

# DataQuest Solutions

## Time Series Analysis with R

### Lesson 1. Introduction to Time Series Analysis

- What is Time Series Analysis
- Components of Time Series Analysis
- Real World Application of Time Series Analysis

### Lesson 2. Time Series Data Preprocessing

- Handling Missing Values
- Outlier Detection and Treatment
- Time series Decompositions
- Transformations: Log, square root, Box-Cox Transformations

### Lesson 3. Exploratory Time Series Analysis

- Autocorrelation and Partial Autocorrelation
- Seasonality Detection
- Trend Analysis

### Lesson 5. Stationarity Checking and Achieving

- Augmented Dickey-Fuller Test
- KPSS Test
- Differencing
- Seasonal Differencing

### Lesson 6. Modelling Time Series

#### a. Traditional Models

- ARIMA Modeling
- SARIMA (Seasonal ARIMA)
- Exponential Smoothing Models
  - Simple Exponential Smoothing
  - Holt's Linear Trend Method
  - Holt-Winters Seasonal Method

- State Space Models
- Dynamic Regression Models
- Time Series Regression with ARIMA Errors

#### **b. Advanced or Modern Models**

- TBATS (handling multiple seasonality)
- Prophet (Facebook's models, prophet package)
- Neural Networks for Time Series: LSTM with Keras

### **Lesson 7. Forecasting**

- Point Forecasts
- Prediction Intervals
- Forecast Evaluation
  - RMSE, MAE, MAPE, Smape
  - Cross Validation for Time Series
- Forecast Visualization

### **Lesson 8. Model Diagnostics**

- Residual Analysis
  - Plot Residuals
  - Check ACF/PACF of residuals
  - Ljung-Box test (Box.test)
- Overfitting/underfitting checks

### **Lesson 9. Multivariate Time Series**

- Vector Autoregression (VAR models)
- Cointegration Analysis (Johansen test)
- Granger Causality testing

### **Lesson 8. Deploying Time Series**

- Packaging forecasts into a shiny app
- Scheduling forecasts (cron jobs)
- Dashboarding forecasts using flexdashboard, shinydashboards