0.1025  -5.13  0.000
SAR  12   -0.8165   0.1125  -7.26  0.000
SAR  24   -0.6512   0.1126  -5.78  0.000
Constant    -1.69    13.32  -0.13  0.900


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  843555 (backforecasts excluded)
              MS =  12590  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square   14.8   26.1   50.2   56.6
DF              8     20     32     44
P-Value     0.064  0.163  0.022  0.097
```

## 10. Model ARIMA (1,1,0) $(2,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.4685   0.1079  -4.34  0.000
SAR  12   -0.1016   0.1779  -0.57  0.570
SAR  24   -0.2420   0.1578  -1.53  0.130
SMA  12    0.7938   0.1994   3.98  0.000
Constant   -2.481    3.036  -0.82  0.417


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  794644 (backforecasts excluded)
              MS =  12040  DF = 66


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square   15.4   19.3   34.3   41.3
DF              7     19     31     43
P-Value     0.032  0.440  0.312  0.545
```

## 11. Model ARIMA (1,1,1) $(0,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1     0.0058   0.1434   0.04  0.968
MA   1     0.8415   0.0798  10.54  0.000
SMA  12    0.8911   0.1047   8.51  0.000
Constant  -0.0160   0.5476  -0.03  0.977


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  608980 (backforecasts excluded)
              MS =  9089  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    6.6   11.5   21.6   28.4
DF              8     20     32     44
P-Value     0.585  0.931  0.919  0.968
```

## 12. Model ARIMA (1,1,1) $(1,1,0)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1    -0.0838   0.1471  -0.57  0.571
SAR  12   -0.5534   0.1101  -5.02  0.000
MA   1     0.7855   0.0912   8.61  0.000
Constant   -0.358    2.772  -0.13  0.898


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  790101 (backforecasts excluded)
              MS =  11793  DF = 67


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    7.2   21.5   34.4   43.2
DF              8     20     32     44
P-Value     0.511  0.369  0.352  0.508
```

## 13. Model ARIMA (1,1,1) $(1,1,1)^{12}$

```
Final Estimates of Parameters

Type         Coef  SE Coef      T      P
AR   1     0.0162   0.1442   0.11  0.911
SAR  12   -0.0720   0.1555  -0.46  0.645
MA   1     0.8462   0.0788  10.74  0.000
SMA  12    0.8881   0.1184   7.50  0.000
Constant   0.0057   0.3777   0.02  0.988


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  607519 (backforecasts excluded)
              MS =  9205  DF = 66


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag            12     24     36     48
Chi-Square    6.8   11.9   22.1   30.0
DF              7     19     31     43
P-Value     0.451  0.888  0.881  0.934
```

## 14. Model ARIMA (1,1,1) $(2,1,0)^{12}$

Final Estimates of Parameters

| Type | | Coef | SE Coef | T | P |
|---|---|---|---|---|---|
| AR | 1 | -0.1043 | 0.1428 | -0.73 | 0.468 |
| SAR | 12 | -0.8940 | 0.1095 | -8.17 | 0.000 |
| SAR | 24 | -0.8834 | 0.1072 | -8.24 | 0.000 |
| MA | 1 | 0.8323 | 0.0819 | 10.16 | 0.000 |
| Constant | | 0.697 | 1.991 | 0.35 | 0.727 |

Differencing: 1 regular, 1 seasonal of order 12
Number of observations: Original series 84, after differencing 71
Residuals: SS = 654844 (backforecasts excluded)
MS = 9922 DF = 66

Modified Box-Pierce (Ljung-Box) Chi-Square statistic

| Lag | 12 | 24 | 36 | 48 |
|---|---|---|---|---|
| Chi-Square | 5.2 | 15.0 | 29.7 | 32.1 |
| DF | 7 | 19 | 31 | 43 |
| P-Value | 0.634 | 0.721 | 0.530 | 0.890 |

## 15. Model ARIMA (1,1,1) $(2,1,1)^{12}$

Final Estimates of Parameters

| Type | | Coef | SE Coef | T | P |
|---|---|---|---|---|---|
| AR | 1 | -0.0943 | 0.1450 | -0.65 | 0.518 |
| SAR | 12 | -0.8280 | 0.1387 | -5.97 | 0.000 |
| SAR | 24 | -0.7884 | 0.1151 | -6.85 | 0.000 |
| MA | 1 | 0.8280 | 0.0836 | 9.91 | 0.000 |
| SMA | 12 | 0.0029 | 0.1882 | 0.02 | 0.988 |
| Constant | | 0.563 | 2.019 | 0.28 | 0.781 |

Differencing: 1 regular, 1 seasonal of order 12
Number of observations: Original series 84, after differencing 71
Residuals: SS = 624950 (backforecasts excluded)
MS = 9615 DF = 65

Modified Box-Pierce (Ljung-Box) Chi-Square statistic

| Lag | 12 | 24 | 36 | 48 |
|---|---|---|---|---|
| Chi-Square | 4.6 | 13.7 | 31.5 | 34.6 |
| DF | 6 | 18 | 30 | 42 |
| P-Value | 0.602 | 0.748 | 0.393 | 0.783 |

**Output Hasil Peraman Jumlah Curah Hujan di Kabupaten Lampung Tengah Periode Januari - Desember 2020 Dengan Model ARIMA (0,1,1) $(0,1,1)^{12}$**

## ARIMA Model: DATA CURAH HUJAN

```
Estimates at each iteration

Iteration      SSE       Parameters
        0  1626961  0.100  0.100  -3.210
        1  1338046  0.250  0.185  -2.741
        2  1118991  0.400  0.282  -2.017
        3   951779  0.550  0.393  -1.256
        4   826276  0.700  0.528  -0.623
        5   751260  0.804  0.678  -0.382
        6   704085  0.842  0.828  -0.462
        7   695306  0.843  0.874  -0.289
        8   694185  0.840  0.884  -0.113
        9   694005  0.840  0.888  -0.060
       10   693977  0.840  0.890  -0.034
       11   693973  0.840  0.891  -0.025
       12   693972  0.840  0.891  -0.020
       13   693972  0.840  0.891  -0.019

Unable to reduce sum of squares any further


Final Estimates of Parameters

Type          Coef  SE Coef      T      P
MA   1      0.8398   0.0670  12.53  0.000
SMA  12     0.8913   0.1038   8.59  0.000
Constant   -0.0187   0.5530  -0.03  0.973


Differencing: 1 regular, 1 seasonal of order 12
Number of observations:  Original series 84, after differencing 71
Residuals:    SS =  608630 (backforecasts excluded)
              MS =  8950  DF = 68


Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag             12     24     36     48
Chi-Square     6.6   11.6   21.6   28.4
DF               9     21     33     45
P-Value      0.676  0.950  0.937  0.974


Forecasts from period 84

                     95% Limits
Period  Forecast     Lower    Upper  Actual
    85   318.485   133.019  503.952
    86   328.176   140.345  516.006
    87   231.169    41.004  421.333
```

| | | | |
|---|---|---|---|
| 88 | 171.663 | -20.807 | 364.134 |
| 89 | 140.305 | -54.444 | 335.055 |
| 90 | 119.400 | -77.601 | 316.402 |
| 91 | 79.913 | -119.316 | 279.141 |
| 92 | 61.781 | -139.649 | 263.212 |
| 93 | 71.148 | -132.461 | 274.757 |
| 94 | 113.065 | -92.699 | 318.830 |
| 95 | 174.668 | -33.230 | 382.565 |
| 96 | 311.980 | 101.971 | 521.989 |