

### **### installing packages and library**

```
install.packages('forecast')
```

```
library('forecast')
```

```
library('tseries')
```

```
library('ggplot2')
```

### **### Plotting the gas time series data**

```
gas.ts1 = ts(gas, start=c(1956,1), end=c(1995,8), frequency=12)
```

```
View(gas.ts1)
```

```
plot(gas.ts1)
```

### **### Decomposition of the data**

```
gas.decom = stl(gas.ts1, s.window = "periodic")
```

```
gas.decom
```

```
plot(gas.decom)
```

### **### Checking stationarity**

```
adf.test(gas.ts1, alternative = "stationary")
```

### **### ACF and PACF plot**

```
acf(gas.ts1, lag.max = 30)
```

```
pacf(gas.ts1, lag.max = 20)
```

### **### Removing seasonal component**

```
deseasonal_gas.ts1 = seasadj(gas.decom)
plot(deseasonal_gas.ts1)
```

### **### Differencing time series data**

```
gas.ts1_df = diff(deseasonal_gas.ts1, differences = 2)
plot(gas.ts1_df)
adf.test(gas.ts1_df, alternative = "stationary")
```

### **### ACF and PACF plot on difference data**

```
acf(gas.ts1_df)
acf(gas.ts1_df, lag.max = 25, main = 'ACF for difference data')
pacf(gas.ts1_df, lag.max = 25, main = 'PACF for difference data')
```

### **### Splitting the time series data into training and test data sets**

```
gas.train = window(deseasonal_gas.ts1, start = c(1970,1), end = c(1993,12))
gas.test = window(deseasonal_gas.ts1, start = c(1994,1))
gasARIMA = arima(gas.train, order = c(12,2,5))
gasARIMA
tsdisplay(residuals(gasARIMA), lag.max = 20, main = 'Residual Model')
```

### **### Fitting with auto arima**

```
gas.autoarima = auto.arima(gas.train, seasonal = FALSE)
gas.autoarima
```

```
gas.autoarima1 = auto.arima(gas.train, stationary = TRUE)
```

```
gas.autoarima1
```

```
tsdisplay(residuals(gas.autoarima), lag.max = 25, main = 'Auto arima residual model')
```

```
### Ljung box test
```

```
# H0 = Residuals are independent
```

```
# Ha = Residuals are not independent
```

```
Box.test(gasARIMA)
```

```
Box.test(gas.autoarima)
```

```
### Forecasting with ARIMA model
```

```
fcast = forecast(gasARIMA, h = 12)
```

```
plot(fcast)
```

```
fcast1 = forecast(gas.autoarima, h = 12)
```

```
plot(fcast1)
```

```
fcast2 = forecast(gas.autoarima1, h = 12)
```

```
plot(fcast2)
```

```
fit1 = auto.arima(gas.ts1, seasonal = FALSE)
```

```
fcast3 = forecast(fit1, h = 12)
```

```
plot(fcast3)
```

### **### Accuracy of the forecast**

```
accu1 = forecast(gasARIMA)
```

```
accuracy(accu1, gas.test)
```

```
accu2 = forecast(gas.autoarima)
```

```
accuracy(accu2, gas.test)
```

```
accu3 = forecast(gas.autoarima1)
```

```
accuracy(accu3, gas.test)
```