W271 HW8

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Build an univariate linear time series model (i.e AR, MA, and ARMA models) using the series in hw08_series.csv.

- Use all the techniques that have been taught so far to build the model, including date examination, data visualization, etc.

- All the steps to support your final model need to be shown clearly.

- Show that the assumptions underlying the model are valid.

- Which model seems most reasonable in terms of satisfying the model's underling assumption?

- Evaluate the model performance (both in- and out-of-sample)

- Pick your "best" models and conduct a 12-step ahead forecast. Discuss your results. Discuss the choice of your metrics to measure "best".

```r
# Load the libraries and tools
library(astsa)
library(zoo)
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##      as.Date, as.Date.numeric
```

```r
library(forecast)
```

```
## Loading required package: timeDate
```

```
## This is forecast 6.2
```

```
##
## Attaching package: 'forecast'
```

```
## The following object is masked from 'package:astsa':
##
##      gas
```

```r
library(stargazer)
```

```
##
## Please cite as:

##   Hlavac, Marek (2015). stargazer: Well-Formatted Regression and Summary Statistics Tables.

##   R package version 5.2. http://CRAN.R-project.org/package=stargazer
```

```r
# load the CSV file
df <- read.csv('hw08_series.csv')
str(df)
```

```
## 'data.frame':    372 obs. of  2 variables:
##  $ X: int  1 2 3 4 5 6 7 8 9 10 ...
##  $ x: num  40.6 41.1 40.5 40.1 40.4 41.2 39.3 41.6 42.3 43.2 ...
```

The CSV file for the HW8 time series consists of two variables: an X variable that is the time interval and an x value corresponding to the time period. There is no information about the time interval or units of the values.

A time series object is created from the dataframe for further analysis.

```r
ts1 <- ts(df$x)
str(ts1)
```

```
##  Time-Series [1:372] from 1 to 372: 40.6 41.1 40.5 40.1 40.4 41.2 39.3 41.6 42.3 43.2 ...
```

```r
summary(ts1)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   36.00   57.38   76.45   84.83  111.50  152.60
```

```r
head(ts1)
```

```
## [1] 40.6 41.1 40.5 40.1 40.4 41.2
```
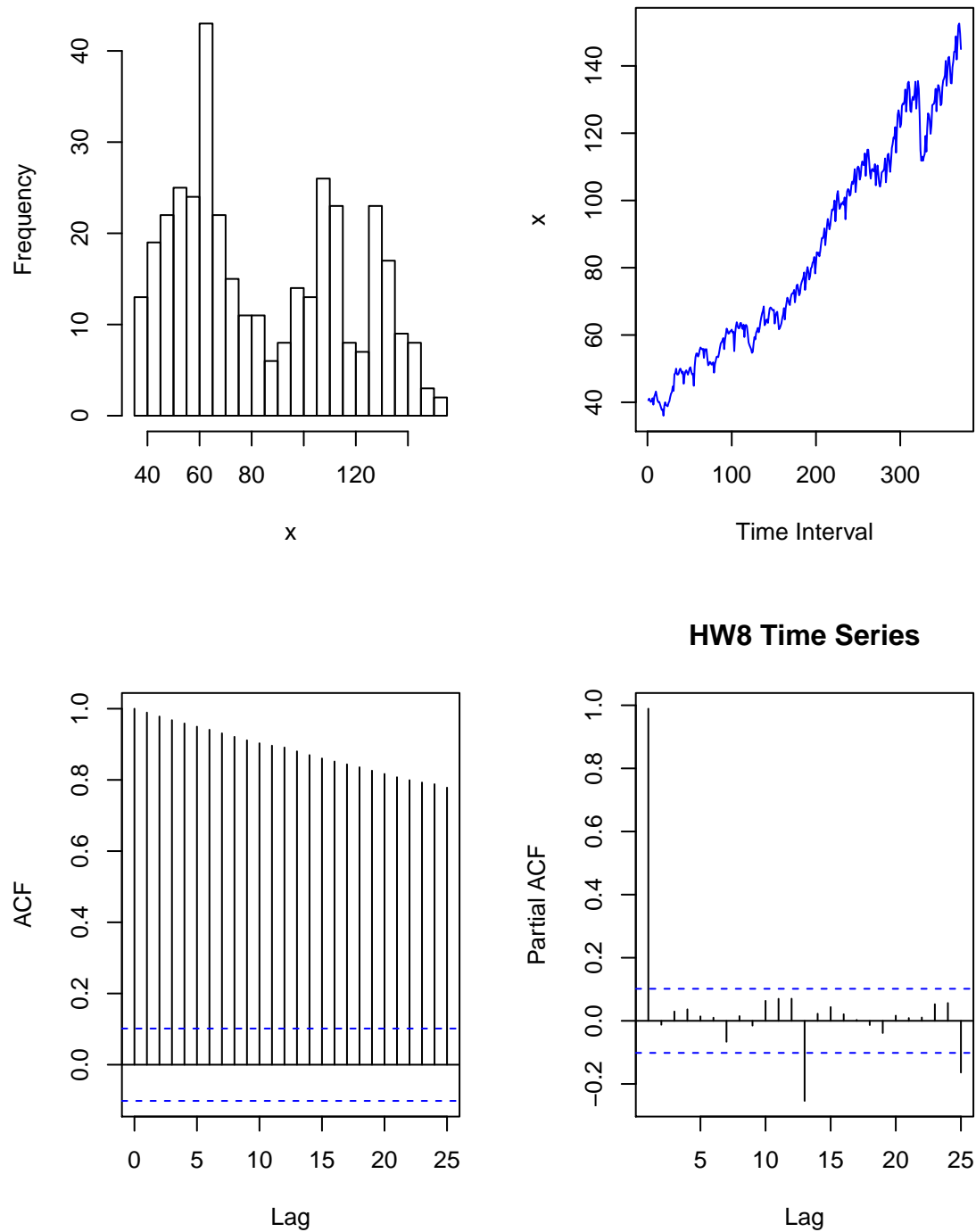
```r
tail(ts1)
```

```
## [1] 141.9 146.9 152.0 152.6 149.7 145.0
```

```
par(mfrow=c(2,2))
hist(ts1, main='', xlab='x', breaks=20)
plot.ts(ts1, col='blue',
        xlab='Time Interval',
        ylab='x',
        main='')
acf(ts1, main='')
pacf(ts1, main='')
title('HW8 Time Series')
```

The time series plot reveals that the HW8 time series is a persistently upward trending series and is not stationary. The autocorrelation shows a very long decay over more than 25 lags while the partial autocorrelation shows statistically significant results at lags 13 and 25.