EX.N0 : 8	**Create an ARIMA model for time series forecasting.**
DATE : 07/04/2025	

AIM:

 To Create an ARIMA model for time series forecasting.

PROGRAM:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")

from statsmodels.tsa.arima.model import ARIMA
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf

file_path = r"D:/221501507/TIME SERIES ANALYSIS AND FORECASTING/EX06/archive (1)
(1)/FINAL_USO.csv"
df = pd.read_csv(file_path, parse_dates=["Date"], index_col="Date")
df.columns = df.columns.str.strip()

target_col = "Adj Close"
if target_col not in df.columns:
    raise ValueError(f"'{target_col}' column not found in dataset.")

ts = df[target_col].dropna()

plt.figure(figsize=(12, 5))
plt.subplot(1, 2, 1)
plot_acf(ts, ax=plt.gca(), lags=40)
plt.title("ACF (AutoCorrelation)")

plt.subplot(1, 2, 2)
plot_pacf(ts, ax=plt.gca(), lags=40)
plt.title("PACF (Partial AutoCorrelation)")
plt.tight_layout()
plt.show()

model = ARIMA(ts, order=(5, 1, 2))  # ARIMA(p,d,q)
model_fit = model.fit()

print("\n ✦ ARIMA Model Summary:")
```
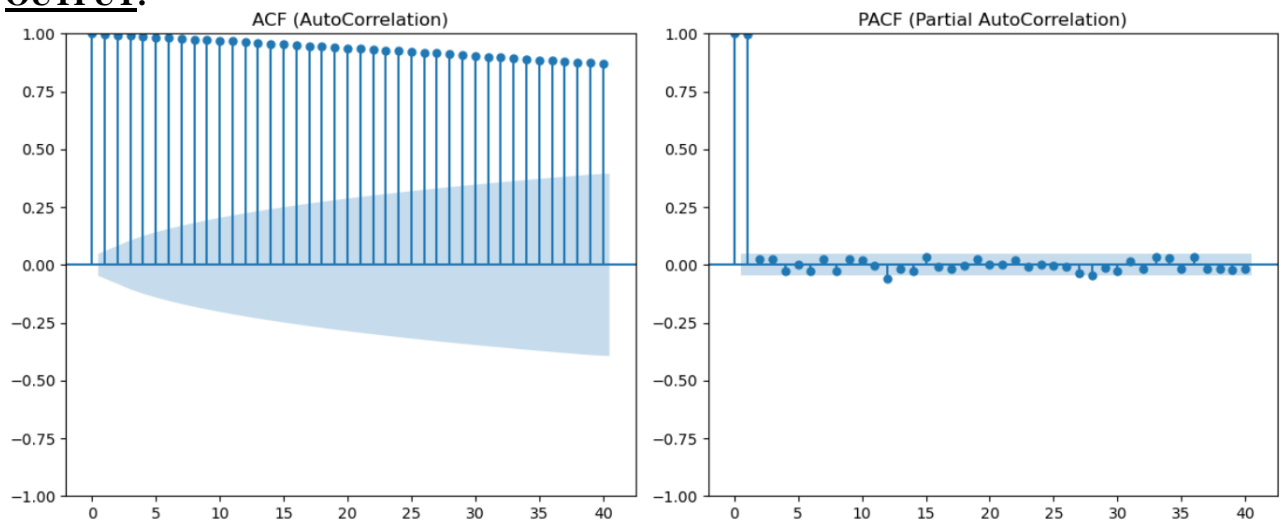
```python
print(model_fit.summary())

forecast_steps = 30  # Days ahead
forecast = model_fit.forecast(steps=forecast_steps)

plt.figure(figsize=(12, 6))
plt.plot(ts, label='Actual', color='blue')
plt.plot(forecast.index, forecast, label='Forecast', color='red')
plt.title("ARIMA Forecast of Gold Price (Adj Close)")
plt.xlabel("Date")
plt.ylabel("Price")
plt.legend()
plt.grid(True)
plt.show()
```

OUTPUT:


```
                               SARIMAX Results
==============================================================================
Dep. Variable:                Adj Close   No. Observations:             1718
Model:                  ARIMA(5, 1, 2)   Log Likelihood            -2819.198
Date:                Sat, 12 Apr 2025   AIC                        5654.396
Time:                        12:06:14   BIC                        5697.982
Sample:                             0   HQIC                       5670.524
                               - 1718
Covariance Type:                  opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1         -0.3127      0.498     -0.628      0.530      -1.289       0.664
ar.L2          0.5132      0.489      1.049      0.294      -0.446       1.472
ar.L3          0.0341      0.052      0.650      0.516      -0.069       0.137
ar.L4          0.0141      0.024      0.578      0.563      -0.034       0.062
ar.L5          0.0322      0.026      1.231      0.219      -0.019       0.083
ma.L1          0.2537      0.499      0.509      0.611      -0.724       1.231
ma.L2         -0.5627      0.461     -1.220      0.222      -1.467       0.341
sigma2         1.5620      0.024     66.248      0.000       1.516       1.608
===================================================================================
Ljung-Box (L1) (Q):                   0.00   Jarque-Bera (JB):          9846.34
Prob(Q):                              1.00   Prob(JB):                     0.00
Heteroskedasticity (H):               0.22   Skew:                        -0.68
Prob(H) (two-sided):                  0.00   Kurtosis:                    14.65
===================================================================================
```
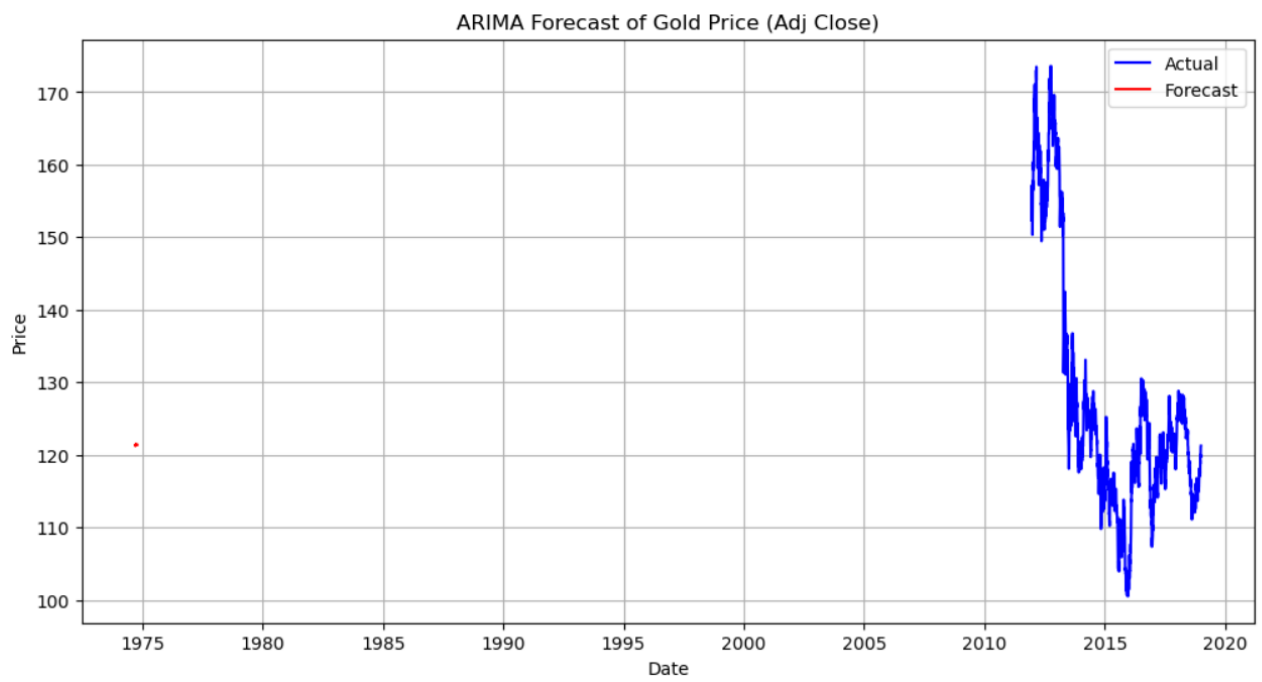
ARIMA Forecast of Gold Price (Adj Close)

RESULT:

Thus, the program for Create an ARIMA model for time series forecasting is executed successfully.