EX:No.10 **DATE:12/04/25**	**Develop vector auto regression model for multivariate time series data forecasting.**

AIM:

To develop a Vector Auto Regression (VAR) model for multivariate time series forecasting using historical data, and evaluate its performance.

ALGORITHM:

Step 1: Load and preprocess the time series dataset.

Step 2: Generate multivariate series (e.g., lagged variables).

Step 3: Resample to monthly frequency and interpolate missing values.

Step 4: Split data into training and testing sets.

Step 5: Forecast future values for test period.

Step 6: Evaluate model performance using metrics (e.g., RMSE).

Step 7: Visualize actual vs forecasted values.

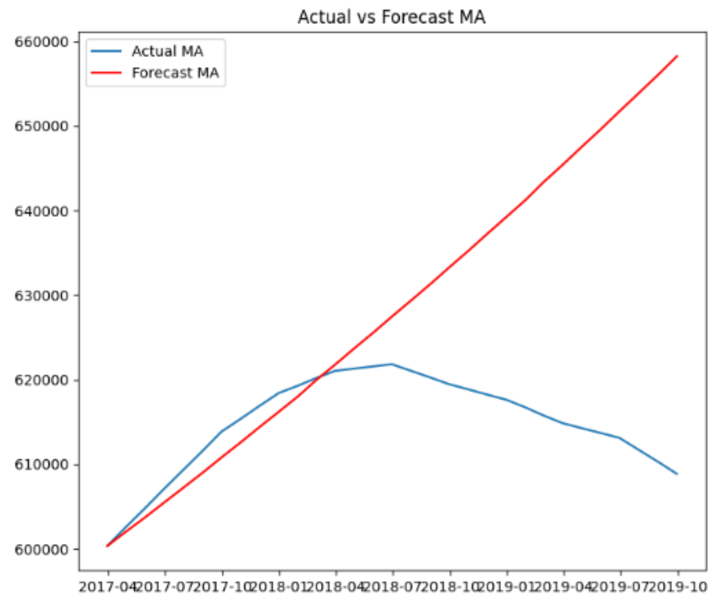
CODE AND DESCRIPTION:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from statsmodels.tsa.api import VAR
from sklearn.metrics import mean_squared_error

# Load dataset
file_path = "/content/ma_lga_12345.csv"
df = pd.read_csv(file_path)

# Convert 'saledate' to datetime
df['saledate'] = pd.to_datetime(df['saledate'], format="%d/%m/%Y")
df.set_index('saledate', inplace=True)
```

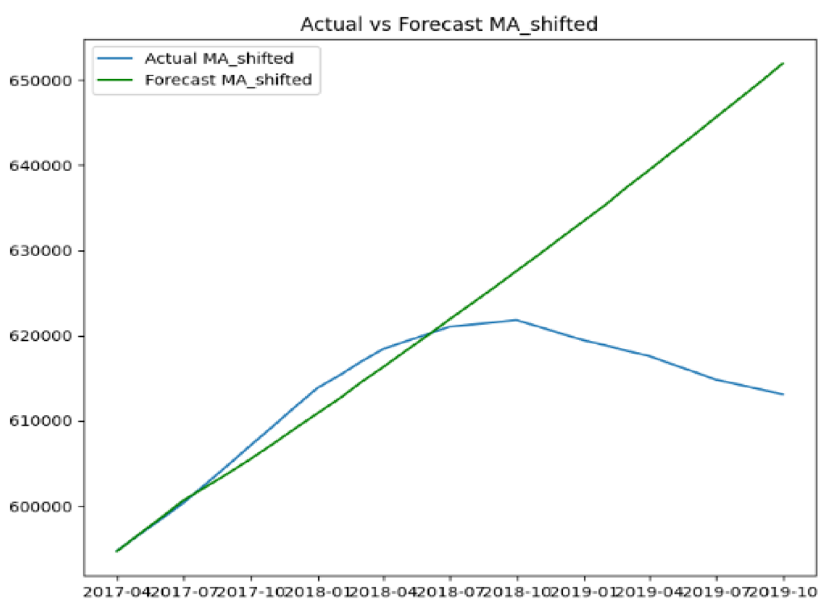
```
# Check available numeric columns
print("Available numeric columns:", df.select_dtypes(include='number').columns.tolist())

# Use 'MA' and create a synthetic second variable
df['MA_shifted'] = df['MA'].shift(1).fillna(method='bfill')  # Create a lagged version

# Resample monthly and interpolate
data = df[['MA', 'MA_shifted']].resample('ME').mean().interpolate()

# Train-test split
n_obs = int(len(data) * 0.8)
train, test = data[:n_obs], data[n_obs:]

# Fit the VAR model
model = VAR(train)
model_fitted = model.fit(maxlags=15, ic='aic')

# Forecast
forecast_input = train.values[-model_fitted.k_ar:]
forecast = model_fitted.forecast(y=forecast_input, steps=len(test))

# Create forecast DataFrame
forecast_df = pd.DataFrame(forecast, index=test.index, columns=['MA_forecast',
'MA_shifted_forecast'])

# Plot forecasts
plt.figure(figsize=(14, 6))

# MA
plt.subplot(1, 2, 1)
plt.plot(test.index, test['MA'], label='Actual MA')
plt.plot(test.index, forecast_df['MA_forecast'], label='Forecast MA', color='red')
plt.title('Actual vs Forecast MA')
plt.legend()
```

```
# MA_shifted
plt.subplot(1, 2, 2)
plt.plot(test.index, test['MA_shifted'], label='Actual MA_shifted')
plt.plot(test.index, forecast_df['MA_shifted_forecast'], label='Forecast MA_shifted', color='green')
plt.title('Actual vs Forecast MA_shifted')
plt.legend()

plt.tight_layout()
plt.show()

# Evaluation
ma_rmse = np.sqrt(mean_squared_error(test['MA'], forecast_df['MA_forecast']))
ma_shifted_rmse = np.sqrt(mean_squared_error(test['MA_shifted'],
forecast_df['MA_shifted_forecast']))

print(f"MA RMSE: {ma_rmse:.2f}")
print(f"MA_shifted RMSE: {ma_shifted_rmse:.2f}")
```

OUTPUT:




```
MA RMSE: 21306.17
MA_shifted RMSE: 15928.27
```



RESULT:

Thus, the program has been completed and verified successfully.