LAMPIRAN

Lampiran 01. Data Analisis

TPK Hotel seluruh Kelas Bintang (Persen)													
Periode	Januari	Februari	Maret	April	Mei	Juni	Juli	Agustus	September	Oktober	November	Desember
2011	64.66	62.23	63.16	64.03	62.9	70.47	71.74	62.69	65.01	65.63	60.15	61.59
2012	62.01	55.52	59.39	59.01	60.21	64.31	62.28	62.17	62.22	65.8	61.07	63.2
2013	57.57	58.05	60.12	58.21	60.31	61.05	62.44	62.64	63.76	60.57	60.94	62.53
2014	57.76	59.13	59.87	61.28	61.01	62.1	61.4	62.07	63.87	62.83	61.36	51.07
2015	53.45	60.03	54.5	54.7	57.51	61.76	64.29	67.49	67.65	65.01	59.09	60.32
2016	54.38	62.46	58.56	55.08	60.04	56.77	70.62	72.4	68.26	62.19	59.71	60.08
2017	59.61	60.82	56.58	58.54	61.91	66.72	72.32	74.86	72.64	65.93	54.08	50.66
2018	52.97	66.66	61.19	63.53	67.55	70.32	74.4	73.83	69.52	68.06	55.92	57.62
2019	53.27	56.48	55.43	60.33	51.56	60.37	61.71	67.1	63.22	63.3	59.46	62.55
2020	59.29	45.98	25.41	3.22	2.07	2.07	2.57	3.68	5.28	9.53	9.32	19
2021	11.15	8.99	10.24	10.09	10.35	16.68	5.23	4.77	9.46	17.73	20.67	30.67
2022	20.71	14.86	21.9	18.98	37.35							

Sumber: BPS Provinsi Bali

Lampiran 02. Hasil Uji ADF Data Praintervensi

- **Hasil Uji ADF data praintervensi sebelum *differencing***

```
> adf.test(Nt)

        Augmented Dickey-Fuller Test

data:  Nt
Dickey-Fuller = -4.8969, Lag order = 4, p-value = 0.01
alternative hypothesis: stationary
```

- **Hasil Uji ADF data praintervensi setelah *differencing* non musiman (*d*=1)**

```
> adf.test(diffNt)

        Augmented Dickey-Fuller Test

data:  diffNt
Dickey-Fuller = -5.819, Lag order = 4, p-value = 0.01
alternative hypothesis: stationary
```

- **Hasil Uji ADF data praintervensi setelah *differencing* musiman (*D*=1)**

```
> adf.test(diffmusiman)

        Augmented Dickey-Fuller Test

data:  diffmusiman
Dickey-Fuller = -5.2527, Lag order = 4, p-value = 0.01
alternative hypothesis: stationary
```

Lampiran 03. Estimasi Model ARIMA Dugaan Sementara

```
> coeftest(model2)

z test of coefficients:

     Estimate Std. Error z value Pr(>|z|)
ar1  -0.28261    0.10818 -2.6125 0.008988 **
sar1 -0.25642    0.10959 -2.3399 0.019288 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model3)

z test of coefficients:

     Estimate Std. Error z value Pr(>|z|)
ma1  -0.62395    0.15959 -3.9097 9.24e-05 ***
sma1 -0.50055    0.15995 -3.1295 0.001751 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model4)

z test of coefficients:

    Estimate Std. Error z value  Pr(>|z|)
ma1 -0.61213    0.13113 -4.6683 3.037e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model5)

z test of coefficients:

     Estimate Std. Error z value  Pr(>|z|)
ma1  -0.59738    0.14424 -4.1417 3.448e-05 ***
sar1 -0.22340    0.11066 -2.0188    0.0435 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model6)

z test of coefficients:

     Estimate Std. Error z value  Pr(>|z|)
sma1 -0.55683    0.16035 -3.4726 0.0005155 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
> coeftest(model7)

z test of coefficients:

      Estimate Std. Error  z value  Pr(>|z|)
ar1   0.409744   0.120131   3.4108 0.0006477 ***
ma1  -0.908209   0.062893 -14.4406 < 2.2e-16 ***
sma1 -0.501199   0.164169  -3.0530 0.0022660 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model8)

z test of coefficients:

      Estimate Std. Error  z value  Pr(>|z|)
ar1   0.430614   0.118599   3.6309 0.0002825 ***
ma1  -0.927787   0.062494 -14.8460 < 2.2e-16 ***
sar1 -0.255227   0.111843  -2.2820 0.0224886 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
> coeftest(model9)

z test of coefficients:

     Estimate Std. Error z value Pr(>|z|)
ar1  -0.27641    0.10768 -2.5669 0.010261 *
sma1 -0.52540    0.16732 -3.1402 0.001688 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model10)

z test of coefficients:

      Estimate Std. Error  z value  Pr(>|z|)
ar1   0.415244   0.122582   3.3875 0.0007054 ***
ar2  -0.029076   0.121027  -0.2402 0.8101413
ma1  -0.901572   0.068932 -13.0792 < 2.2e-16 ***
sma1 -0.505538   0.163835  -3.0857 0.0020310 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model11)

z test of coefficients:

      Estimate Std. Error z value Pr(>|z|)
ar1   0.360418   0.272099  1.3246 0.185309
ma1  -0.849589   0.290104 -2.9286 0.003405 **
ma2  -0.048738   0.234219 -0.2081 0.835160
sma1 -0.504246   0.163852 -3.0774 0.002088 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model12)

z test of coefficients:

      Estimate Std. Error z value  Pr(>|z|)
ma1  -0.517396   0.098613 -5.2467 1.548e-07 ***
ma2  -0.295899   0.096887 -3.0541 0.0022576 **
sma1 -0.522552   0.156140 -3.3467 0.0008178 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model13)

z test of coefficients:

     Estimate Std. Error z value Pr(>|z|)
ar1  -0.33638    0.11106 -3.0287 0.002456 **
ar2  -0.20018    0.10978 -1.8234 0.068247 .
sma1 -0.51575    0.16460 -3.1334 0.001728 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> coeftest(model14)

z test of coefficients:

      Estimate Std. Error  z value  Pr(>|z|)
ar1   1.482171   0.088260  16.7933 < 2.2e-16 ***
ar2  -0.544503   0.090556  -6.0129 1.823e-09 ***
ma1  -1.972527   0.124960 -15.7852 < 2.2e-16 ***
ma2   0.999736   0.126629   7.8950 2.904e-15 ***
sma1 -0.582449   0.162558  -3.5830 0.0003396 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Lampiran 04. Pengujian Diagnostik Model ARIMA

- ***Ljung-Box***

```
> checkresiduals(model2)

        Ljung-Box test

data:  Residuals from ARIMA(1,1,0)(1,1,0)[12]
Q* = 39.238, df = 20, p-value = 0.006227

Model df: 2.   Total lags used: 22

> checkresiduals(model3)

        Ljung-Box test

data:  Residuals from ARIMA(0,1,1)(0,1,1)[12]
Q* = 30.115, df = 20, p-value = 0.06801

Model df: 2.   Total lags used: 22

> checkresiduals(model4)

        Ljung-Box test

data:  Residuals from ARIMA(0,1,1)(0,1,0)[12]
Q* = 36.653, df = 21, p-value = 0.01845

Model df: 1.   Total lags used: 22

> checkresiduals(model5)

        Ljung-Box test

data:  Residuals from ARIMA(0,1,1)(1,1,0)[12]
Q* = 33.298, df = 20, p-value = 0.03128

Model df: 2.   Total lags used: 22

> checkresiduals(model6)

        Ljung-Box test

data:  Residuals from ARIMA(0,1,0)(0,1,1)[12]
Q* = 33.503, df = 21, p-value = 0.04093

Model df: 1.   Total lags used: 22

> checkresiduals(model7)

        Ljung-Box test

data:  Residuals from ARIMA(1,1,1)(0,1,1)[12]
Q* = 19.02, df = 19, p-value = 0.4556

Model df: 3.   Total lags used: 22

> checkresiduals(model8)

        Ljung-Box test

data:  Residuals from ARIMA(1,1,1)(1,1,0)[12]
Q* = 22.372, df = 19, p-value = 0.2661

Model df: 3.   Total lags used: 22
```

```
> checkresiduals(model9)

        Ljung-Box test

data:  Residuals from ARIMA(1,1,0)(0,1,1)[12]
Q* = 33.974, df = 20, p-value = 0.0263

Model df: 2.   Total lags used: 22

> checkresiduals(model12)

        Ljung-Box test

data:  Residuals from ARIMA(0,1,2)(0,1,1)[12]
Q* = 18.113, df = 19, p-value = 0.5149

Model df: 3.   Total lags used: 22

> checkresiduals(model14)

        Ljung-Box test

data:  Residuals from ARIMA(2,1,2)(0,1,1)[12]
Q* = 18.533, df = 17, p-value = 0.356

Model df: 5.   Total lags used: 22
```

- **Normalitas**

```
> ks.test(model3$residuals, "pnorm", mean(model3$residuals), sd(model3$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  model3$residuals
D = 0.1115, p-value = 0.1297
alternative hypothesis: two-sided

> ks.test(model7$residuals, "pnorm", mean(model7$residuals), sd(model7$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  model7$residuals
D = 0.13028, p-value = 0.04779
alternative hypothesis: two-sided

> ks.test(model8$residuals, "pnorm", mean(model8$residuals), sd(model8$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  model8$residuals
D = 0.14174, p-value = 0.02407
alternative hypothesis: two-sided

> ks.test(model12$residuals, "pnorm", mean(model12$residuals), sd(model12$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  model12$residuals
D = 0.14232, p-value = 0.02321
alternative hypothesis: two-sided

> ks.test(model14$residuals, "pnorm", mean(model14$residuals), sd(model14$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  model14$residuals
D = 0.11681, p-value = 0.09938
alternative hypothesis: two-sided
```

Lampiran 05. Peramalan Data Intervensi 1 dengan Model ARIMA

```
> frc.modelNt
         Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
Mar 2020       50.71371 46.86621 55.24941 45.05665 57.99519
Apr 2020       55.76918 50.77483 61.85318 48.47668 65.64411
May 2020       54.50834 49.62704 60.45460 47.38090 64.15968
Jun 2020       60.07201 54.13795 67.46700 51.44762 72.17002
```

Lampiran 06. Penduga Parameter dan Pengujian Diagnostik Intervensi 1

- **Estimasi Model Intervensi 1**

```
> coeftest(model.intv1)

z test of coefficients:

            Estimate  Std. Error  z value  Pr(>|z|)
ar1       4.4714e-01  1.1869e-01   3.7672 0.0001651 ***
ma1      -9.1556e-01  6.5518e-02 -13.9742 < 2.2e-16 ***
sma1     -4.8265e-01  1.7035e-01  -2.8333 0.0046068 **
T111-MA0 -8.9009e+02  2.5602e+02  -3.4767 0.0005076 ***
T111-MA1 -1.5384e+03  2.9165e+02  -5.2749 1.328e-07 ***
T111-MA2 -1.4644e+03  3.1492e+02  -4.6501 3.317e-06 ***
T111-MA3 -1.8326e+03  3.1071e+02  -5.8980 3.680e-09 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

- **Uji Diagnostik**

```
> checkresiduals(ARIMA_train1)

        Ljung-Box test

data:  Residuals from Regression with ARIMA(1,1,1)(0,1,1)[12] errors
Q* = 23.307, df = 19, p-value = 0.2241

Model df: 4.   Total lags used: 23

> ks.test(ARIMA_train1$residuals, "pnorm",mean(ARIMA_train1$residuals)
+         ,sd(ARIMA_train1$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  ARIMA_train1$residuals
D = 0.1392, p-value = 0.02412
alternative hypothesis: two-sided
```

Lampiran 07. Peramalan Data Intervensi 2 dengan Model Intervensi 1

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
Jul 2020	63.628000	58.170518	68.65304	55.062993	71.16967
Aug 2020	66.332258	60.178199	71.96198	56.650482	74.77080
Sep 2020	62.581808	55.611472	68.85010	51.541448	71.94762
Oct 2020	60.552367	53.096520	67.18590	48.689679	70.44509
Nov 2020	53.094661	44.233118	60.67559	38.729937	64.32808
Dec 2020	54.625371	45.934242	62.11214	40.587000	65.73113
Jan 2021	51.706583	42.306326	59.64334	36.359386	63.44418
Feb 2021	48.793133	38.576371	57.21378	31.868676	61.20424
Mar 2021	42.130481	29.562481	51.73038	19.924191	56.15183
Apr 2021	46.017896	34.762921	55.01680	26.966210	59.22968
May 2021	49.335268	38.946241	57.88904	32.113908	61.94083
Jun 2021	57.633032	48.954559	65.16589	43.667830	68.82061
Jul 2021	61.279957	52.293767	69.10744	46.844137	72.91172
Aug 2021	64.216591	55.292180	72.04392	49.926301	75.86126
Sep 2021	60.408963	50.544098	68.87519	44.444345	72.96037

Lampiran 08. Penduga Parameter serta Pengujian Diagnostik Intervensi 2

- **Estimasi Model Intervensi 2**

```
> coeftest(model.intv2)

z test of coefficients:

                                        Estimate  Std. Error  z value  Pr(>|z|)
ar1                                    5.7394e-01  8.6774e-02   6.6142 3.737e-11 ***
ma1                                   -9.9999e-01  4.9923e-02 -20.0305 < 2.2e-16 ***
sma1                                  -5.1152e-01  1.8338e-01  -2.7894  0.005281 **
T111_2-MA0                            -9.4311e+02  2.3079e+02  -4.0864 4.380e-05 ***
T111_2-MA1                            -1.5326e+03  2.7081e+02  -5.6594 1.519e-08 ***
T111_2-MA2                            -1.5369e+03  2.7579e+02  -5.5727 2.508e-08 ***
T111_2-MA3                            -1.7778e+03  2.5508e+02  -6.9694 3.184e-12 ***
X.T115...1....seq.train2.....115..-MA0 -1.8082e+03  1.8338e+02  -9.8606 < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

- **Uji Diagnosis**

```
> checkresiduals(ARIMA_train2)

        Ljung-Box test

data:  Residuals from Regression with ARIMA(1,1,1)(0,1,1)[12] errors
Q* = 28.479, df = 20, p-value = 0.09854

Model df: 4.   Total lags used: 24

> ks.test(ARIMA_train2$residuals, "pnorm",mean(ARIMA_train2$residuals),
+         sd(ARIMA_train2$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  ARIMA_train2$residuals
D = 0.097279, p-value = 0.1739
alternative hypothesis: two-sided
```

Lampiran 09. Peramalan Data Intervensi 3 dengan Model Intervensi 2

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
Oct 2021	24.405265	-9.852119	35.89349	-21.53493	40.68238
Nov 2021	6.842583	-29.755802	31.29000	-37.13389	38.37425
Dec 2021	14.122751	-29.874705	35.93665	-38.34808	43.23802
Jan 2022	-7.047600	-35.510071	34.08243	-43.61437	42.46008
Feb 2022	-7.295324	-36.868925	35.39572	-45.28522	44.09410
Mar 2022	-22.251409	-43.357216	29.82486	-51.11649	40.28093
Apr 2022	-22.307959	-44.154830	30.89145	-52.13745	41.50820
May 2022	-22.228153	-44.779155	31.88907	-52.96332	42.62437

Lampiran 10. Pendugaan Parameter serta Pengujian Diagnostik Intervensi 3

- **Estimasi Parameter Model Intervensi 3**

```
> coeftest(model.intv3)

z test of coefficients:

           Estimate Std. Error  z value  Pr(>|z|)
ar1        0.552817   0.090167   6.1310 8.731e-10 ***
ma1       -0.999999   0.030674 -32.6010 < 2.2e-16 ***
sma1      -0.286519   0.110687  -2.5886 0.0096377 **
T111-MA0 -21.589334   3.079542  -7.0106 2.374e-12 ***
T111-MA1 -44.552405   3.644730 -12.2238 < 2.2e-16 ***
T111-MA2 -43.954075   3.765805 -11.6719 < 2.2e-16 ***
T111-MA3 -48.761627   3.524836 -13.8337 < 2.2e-16 ***
T115-MA0 -42.064738   2.464624 -17.0674 < 2.2e-16 ***
T130-MA0   8.677471   2.630748   3.2985 0.0009721 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

- **Uji Diagnostik**

```
> checkresiduals(ARIMA_train3)

        Ljung-Box test

data:  Residuals from Regression with ARIMA(1,1,1)(0,1,1)[12] errors
Q* = 28.211, df = 20, p-value = 0.1045

Model df: 4.   Total lags used: 24

> ks.test(ARIMA_train3$residuals, "pnorm",mean(ARIMA_train3$residuals),
+         sd(ARIMA_train3$residuals))

        Asymptotic one-sample Kolmogorov-Smirnov test

data:  ARIMA_train3$residuals
D = 0.094019, p-value = 0.1837
alternative hypothesis: two-sided
```

Lampiran 11. *R Script* Dalam Analisis

```
library(forecast)
library(MASS)
library(lmtest)
library(tseries)
library(TSA)
library(tsoutliers)

#Input Data
library(readxl)
data.excel <- read_excel(file.choose())
data.excel
mydata <- data.excel
class(mydata)
#mendefinisikan data merupakan data time series
tsdata <- ts(data.excel$TPK, start = c(2011, 1), end = c(2022, 3), frequency =
12)
class(tsdata)
str(tsdata)

#plot data
plot(tsdata, main="Plot TPK Hotel Bintang Prov. Bali Jan 2011 - Mar 2022",
col="blue")
points(tsdata, cex=0.5, col="red", lwd=2)

#---------pemodelan ARIMA----------#

Nt <- ts(tsdata[1:110], start = (c(2011,1)), end = c(2020, 2), frequency = 12)
plot(Nt, col="blue")
points(Nt, cex=0.5, col="red", lwd=2)

#-Stasioneritas Data-#
boxcox(Nt~1, plotit = T, seq(-3,4))
adf.test(Nt)
acf(Nt,40)

#differencing non musiman (transformasi rata-rata)
diffNt <- diff(Nt)
acf(diffNt, 40)
pacf(diffNt, 40)
plot(diffNt, col="blue")
```

```
points(diffNt, cex=0.5, col="red", lwd=2)
adf.test(diffNt)

#differencing musiman
diffmusiman <- diff(diffNt, lag = 12)
par(mfrow = c(1,2))
acf(diffmusiman, 50)
pacf(diffmusiman, 50)
plot(diffmusiman, col="blue")
points(diffmusiman, cex=0.5, col="red", lwd=2)
adf.test(diffmusiman)

#identifikasi model (model-model sementara)
Nt_ARIMA <- auto.arima(Nt, d=1, D=1, seasonal=T, stepwise=T, trace=T,
                       lambda=lambda.model)
auto.arima(Nt, d=1, D=1)

#-estimasi parameter-#
model1 = arima(Nt, order=c(0,1,0), seasonal=list(order=c(0,1,0), period=12))
coeftest(model1)
model2 = arima(Nt, order=c(1,1,0), seasonal=list(order=c(1,1,0), period=12))
coeftest(model2)
model3 = arima(Nt, order=c(0,1,1), seasonal=list(order=c(0,1,1), period=12))
coeftest(model3)
model4 = arima(Nt, order=c(0,1,1), seasonal=list(order=c(0,1,0), period=12))
coeftest(model4)
model5 = arima(Nt, order=c(0,1,1), seasonal=list(order=c(1,1,0), period=12))
coeftest(model5)
model6 = arima(Nt, order=c(0,1,0), seasonal=list(order=c(0,1,1), period=12))
coeftest(model6)
model7 = arima(Nt, order=c(1,1,1), seasonal=list(order=c(0,1,1), period=12))
coeftest(model7)
model8 = arima(Nt, order=c(1,1,1), seasonal=list(order=c(1,1,0), period=12))
coeftest(model8)
model9 = arima(Nt, order=c(1,1,0), seasonal=list(order=c(0,1,1), period=12))
coeftest(model9)
model10 = arima(Nt, order=c(2,1,1), seasonal=list(order=c(0,1,1), period=12))
coeftest(model10)
model11 = arima(Nt, order=c(1,1,2), seasonal=list(order=c(0,1,1), period=12))
coeftest(model11)
model12 = arima(Nt, order=c(0,1,2), seasonal=list(order=c(0,1,1), period=12))
coeftest(model12)
```

```
model13 = arima(Nt, order=c(2,1,0), seasonal=list(order=c(0,1,1), period=12))
coeftest(model13)
model14 = arima(Nt, order=c(2,1,2), seasonal=list(order=c(0,1,1), period=12))
coeftest(model14)

#-uji diagnostik-#
#uji asumsi white noise (uji ljung-box)
checkresiduals(model2)
checkresiduals(model3)
checkresiduals(model4)
checkresiduals(model5)
checkresiduals(model6)
checkresiduals(model7)
checkresiduals(model8)
checkresiduals(model9)
checkresiduals(model12)
checkresiduals(model14)

#uji normalitas(kolmogorov-smirnov)
ks.test(model3$residuals, "pnorm", mean(model3$residuals),
sd(model3$residuals))
ks.test(model7$residuals, "pnorm", mean(model7$residuals),
sd(model7$residuals))
ks.test(model8$residuals, "pnorm", mean(model8$residuals),
sd(model8$residuals))
ks.test(model12$residuals, "pnorm", mean(model12$residuals),
sd(model12$residuals))
ks.test(model14$residuals, "pnorm", mean(model14$residuals),
sd(model14$residuals))
#uji normalitas secara visual
par(mfrow=c(3,2))
qqnorm(model3$residuals, main="Normal Plot Residual (0,1,1)(0,1,1)12")
qqline(model3$residuals, col="blue", lwd=2)
qqnorm(model7$residuals, main="Normal plot Residual (1,1,1)(0,1,1)12")
qqline(model7$residuals, col="blue", lwd=2)
qqnorm(model8$residuals, main="Normal Plot Residual (1,1,1)(1,1,0)12")
qqline(model8$residuals, col="blue", lwd=2)
qqnorm(model12$residuals, main="Normal Plot Residual (0,1,2)(0,1,1)12")
qqline(model12$residuals, col="blue", lwd=2)
qqnorm(model14$residuals, main="Normal Plot Residual (2,1,2)(0,1,1)12")
qqline(model14$residuals, col="blue", lwd=2)
```

```
#(AIC) penentuan model
AIC(model3)
AIC(model7)
AIC(model8)
AIC(model12)
AIC(model14)


#----------analisisi intervensi----------#

#----intervensi 1 ----#

#-peramalan data intervensi pertama menggunakan model ARIMA Nt-#
frc.modelNt <- forecast(Nt_ARIMA, h=4)
#plot perbandingan data dengan peramalan
plot(frc.modelNt, main=NA, ylab="TPK Hotel", ylim=c(0,88))
points(tsdata, cex=0.5, col="dark red", pch=19)
lines(tsdata, col="red")
points(ts(c(frc.modelNt$fitted, frc.modelNt$mean), start = c(2011,1),
         frequency =12), cex=0.5, col="dark blue", pch=19)
lines(ts(c(frc.modelNt$fitted, frc.modelNt$mean), start = c(2011,1),
        frequency =12), col="blue")
legend("bottomleft", legend=c("Data TPK", "Peramalan Nt" ), cex=0.8, lty=1,
       col=c("dark red", "blue"), pch=c(19, 19))
#histogram sisaan disekitar T
error.idintv = rep(0,114)
error.idintv[1:110] <- Nt_ARIMA$residuals
error.idintv[111:114] <- tsdata[111:114] - frc.modelNt$mean
error.idintv[111:114]
plot(error.idintv, type="h", xlab="Waktu(T)", ylab="Residual", xaxt="n", )
abline(h=c(-2*sd(model7$residuals), 2*sd(model7$residuals)), col="blue",
lty=2)
abline(v=111, col="red", lty=3, lwd=2)
text(111, -30, "T=111", cex=0.8, pos=2, col="red")
axis(1, at=c(0,50,80,100,114), labels=c("T-114","T-64","T-34","T-14","T+3"))

library(tsoutliers)
train = ts(tsdata[1:129], start=c(2011,1), frequency=12)
tsdata_outlier= tsoutliers::tso(train ,types=c("TC","AO","LS"),
                                maxit.iloop=10, tsmethod="auto.arima")
plot(tsdata_outlier)
```

```
#-estimas dan uji signifikan parameter intervensi-#
train1 = ts(tsdata[1:114], start=c(2011,1), frequency=12)
lambda.md1=BoxCox.lambda(train1)
tsdata_box=BoxCox(train1, lambda.md1)

Intervensi_1 <- TSA::arimax(tsdata_box, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train1)==111)),
                        transfer = list(c(0,0)))
Intervensi_1
coeftest(Intervensi_1)

Intervensi_2 <- TSA::arimax(tsdata_box, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train1)==111)),
                        transfer = list(c(0,1)), method="ML")
Intervensi_2
coeftest(Intervensi_2)

Intervensi_3 <- TSA::arimax(tsdata_box, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train1)==111)),
                        transfer = list(c(0,2)), method="ML")
Intervensi_3
coeftest(Intervensi_3)
#model yang signifikan
model.intv1 <- TSA::arimax(tsdata_box, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train1)==111)),
                        transfer = list(c(0,3)),method="ML")
model.intv1
coeftest(model.intv1)

#-uji diagnostik-#
#compute model
T111 = 1*(seq(train1)==111)
lambda.md1=BoxCox.lambda(train1)

s.111<- filter(T111, c(-8.9009e+02,-1.5384e+03, -1.4644e+03, -1.8326e+03)
             ,method = "con", sides=1)
s.111[is.na(s.111)]<-0
m.111 <- stats:: filter(s.111,1, method="rec", sides=1)
```

```
ARIMA_train1 <- Arima(train1,lambda = lambda.md1, order=c(1,1,1),
                  seasonal = list(order=c(0,1,1), period = 12),
                  xreg=m.111, include.mean = T)

#uji asumsi white noise (ljung-box)
checkresiduals(ARIMA_train1)

#uji normalitas
ks.test(ARIMA_train1$residuals, "pnorm",mean(ARIMA_train1$residuals)
       ,sd(ARIMA_train1$residuals))
#uji normalitas secara visual
qqnorm(ARIMA_train1$residuals, main="Normal Plot Residual model
intervensi 1")
qqline(ARIMA_train1$residuals, col="blue", lwd=2)

#-peramalan model intervensi-#
peramalan <-forecast(ARIMA_train1, xreg=m.111, h=15)
peramalan
frc.model.intv1<-ts(frc.mdintv1$mean)[1:15]
frc.model.intv1
#plot perbandingan data dengan peramalan model intervensi 1
plot.intv1=plot(peramalan,main=NA, ylab="TPK Hotel", xlim=c(2011,2022),
ylim=c(-20,77))
points(tsdata, cex=0.8, col="dark red", pch=19)
lines(tsdata, col="red")
points.frcintv1 = points(ts(c(frc.mdintv1$fitted, frc.mdintv1$mean),
                        start = c(2011,1), end=c(2021,9),
                        frequency =12), cex=0.8, col="dark blue", pch=19)
lines(ts(c(frc.mdintv1$fitted,frc.mdintv1$mean), start = c(2011,1),
        frequency =12), end=c(2021,9),col="blue")
legend("bottomleft", legend=c("Data TPK", "Peramalan Model Intervensi 1"),
      cex=0.8, lty=1,col=c("dark red", "blue"), pch=c(19, 19))


#----intervensi 2 ----#

#-peramalan data intervensi 2 menggunakan model intervensi 1-#
peramalan <-forecast(ARIMA_train1, xreg=m.111, h=15)
peramalan
frc.model.intv1<-ts(frc.mdintv1$mean)[1:15]
frc.model.intv1
```

```
#histogram sisaan disekitar T
error.idintv2 = rep(0,129)
error.idintv2[1:114] <- ARIMA_train1$residuals
error.idintv2[115:129] <- tsdata[115:129] - frc.model.intv1
error.idintv2[115:129]
plot(error.idintv2, type="h", xlab="Waktu(T)", ylab="Residual", xaxt="n")
abline(h=c(-2*sd(ARIMA_train1$residuals),
2*sd(ARIMA_train1$residuals),col="red", lty=2))
abline(v=115, col="red", lty=3, lwd=2)
text(114, 530, "T=115", cex=0.8, pos=2, col="red")
axis(1, at=c(115,120, 129), labels=c("T","T+5","T+14"))

#-estimas dan uji signifikan parameter intervensi 2-#
train2 = ts(tsdata[1:129], start=c(2011,1), frequency=12)
lambda.md2=BoxCox.lambda(train2)
tsdata_box.2=BoxCox(train2, lambda.md2)

intervensi2.2 <- TSA::arimax(tsdata_box.2, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train2)==111),
                                             (T115= 1*(seq(train2)>=115))),
                        transfer = list(c(0,3),c(0,1)),method="ML")
intervensi2.2
coeftest(intervensi2.2)

intervensi2.3 <- TSA::arimax(tsdata_box.2, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train2)==111),
                                             (T115= 1*(seq(train2)>=115))),
                        transfer = list(c(0,3),c(1,0)),method="ML")
intervensi2.3
coeftest(intervensi2.3)
#model yang signifikan
model.intv2 <- TSA::arimax(tsdata_box.2, order = c(1,1,1),
                      seasonal = list(order=c(0,1,1), period = 12),
                      xtransf = data.frame(T111_2 = 1*(seq(train2)==111),
                                           (T115= 1*(seq(train2)>=115))),
                      transfer = list(c(0,3),c(0,0)),method="ML")
model.intv2
coeftest(model.intv2)

#-uji diagnostik-#
```

```
#compute model
T111_2 = 1*(seq(train2)==111)
T115= 1*(seq(train2)>=115)
lambda.md2=BoxCox.lambda(train2)

s.111_2<- filter(T111_2, c(-9.4311e+02,-1.5326e+03,-1.369e+03,-1.7778e+03)
              ,method = "con", sides=1)
s.111_2[is.na(s.111_2)]<-0
m.111_2 <-filter(s.111_2,filter=1,"recursive", sides=1)
m.111_2[1:114]
m.115<- filter(T115, filter=1, "recursive", sides=1)*-1.8326e+03
m.115[115:129]
xreg2 <- c(m.111_2[1:114],m.115[115:129])

ARIMA_train2 <- Arima(train2,lambda = lambda.md2, order=c(1,1,1),
                  seasonal = list(order=c(0,1,1), period = 12),
                  xreg= xreg2,
                  include.mean = T)

#uji asumsi white noise (ljung-box)
checkresiduals(ARIMA_train2)

#uji normalitas(kolmogorov-smirnov)
ks.test(ARIMA_train2$residuals, "pnorm",mean(ARIMA_train2$residuals),
       sd(ARIMA_train2$residuals))
#uji normalitas secara visual
qqnorm(ARIMA_train2$residuals, main="Normal Plot Residual intervensi 2")
qqline(ARIMA_train2$residuals, col="blue", lwd=2)

#-peramalan model intervensi-#
peramalan2 <-forecast(ARIMA_train2, xreg=xreg2)
peramalan2
frc.model.intv2<-ts(peramalan2$mean)[1:6]
frc.model.intv2
#plot perbandingan data dengan peramalan model intervensi 2
plot.intv2=plot(peramalan2,main=NA, ylab="TPK Hotel", xlim=c(2011,2022),
ylim=c(-20,77))
points(tsdata, cex=0.7, col="dark red", pch=19)
lines(tsdata, col="red")
points.frcintv2 = points(ts(c(peramalan2$fitted, peramalan2$mean),
                        start = c(2011,1), end=c(2022,3),
                        frequency =12), cex=0.7, col="dark blue", pch=19)
```

```
lines(ts(c(peramalan2$fitted,peramalan2$mean), start = c(2011,1),
        frequency =12), end=c(2022,3),col="blue")
legend("bottomleft", legend=c("Data TPK", "Peramalan Model Intervensi 2'
       cex=0.8, lty=1,col=c("dark red", "blue"), pch=c(19, 19))


#----intervensi 3 ----#

#peramalan data intervensi 3 menggunakan model intervensi 2
peramalan2 <-forecast(ARIMA_train2, xreg=xreg2)
peramalan2$fitted
frc.model.intv2<-ts(peramalan2$mean)[1:6]
frc.model.intv2

#histogram sisaan disekitar T
error.idintv3 = rep(0,135)
error.idintv3[1:129] <- ARIMA_train2$residuals
error.idintv3[130:135] <- tsdata[130:135] - frc.model.intv2
error.idintv3[130:135]
plot(error.idintv3, type="h", xlab="Waktu(T)", ylab="Residual", xaxt="n")
abline(h=c(-2*sd(ARIMA_train2$residuals),
2*sd(ARIMA_train2$residuals),col="blue", lty=1))
abline(v=130, col="red", lty=3, lwd=1)
text(130, 550, "T=130", cex=0.8, pos=2, col="red")
axis(1, at=c(135), labels=c("T+5"))

#-estimas dan uji signifikan parameter intervensi 3-#
train3 = ts(tsdata[1:135], start=c(2011,1), frequency=12)
lambda.md3=BoxCox.lambda(train3)
tsdata_box.3=BoxCox(train3, lambda.md3)

intervensi3.1 <- TSA::arimax(tsdata_box.3, order = c(1,1,1),
                        seasonal = list(order=c(0,1,1), period = 12),
                        xtransf = data.frame(T111 = 1*(seq(train3)==111),
                                             T115 = 1*(seq(train3)>=115),
                                             T130 = 1*(seq(train3)>=130)),
                        transfer = list(c(0,3),c(0,0),c(0,1)),method="ML")
coeftest(intervensi3.1)
#Model yang signifikan
model.intv3 <- TSA::arimax(tsdata_box.3, order = c(1,1,1),
                       seasonal = list(order=c(0,1,1), period = 12),
```

```
                    xtransf = data.frame(T111 = 1*(seq(train3)==111),
                                         T115 = 1*(seq(train3)>=115),
                                         T130 = 1*(seq(train3)>=130)),
                    transfer = list(c(0,3),c(0,0),c(0,0)),method="ML")
model.intv3
coeftest(model.intv3)

#-uji diagnostik-#
#compute model
T111_3 = 1*(seq(train3)==111)
T115_3= 1*(seq(train3)>=115)
T130 = 1*(seq(train3)>=130)
lambda.md3=BoxCox.lambda(train3)

s.111_3<- filter(T111_3, c(-21.589334,-44.552405,-43.954075,-48.761627)
          ,method = "con", sides=1)
s.111_3[is.na(s.111_3)]<-0
m.111_3 <-filter(s.111_3,filter=1,"recursive", sides=1)
m.111_3[1:114]
m.115_3<- filter(T115_3, filter=1, "recursive", sides=1)*-42.064738
m.115_3[115:129]
m.130<- filter(T130, filter=1, "recursive", sides=1)*8.677471
m.130[130:135]

xreg3 <- c(m.111_3[1:114],m.115_3[115:129],m.130[130:135])

ARIMA_train3 <- Arima(train3,lambda = lambda.md3, order=c(1,1,1),
                seasonal = list(order=c(0,1,1), period = 12),
                xreg= xreg3,
                include.mean = T)

#uji asumsi white noise (ljung-box)
checkresiduals(ARIMA_train3)

#uji normalitas(kolmogorov-smirnov)
ks.test(ARIMA_train3$residuals, "pnorm",mean(ARIMA_train3$residuals),
      sd(ARIMA_train3$residuals))
#uji normalitas secara visual
qqnorm(ARIMA_train3$residuals, main="Normal Plot Residual intervensi 3")
qqline(ARIMA_train3$residuals, col="blue", lwd=2)
```

```
#---------- peramalan model intervensi Multi Input ----------#

peramalan3 <-forecast(ARIMA_train3, xreg=xreg3)
peramalan3
frc.model.intv3<-ts(peramalan3$mean)[1:45]
frc.model.intv3
#plot perbandingan data dengan peramalan model intervensi 3
plot.intv3=plot(peramalan3,main=NA, ylab="TPK Hotel", xlim=c(2020,2025),
ylim=c(-20,79))
```

Lampiran 12. Riwayat Hidup

RIWAYAT HIDUP

Dewa Ayu Alit Damayanti lahir di Jakarta pada tanggal 17 April 2000. Penulis lahir dari pasangan suami istri Bapak Sang Nyoman Giri Jaya dan Ibu Purwati Handayani. Penulis berkebangsaan Indonesia dan beragama Hindu. Kini penulis beralamat di Banjar Peninjoan Desa Peninjoan, Kecamatan Tembuku, Kabupaten Bangli, Provinsi Bali. Penulis menyelesaikan pendidikan dasar di SD Negeri 1 Peninjoan dan lulus pada tahun 2012. Kemudian penulis melanjutkan di SMP Negeri 2 Tembuku dan lulus pada tahun 2015. Pada tahun 2018, penulis lulus dari SMA Negeri 1 Tembuku dan melanjutkan pendidikan ke Program Studi S1 Matematika di Universitas Pendidikan Ganesha. Pada semester akhir tahun 2022, penulis telah menyelesaikan Tugas Akhir berupa Skripsi yang berjudul "Model Intervensi untuk Peramalan Tingkat Penghunian Kamar (TPK) Hotel Bintang di Provinsi Bali Dampak Pandemi Covid-19". Selanjutnya, mulai November 2022, penulis telah menyelesaikan studinya sebagai mahasiswa Program Studi S1 Matematika di Universitas Pendidikan Ganesha.