Experiment No.5
Implementation of ARIMA model in python / R.
Date of Performance:
Date of Submission:

Experiment No 5

Aim- Implementation of ARIMA model in **R** Programming.

Objective- To Understand use of Auto-Regression Integrated Moving Average Time Series Model

Theory-

In R programming , data analysis and visualization is so easy to learn the behavior of the data. Moreover, the **R** language is used mostly in the data science field after Python. Time series analysis is a type of analysis of data used to check the behavior of data over a period of time. The data is collected over time sequentially by the **ts()** function along with some parameters. It helps in analyzing the pattern of the data over a graph. There are many techniques used to forecast the time series object over the plot graph but the **ARIMA model** is the most widely used approach out of them.

Time Series Forecasting

Time series forecasting is a process of predicting future values with the help of some statistical tools and methods used on a data set with historical data. Some of the applications of time series forecasting are:

- Predicting stock prices
- Forecast weather
- Forecast the sales of a product

ARIMA model

ARIMA stands for AutoRegressive Integrated Moving Average and is specified by three order parameters: *(p, d, q).*

- **AR(p) Autoregression:** A regression model that utilizes the dependent relationship between a current observation and observations over a previous period.An auto regressive *(AR(p))* component refers to the use of past values in the regression equation for the time series.
- **I(d) Integration:** Uses differencing of observations (subtracting an observation from observation at the previous time step) in order to make the time series stationary. Differencing involves the subtraction of the current values of a series with its previous values d number of times.

1. Load the data set after installing the package forecast.
2. The Steps of Pre-processing are done, which creates a separate time-series or timestamp.
3. Making Time-series stationary and check the required transformations.
4. The difference value 'd' will be performed.
5. The core important step in ARIMA is plotting ACF and PACF.
6. Determine the two parameters p and q from the plots.
7. The previously created value fits the Aroma model and predicts the future values. The Fitting Process is also named as Box-Jenkins Method.
8. Doing Validation.auto. Arima() function is used for automatic prediction and ARIMA Models. This function uses unit root tests, minimization of the AIC and MLE to obtain an ARIMA model. To make the series stationary, we need to differentiate a previous value from the current value.

   d= pval-cval, if the value is already stationary the d=O.

   predict() - Used to predict the model based on the results of the various fitting model used.

Implementation of ARIMA model in R

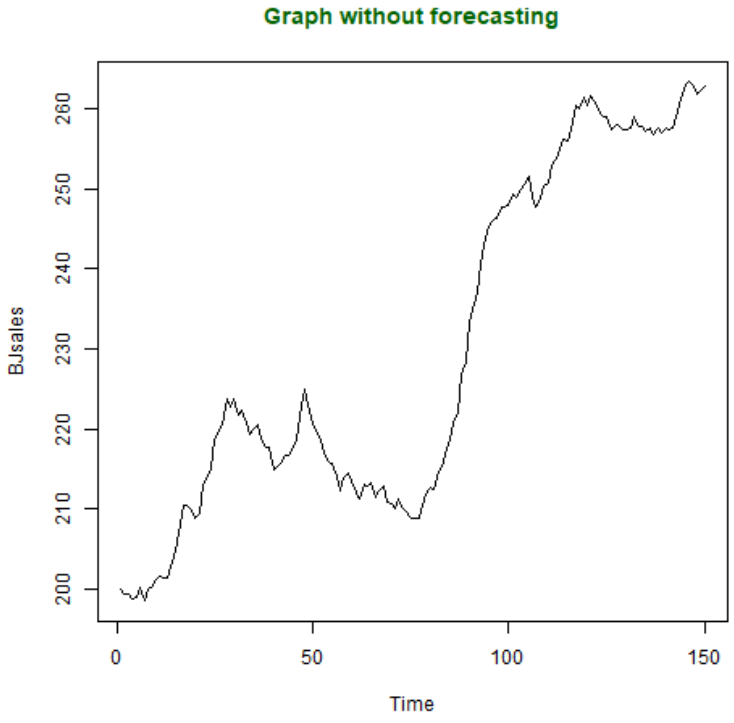
Program:

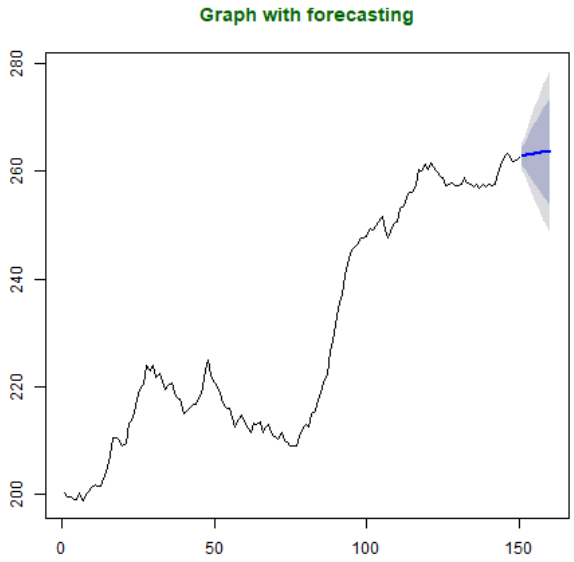
```
install.packages("forecast")

# library required for forecasting
library(forecast)

# Output to be created as png file
png(file = "TimeSeriesGFG.png")

# Plotting graph without forecasting
plot(BJsales, main = "Graph without forecasting",
col.main = "darkgreen")

# Saving the file
dev.off()

# Output to be created as png file
png(file = "TimeSeriesARIMAGFG.png")

# Fitting model using arima model
fit <- auto.arima(BJsales)

# Next 10 forecasted values
forecastedValues <- forecast(fit, 10)
```

```
# Print forecasted values
print(forecastedValues)

plot(forecastedValues, main = "Graph with forecasting",
col.main = "darkgreen")

# saving the file
dev.off()
```

Output:

Point	Forecast	Lo 80	Hi 80	Lo 95	Hi 95
151	262.8620	261.1427	264.5814	260.2325	265.4915
152	263.0046	260.2677	265.7415	258.8189	267.1903
153	263.1301	259.4297	266.8304	257.4709	268.7893
154	263.2405	258.5953	267.8857	256.1363	270.3447
155	263.3377	257.7600	268.9153	254.8074	271.8680
156	263.4232	256.9253	269.9211	253.4855	273.3608
157	263.4984	256.0941	270.9028	252.1744	274.8224
158	263.5647	255.2691	271.8602	250.8778	276.2516
159	263.6229	254.4529	272.7930	249.5986	277.6473
160	263.6742	253.6474	273.7011	248.3395	279.0089





Conclusion:-

1. The difference between the actual value of the time series and the forecasted value called- **forecast error.**
2. Use of ARIMA ()-
   The ARIMA (AutoRegressive Integrated Moving Average) model is a powerful tool in time series analysis used to forecast future values based on historical data. It combines three key components: AutoRegressive (AR), Integrated (I), and Moving Average (MA). The AR component represents the relationship between the current observation and a lagged observation, while the MA component models the relationship between the current observation and a residual error from a moving average model applied to lagged observations. The I component involves differencing the time series to make it stationary, ensuring that the mean and variance remain constant over time. The ARIMA model allows for the exploration of temporal patterns, identification of trends, and prediction of future values, making it widely utilized in various fields such as finance, economics, and meteorology.
3. Use of forecast()-
   The `forecast()` function in R is a powerful tool for generating forecasts based on time series models, including ARIMA and other methods. It takes a fitted model object, such as one produced by `arima()` or other time series modeling functions, and generates forecasts for future time periods based on the model's parameters. The function allows users to specify the number of periods ahead they want to forecast and provides additional options for controlling aspects of the forecast, such as confidence intervals and prediction intervals. `forecast()` is widely used in applications where predicting future values based on historical data is essential, such as sales forecasting, demand planning, and financial projections. It simplifies the process of generating accurate forecasts by automating many of the calculations involved in time series modeling and prediction.