JAIPURIA INSTITUTE OF MANAGEMENT
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JAIPURIA INSTITUTE OF MANAGEMENT, NOIDA
PGDM / PGDM (M) / PGDM (SM)
FIFTH TRIMESTER (Batch 2024-26)
END TERM EXAMINATIONS, JANUARY 2026

SET-2

Course Name	Business Forecasting	Course Code	**XO831**
Max. Time	**2 hours**	Max. Marks	**40 MM**

INSTRUCTIONS:

1. All questions are compulsory to attempt.
2. Standard statistical tables and calculator use are permitted.

Q1. SwiftCart, a leading quick-commerce player in Noida, is struggling with inventory wastage due to inaccurate hourly demand forecasts. Their data shows a strong daily cycle where orders peak during breakfast (8 AM - 10 AM) and late-night snacks (11 PM - 1 AM). Category managers have observed that while a linear trend helps explain the overall growth in the user base, the "shocks" in the system—such as a sudden 15-minute rainstorm—cause immediate spikes in tea and snack orders that eventually taper off.

The data science team is debating between using a simple ARIMA model or a more complex Triple Exponential Smoothing (Holt-Winters) approach to manage these patterns.

Questions (1+6+5 =12 Marks):

a) Identify the specific value for the seasonal period (m) that should be used if SwiftCart is modelling hourly data that repeats every day.

b) Critically evaluate the difference between the theoretical impact of an integrated order d=1 (linear trend) versus d=2 (quadratic trend) for a fast-growing startup like SwiftCart. Discuss why choosing d=2 might be risky for long-term stability.

c) Explain the Triple Exponential Smoothing (Holt-Winters) method. Discuss its three components and justify why it might be more intuitive for a category manager than an ARIMA (p, d, q) model when dealing with both trend and seasonality.

Q2. You are reviewing a SARIMAX results table generated for SwiftCart's "Beverages" category. The following coefficients and diagnostic stats are provided:

Model Coefficient & Diagnostic Table

Variable / Metric	Coefficient	Std. Error	P > |z|
ar.L1 (p)	0.8520	0.045	0.000
ma.L1 (q)	-0.5611	0.320	0.434
ar.S.L12	0.2130	0.012	0.002
Skewness / Kurtosis	-0.01 / 3.79	—	—
Prob (H)	0.11	—	—

Questions (4x3 = 12 Marks):

a) Analyse the significance of the **ar.L1** and **ma.L1** variables based on their p-values. If the **std err** of a coefficient is high relative to its value, what does this suggest about its reliability in the model?

b) Interpret the **ar.S.L12** coefficient. What does this specific value represent in the context of monthly forecasting, and how does it influence the prediction for the current month?

c) Evaluate the **Skew**, **Kurtosis**, and **Prob (H)** values. Does this model suffer from heteroskedasticity, and what do the skew/kurtosis figures suggest about the normality of the residuals?

Q3. During your final round interview at an analytics firm, the panel presents the following technical hurdles **(4x4 = 16 Marks)**

a) You are looking at an ACF and PACF plot. The PACF shows a sharp spike at Lag 1 and then cuts off, while the ACF decays gradually. Identify which model (AR or MA) is indicated and explain the logic behind this identification.

b) Compare the **Akaike Information Criterion (AIC)** and the **Bayesian Information Criterion (BIC)**. How do these metrics balance model fit versus complexity, and which one would you prioritize if you wanted to avoid "overfitting" on a small dataset?

c) Discuss the difference between **Standardization** and **Normalization**. Justify which approach is more appropriate for a SARIMAX model where variables like "Total Spend" and "Discount Percentage" are measured on vastly different scales.

d) Why is ARIMA generally considered effective only for short-term forecasting? Discuss the "Grid Search" concept used in Auto-ARIMA and why manual interpretation of plots is still considered a valuable "sanity check" despite being slower.