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| **Sem: Dec-2024**  **Maximum Marks: 50 Examination: End Term Exam Date: 14 Dec, 2024 Duration: 2.5hrs** | | |
| **Programme code: 18**  **Programme: MBA for Working Executive** | **Class:** SY | **Semester: III**  **Batch- 2023-24** |
| **College:**  **K. J. Somaiya Institute of Management** | **Name of the department/Section/Center: BA** | |
| **Course Code: 117P18C303** | **Name of the Course: Time Series Analytics** | |
| **Instructions:**   1. **All the questions are compulsory.** 2. **Provide all the answers in a single Excel file with multiple sheets.** 3. **Make suitable assumptions if required and state them.** | | |

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| **Question No.** |  | **Max.**  **Marks** |
|  | A leading financial consulting firm has been closely monitoring changes in consumer sentiment to provide actionable insights to its clients, including retail companies, policymakers, and investors. Consumer sentiment is a critical indicator of economic health, reflecting the optimism or pessimism of households regarding their financial conditions and the overall economy. Recently, the firm observed fluctuations in consumer sentiment over the years, which could significantly impact consumer spending and investment decisions. These changes appear to correlate with various external factors such as economic policies, market conditions, and global events. The firm has collected monthly data on consumer sentiment from January 2010 to November 2018 and want to analyze this time-series data. The goal is to identify trends, seasonal patterns, and any anomalies that could indicate shifts in consumer behavior. Based on this analysis, the firm aims to develop predictive models to forecast consumer sentiment for future periods. **[Excel- Consumer Sentiment]**   1. Apply the appropriate model and forecast the result for the period Jan 2019. | 10 |
|  | A major financial institution is analyzing inflation rates from January 2012 to December 2016 to understand historical trends and develop strategies to forecast future inflation levels. Inflation is a critical economic indicator, reflecting the rate at which prices for goods and services rise. Persistent changes in inflation affect household purchasing power, business costs, and monetary policy decisions. The institution's primary objective is to identify patterns in inflation rates and assess how they align with macroeconomic factors such as economic growth, supply chain dynamics, and global economic events. By leveraging the insights derived from this data, the institution aims to support businesses, policymakers, and investors in making informed decisions. **[Excel- Inflation rate]**   1. Apply the exponential smoothing method. Calculate the optimal alpha and Mean square error. 2. Apply the moving average period for n = 3 and calculate Mean square error. 3. Compare which methos is better and forecast the result for the next period. | 10 |
|  | Lowe’s, a leading home improvement retailer, has experienced significant variations in its quarterly revenues over the years. The management team is keen to analyze these revenue patterns to identify trends, seasonality, and potential opportunities for growth. The dataset provided captures quarterly revenues from Q1 2010 to Q3 2018, offering a comprehensive view of Lowe’s financial performance during this period. **[Excel- Revenue Lowes]**   1. Plot the graph and examine the components of the time series. Determine whether the additive decomposition method or the multiplicative decomposition method is more suitable and justify your choice. 2. Forecast the result for 2019 Q1 to Q4. | 15 |
| 4. | Give the answer of the following questions based on the following R code:   |  | | --- | | # Load the necessary library  library(forecast)  # Load data and create time series  setwd("D:/time series forecasting")  data1 <- read.csv("revenue.csv")  data2 <- ts(data1, frequency = 4)  # Apply ETS model and specify the type  ets\_model <- ets(data2, model = "AAA")  # Print the model summary  summary(ets\_model)  # Forecast for the next 4 periods  ets\_forecast <- forecast(ets\_model, h = 4)  # Print forecast  print(ets\_forecast) |  1. What do each of the three components in "AAA" represent? 2. What is the difference between “AAA” and “ANA” models. | 5 |
| 5. | Following id the R code:   |  | | --- | | # Load necessary libraries  library(forecast)  library(tseries)  # Import the dataset  temperature\_data <- read.csv("monthly\_temperature.csv")  # Convert the temperature data into a time series object with a frequency of 12 (monthly data for one year)  temperature\_ts <- ts(temperature\_data$temperature, frequency = 12)  # Plot the time series data  plot(temperature\_ts)  # Perform Augmented Dickey-Fuller (ADF) test to check for stationarity  adf\_test <- adf.test(temperature\_ts)  print(adf\_test)  # Differencing the series to make it stationary  temperature\_ts\_diff <- diff(temperature\_ts)  # Perform ADF test on the differenced series  adf\_diff\_test <- adf.test(temperature\_ts\_diff)  print(adf\_diff\_test)  # Plot ACF and PACF to determine the AR and MA components  acf(temperature\_ts\_diff)  pacf(temperature\_ts\_diff)  # Fit an ARIMA model to the differenced series  arima\_model<-arima(temperature\_ts,order=c(1,1,1), seasonal=list(order=c(1,1,1), period=12))  # Summary of the ARIMA model  summary(arima\_model)  # Make forecasts using the fitted ARIMA model  forecast\_values <- forecast(arima\_model, h=6)  plot(forecast\_values) | | Give the answer to the following questions:   1. What is the purpose of converting the temperature data into a time series object (ts) with a frequency of 12? How does this affect the analysis of the data? 2. What is the purpose of performing the Augmented Dickey-Fuller (ADF) test on the original temperature time series? If the p-value of the ADF test is less than 0.05, what can you conclude about the stationarity of the data? Frame the null and alternative hypotheses. 3. Why is differencing applied to the temperature data (diff(temperature\_ts)), and what does differencing achieve in terms of making the time series stationary? | | 10 |