

21BDS0340

Abhinav Dinesh Srivatsa

Programming for Data Science Lab

Digital Assignment – IV

Code

```
install.packages("quantmod")
install.packages("forecast")
install.packages("xlsx")
install.packages("tseries")
install.packages("timeSeries")
install.packages("dplyr")
install.packages("fGarch")
install.packages("prophet")
library(prophet)
library(quantmod)
library(forecast)
library("xlsx")
library(tseries)
library(timeSeries)
library(dplyr)
library(fGarch)

getSymbols("AMZN", src = "yahoo", from = "2015-01-01")
AMZN

print(adf.test(AMZN$AMZN.Close))

auto.arima(AMZN$AMZN.Close, lambda = "auto")

modelfit <- auto.arima(AMZN$AMZN.Close, lambda = "auto")
price_forecast <- forecast(modelfit, h = 30)
plot(price_forecast)

head(price_forecast$mean)
head(price_forecast$lower)
tail(price_forecast$upper)

N = length(AMZN$AMZN.Close)
n = 0.7 * N
train = AMZN$AMZN.Close[1:n, ]
test = AMZN$AMZN.Close[(n + 1):N, ]
trainarimafit <- auto.arima(train, lambda = "auto")
predlen = length(test)
trainarimafit <- forecast(trainarimafit, h = predlen)

meanvalues <- as.vector(trainarimafit$mean)
```

```
precios <- as.vector(test$AMZN.Close)
plot(meanvalues, type = "l", col = "red")
lines(precios, type = "l")
```

Output

```
> install.packages("quantmod")
also installing the dependencies 'xts', 'TTR'
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/xts_0.13.2.tgz'
Content type 'application/x-gzip' length 902876 bytes (881 KB)
=====
downloaded 881 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/TTR_0.24.4.tgz'
Content type 'application/x-gzip' length 542283 bytes (529 KB)
=====
downloaded 529 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/quantmod_0.4.26.tgz'
Content type 'application/x-gzip' length 1052992 bytes (1.0 MB)
=====
downloaded 1.0 MB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlycgt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
```

```
> install.packages("forecast")
also installing the dependencies 'quadprog', 'fracdiff', 'lmtest', 'timeDate',
'tseries', 'urca'
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/quadprog_1.5-8.tgz'
Content type 'application/x-gzip' length 40521 bytes (39 KB)
=====
downloaded 39 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/fracdiff_1.5-3.tgz'
Content type 'application/x-gzip' length 127617 bytes (124 KB)
=====
downloaded 124 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-
arm64/contrib/4.2/lmtest_0.9-40.tgz'
Content type 'application/x-gzip' length 407278 bytes (397 KB)
=====
downloaded 397 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/timeDate_4032.109.tgz'
Content type 'application/x-gzip' length 1427112 bytes (1.4 MB)
```

```
=====
downloaded 1.4 MB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/tseries_0.10-55.tgz'
Content type 'application/x-gzip' length 418999 bytes (409 KB)
```

```
=====
downloaded 409 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/urca_1.3-3.tgz'
Content type 'application/x-gzip' length 1101251 bytes (1.1 MB)
```

```
=====
downloaded 1.1 MB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/forecast_8.22.0.tgz'
Content type 'application/x-gzip' length 2484322 bytes (2.4 MB)
```

```
=====
downloaded 2.4 MB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
```

```
> install.packages("xlsx")
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/xlsx_0.6.5.tgz'
Content type 'application/x-gzip' length 372567 bytes (363 KB)
```

```
=====
downloaded 363 KB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
```

```
> install.packages("tseries")
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/tseries_0.10-55.tgz'
Content type 'application/x-gzip' length 418999 bytes (409 KB)
```

```
=====
downloaded 409 KB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
```

```
> install.packages("timeSeries")
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/timeSeries_4032.109.tgz'
Content type 'application/x-gzip' length 2072512 bytes (2.0 MB)
=====
downloaded 2.0 MB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
> install.packages("dplyr")
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/dplyr_1.1.4.tgz'
Content type 'application/x-gzip' length 1595439 bytes (1.5 MB)
=====
downloaded 1.5 MB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
> install.packages("fGarch")
also installing the dependencies 'rbibutils', 'gss', 'stabledist', 'gbutils',
'Rdpack', 'fBasics', 'fastICA', 'cvar'

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/rbibutils_2.2.16.tgz'
Content type 'application/x-gzip' length 1029790 bytes (1005 KB)
=====
downloaded 1005 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/gss_2.2-7.tgz'
Content type 'application/x-gzip' length 1764859 bytes (1.7 MB)
=====
downloaded 1.7 MB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/stabledist_0.7-1.tgz'
Content type 'application/x-gzip' length 73215 bytes (71 KB)
=====
downloaded 71 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/gbutils_0.5.tgz'
Content type 'application/x-gzip' length 250421 bytes (244 KB)
=====
downloaded 244 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/Rdpack_2.6.tgz'
```

Content type 'application/x-gzip' length 746967 bytes (729 KB)

downloaded 729 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/fBasics_4032.96.tgz'

Content type 'application/x-gzip' length 2678237 bytes (2.6 MB)

downloaded 2.6 MB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/fastICA_1.2-4.tgz'

Content type 'application/x-gzip' length 62774 bytes (61 KB)

downloaded 61 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/cvar_0.5.tgz'

Content type 'application/x-gzip' length 257290 bytes (251 KB)

downloaded 251 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/fGarch_4033.92.tgz'

Content type 'application/x-gzip' length 680701 bytes (664 KB)

downloaded 664 KB

The downloaded binary packages are in

/var/folders/2f/9fz2wbqj7vlycgt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages

> install.packages("prophet")

also installing the dependencies 'tensorA', 'distributional', 'matrixStats', 'posterior', 'inline', 'gridExtra', 'loo', 'QuickJSR', 'RcppEigen', 'dygraphs', 'extraDistr', 'rstan', 'rstantools', 'StanHeaders'

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/tensorA_0.36.2.1.tgz'

Content type 'application/x-gzip' length 224376 bytes (219 KB)

downloaded 219 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/distributional_0.4.0.tgz'

Content type 'application/x-gzip' length 429003 bytes (418 KB)

downloaded 418 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/matrixStats_1.2.0.tgz'

Content type 'application/x-gzip' length 621826 bytes (607 KB)

downloaded 607 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/posterior_1.5.0.tgz'

Content type 'application/x-gzip' length 963383 bytes (940 KB)

downloaded 940 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/inline_0.3.19.tgz'

Content type 'application/x-gzip' length 127860 bytes (124 KB)

downloaded 124 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/gridExtra_2.3.tgz'

Content type 'application/x-gzip' length 1104752 bytes (1.1 MB)

downloaded 1.1 MB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/loo_2.7.0.tgz'

Content type 'application/x-gzip' length 1856325 bytes (1.8 MB)

downloaded 1.8 MB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/QuickJSR_1.1.3.tgz'

Content type 'application/x-gzip' length 3766336 bytes (3.6 MB)

downloaded 3.6 MB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/RcppEigen_0.3.4.0.0.tgz'

Content type 'application/x-gzip' length 4943708 bytes (4.7 MB)

downloaded 4.7 MB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/dygraphs_1.1.1.6.tgz'

Content type 'application/x-gzip' length 424406 bytes (414 KB)

downloaded 414 KB

trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/extraDistr_1.10.0.tgz'

Content type 'application/x-gzip' length 3706597 bytes (3.5 MB)

downloaded 3.5 MB

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/rstan_2.32.6.tgz'
Content type 'application/x-gzip' length 8927989 bytes (8.5 MB)
```

```
=====
downloaded 8.5 MB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/rstantools_2.4.0.tgz'
Content type 'application/x-gzip' length 166623 bytes (162 KB)
```

```
=====
downloaded 162 KB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/StanHeaders_2.32.6.tgz'
Content type 'application/x-gzip' length 2874644 bytes (2.7 MB)
```

```
=====
downloaded 2.7 MB
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.2/prophet_1.0.tgz'
Content type 'application/x-gzip' length 6164557 bytes (5.9 MB)
```

```
=====
downloaded 5.9 MB
```

The downloaded binary packages are in

```
/var/folders/2f/9fz2wbqj7vlcygt681kl2k0m0000gn/T//Rtmpbq6hsX/downloaded_packages
```

```
> library(prophet)
Loading required package: Rcpp
Loading required package: rlang
> library(quantmod)
Loading required package: xts
Loading required package: zoo
```

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

The following objects are masked from 'package:base':

```
as.Date, as.Date.numeric
```

```
Loading required package: TTR
Registered S3 method overwritten by 'quantmod':
  method      from
as.zoo.data.frame zoo
> library(forecast)
> library("xlsx")
> library(tseries)
```

```
'tseries' version: 0.10-55
```

`'tseries'` is a package for time series analysis and computational finance.

See `'library(help="tseries")'` for details.

```
> library(timeSeries)
Loading required package: timeDate
```

Attaching package: `'timeSeries'`

The following object is masked from `'package:zoo'`:

```
time<-
```

The following objects are masked from `'package:graphics'`:

```
lines, points
```

```
> library(dplyr)
```

```
##### Warning from 'xts' package #####
#
# The dplyr lag() function breaks how base R's lag() function is supposed to #
# work, which breaks lag(my_xts). Calls to lag(my_xts) that you type or #
# source() into this session won't work correctly. #
#
# Use stats::lag() to make sure you're not using dplyr::lag(), or you can add #
# conflictRules('dplyr', exclude = 'lag') to your .Rprofile to stop #
# dplyr from breaking base R's lag() function. #
#
# Code in packages is not affected. It's protected by R's namespace mechanism #
# Set `options(xts.warn_dplyr_breaks_lag = FALSE)` to suppress this warning. #
#
#####
```

Attaching package: `'dplyr'`

The following objects are masked from `'package:timeSeries'`:

```
filter, lag
```

The following objects are masked from `'package:xts'`:

```
first, last
```

The following objects are masked from `'package:stats'`:

```
filter, lag
```

The following objects are masked from `'package:base'`:

`intersect, setdiff, setequal, union`

```
> library(fGarch)
```

NOTE: Packages 'fBasics', 'timeDate', and 'timeSeries' are no longer attached to the search() path when 'fGarch' is attached.

If needed attach them yourself in your R script by e.g.,
`require("timeSeries")`

Attaching package: 'fGarch'

The following object is masked from 'package:TTR':

`volatility`

```
> getSymbols("AMZN", src = "yahoo", from = "2015-01-01")
```

```
[1] "AMZN"
```

```
> AMZN
```

	AMZN.Open	AMZN.High	AMZN.Low	AMZN.Close	AMZN.Volume	AMZN.Adjusted
2015-01-02	15.6290	15.7375	15.3480	15.4260	55664000	15.4260
2015-01-05	15.3505	15.4190	15.0425	15.1095	55484000	15.1095
2015-01-06	15.1120	15.1500	14.6190	14.7645	70380000	14.7645
2015-01-07	14.8750	15.0640	14.7665	14.9210	52806000	14.9210
2015-01-08	15.0160	15.1570	14.8055	15.0230	61768000	15.0230
2015-01-09	15.0740	15.1435	14.8340	14.8465	51848000	14.8465
2015-01-12	14.8780	14.9255	14.4640	14.5705	68428000	14.5705
2015-01-13	14.8740	15.0750	14.6615	14.7370	82728000	14.7370
2015-01-14	14.5965	14.7955	14.3250	14.6635	110774000	14.6635
2015-01-15	14.7000	14.8000	14.3410	14.3475	88384000	14.3475

...

2024-03-15	176.6400	177.9300	173.9000	174.4200	72115500	174.4200
2024-03-18	175.8000	176.6900	174.2800	174.4800	31250700	174.4800
2024-03-19	174.2200	176.0900	173.5200	175.9000	26880900	175.9000
2024-03-20	176.1400	178.5300	174.6400	178.1500	29947200	178.1500
2024-03-21	179.9900	181.4200	178.1500	178.1500	32824300	178.1500
2024-03-22	177.7500	179.2600	176.7500	178.8700	27964100	178.8700
2024-03-25	178.0100	180.9900	177.2400	179.7100	29815500	179.7100
2024-03-26	180.1500	180.4500	177.9500	178.3000	29659000	178.3000
2024-03-27	179.8800	180.0000	177.3100	179.8300	33272600	179.8300
2024-03-28	180.1700	181.7000	179.2600	180.3800	38027400	180.3800

```
> print(adf.test(AMZN$AMZN.Close))
```

Augmented Dickey-Fuller Test

data: AMZN\$AMZN.Close

Dickey-Fuller = -1.9801, Lag order = 13, p-value = 0.5868

alternative hypothesis: stationary

```
> auto.arima(AMZN$AMZN.Close, lambda = "auto")
```

Series: AMZN\$AMZN.Close

ARIMA(2,1,2) with drift

Box Cox transformation: lambda= -0.2133491

Coefficients:

	ar1	ar2	ma1	ma2	drift
	-0.3357	-0.9123	0.3396	0.9342	5e-04
s.e.	0.0779	0.0482	0.0681	0.0420	2e-04

sigma^2 = 6.83e-05: log likelihood = 7850.31

AIC=-15688.62 AICc=-15688.58 BIC=-15654.11

```
> modelfit <- auto.arima(AMZN$AMZN.Close, lambda = "auto")
```

```
> price_forecast <- forecast(modelfit, h = 30)
```

```
> plot(price_forecast)
```

```
> head(price_forecast$mean)
```

Time Series:

Start = 2326

End = 2331

Frequency = 1

```
[1] 180.7254 181.0617 181.2000 181.4142 181.7851 182.0347
```

```
> head(price_forecast$lower)
```

Time Series:

Start = 2326

End = 2331

Frequency = 1

	80%	95%
2326	175.0356	172.1117
2327	173.0458	168.9768
2328	171.3621	166.4167
2329	170.0846	164.4349
2330	169.1729	162.9265
2331	168.2412	161.4532

```
> tail(price_forecast$upper)
```

Time Series:

Start = 2350

End = 2355

Frequency = 1

	80%	95%
2350	220.6896	241.5986
2351	221.7744	243.2479
2352	222.8718	244.9086
2353	223.8888	246.4832
2354	224.9046	248.0532
2355	225.9795	249.6837

```
> N = length(AMZN$AMZN.Close)
```

```
> n = 0.7 * N
```

```
> train = AMZN$AMZN.Close[1:n, ]
```

```
> test = AMZN$AMZN.Close[(n + 1):N, ]
```

```
> trainarimafit <- auto.arima(train, lambda = "auto")
```

```
> predlen = length(test)
```

```
> trainarimafit <- forecast(trainarimafit, h = predlen)
```

```
> meanvalues <- as.vector(trainarimafit$mean)
```

```
> precios <- as.vector(test$AMZN.Close)
```

```
> plot(meanvalues, type = "l", col = "red")  
> lines(precios, type = "l")
```

Forecasts from ARIMA(2,1,2) with drift

