W271-2 – Spring 2016 – **HW 6**

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Contents

Exercises

Exercise 1

a. **Discuss the mean and variance functions and how the similarities and differences from those we studied in classical linear model.**

...

b. **Define strict and weak statonarity**

...

Exercise 2

a. **Generate a zero-drift random walk model using 500 simulation.**

```r
set.seed(123)
N <- 500 # number of simulations / time periods
wn <- rnorm(n = N, mean = 0, sd = 1) # white noise (can use any mean and sd)
rw <- cumsum(wn)
```

b. **Provide the descriptive statistics of the simulated realizations. The descriptive statistics should include the mean, standard deviation, 25th, 50th, and 75th quantiles, minimum, and maximum.**

```r
# See the definition of the function in ## @knitr Libraries-Functions-Constants
desc_stat(rw, 'Random walk',
          'Descriptive statistics of the simulated random walk')
```

Table 1: Descriptive statistics of the simulated random walk

	Random walk
Mean	4.58
St. Dev	4.87
1st Quartile	0.97
Median	3.42
3rd Quartile	8.27
Min	-5.16
Max	19.35

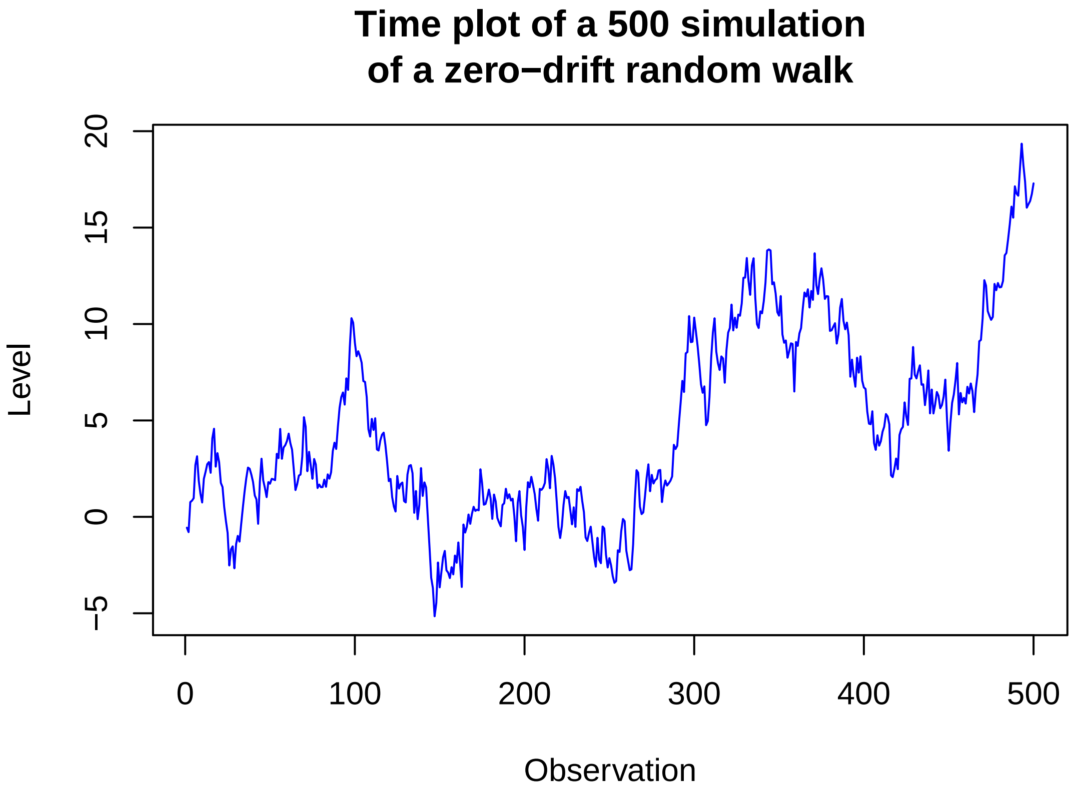
c. **Plot the time-series plot of the simulated realizations.**

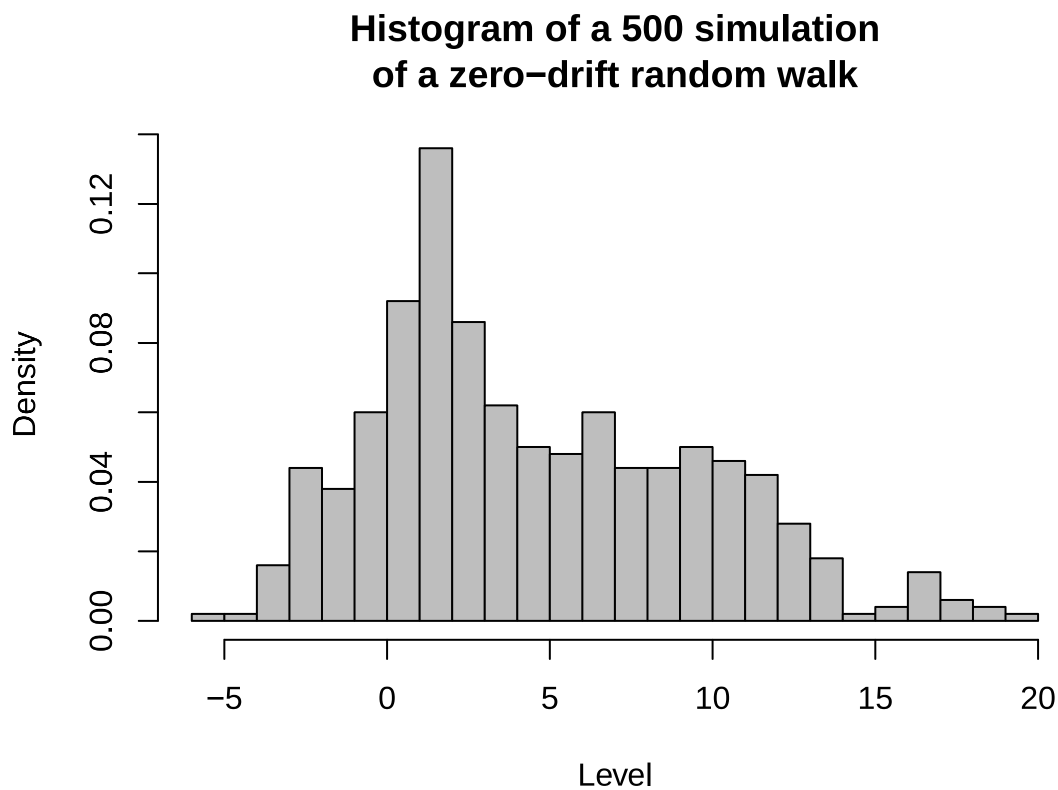
See the last part of this Exercise in the following page.

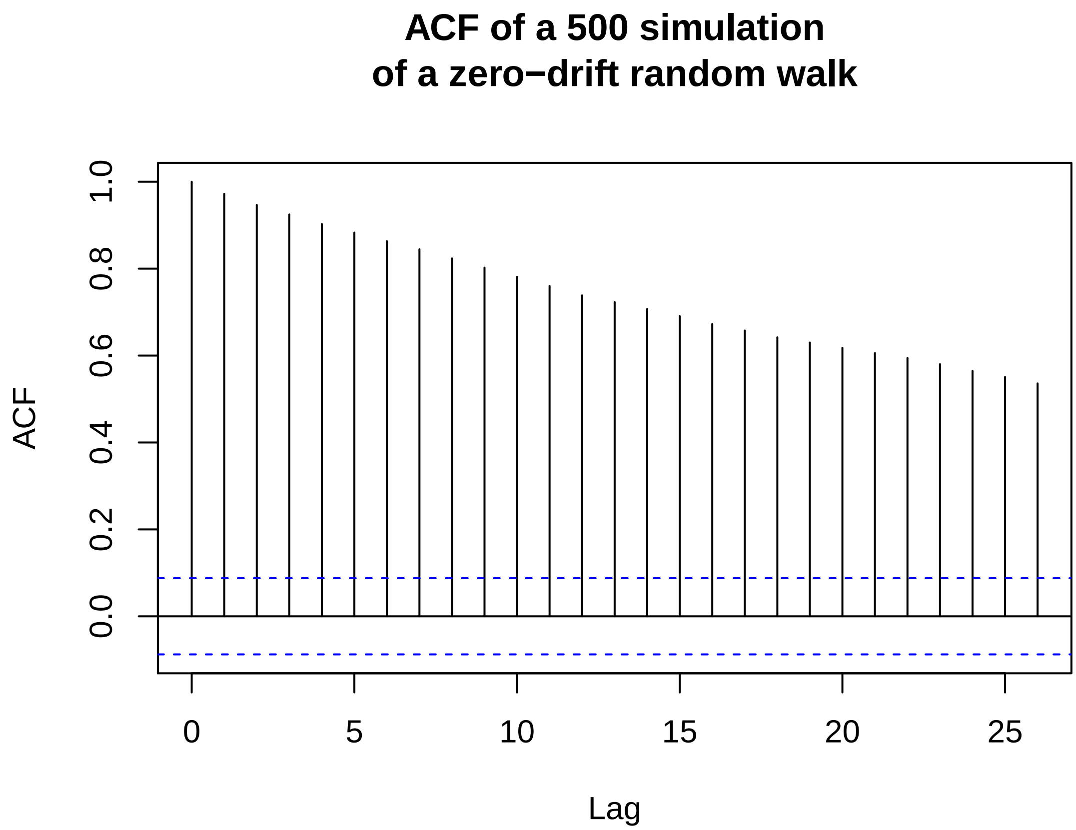
d. **Plot the autocorrelation graph.**

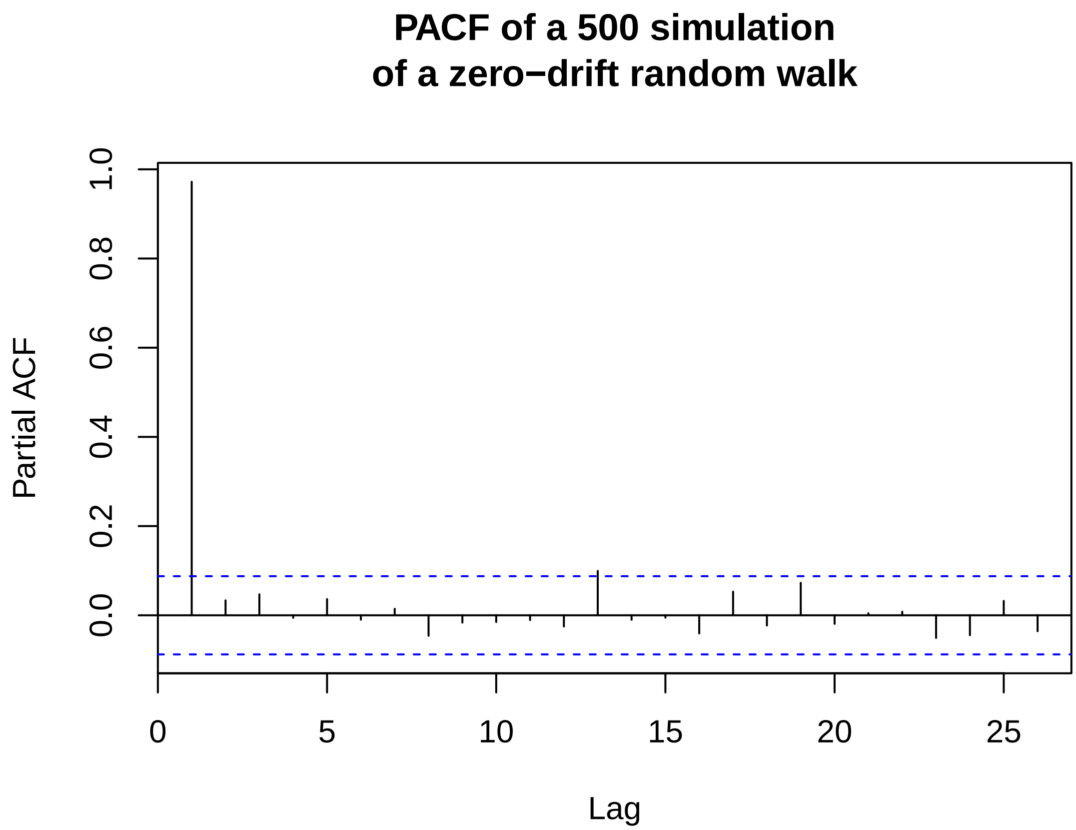
See the last part of this Exercise in the following page.

e. **Plot the partial autocorrelation graph.**




Histogram of a 500 simulation
of a zero−drift random walk
Density
0.00
0.04
0.08
0.12
−5
0
5
10
15
20
Level


ACF of a 500 simulation
of a zero−drift random walk
ACF
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
Lag


PACF of a 500 simulation
of a zero−drift random walk
Partial ACF
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
Lag

Exercise 3

a. **Generate a random walk with drift model using 500 simulation, with the drift = 0.5.**

```
drift <- 0.5 # drift
# Use the same GWN that genereate the prev. zero-drift RW
# set.seed(123); wn <- rnorm(n = N, mean = 0, sd = 1)
rw_drift <- cumsum(wn + drift)
```

b. **Provide the descriptive statistics of the simulated realizations. The descriptive statistics should include the mean, standard deviation, 25th, 50th, and 75th quantiles, minimum, and maximum.**

```
# See the definition of the function in ## @knitr Libraries-Functions-Constants
desc_stat(cbind(rw, rw_drift), c('Random walk', 'Random walk with 0.5 drift'),
          'Descriptive statistics of the two simulated random walks')
```

Table 2: Descriptive statistics of the two simulated random walks

	Random walk	Random walk with 0.5 drift
Mean	4.58	129.83
St. Dev	4.87	75.43
1st Quartile	0.97	64.58
Median	3.42	122.91
3rd Quartile	8.27	199.68
Min	-5.16	-0.06
Max	19.35	267.30

c. **Plot the time-series plot of the simulated realizations.**

See the last part of this Exercise in the following page.

d. **Plot the autocorrelation graph.**

See the last part of this Exercise in the following page.

e. **Plot the partial autocorrelation graph.**

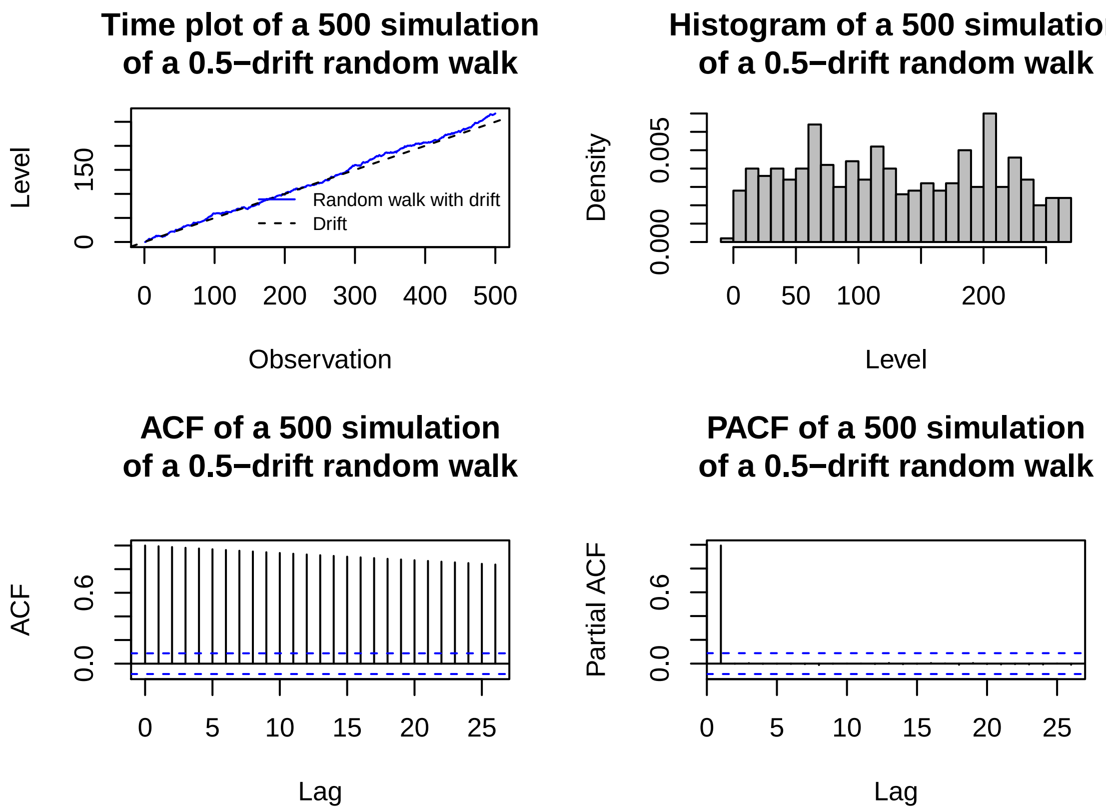


Figure 1: Time-series plot, histogram, correlogram, and partial autocorrelogram of the 500 simulation of a 0.5-drift random walk

---

Exercise 4

Use the series from `INJCJC.csv`.

a. **Load the data and examine the basic structure of the data using `str()`, `dim()`, `head()`, and `tail()` functions.**

```
INJCJC <- read.csv('INJCJC.csv', header = TRUE)
str(INJCJC)
```

```
## 'data.frame':    1300 obs. of  3 variables:
##  $ Date   : Factor w/ 1300 levels "1-Apr-05","1-Apr-11",..: 1102 143 442 784 483 1271 312 654 498 128
##  $ INJCJC : int  355 369 375 345 368 367 348 350 351 349 ...
##  $ INJCJC4: num  362 366 364 361 364 ...
```

```
dim(INJCJC); obs <- dim(INJCJC)[1]
```

```
## [1] 1300    3
```

```
head(INJCJC)
```

```
##        Date INJCJC INJCJC4
## 1  5-Jan-90    355  362.25
## 2 12-Jan-90    369  365.75
## 3 19-Jan-90    375  364.25
## 4 26-Jan-90    345  361.00
## 5  2-Feb-90    368  364.25
## 6  9-Feb-90    367  363.75
```

```
tail(INJCJC)
```

```
##           Date INJCJC INJCJC4
## 1295 24-Oct-14    288  281.25
## 1296 31-Oct-14    278  279.00
## 1297  7-Nov-14    293  285.75
## 1298 14-Nov-14    292  294.25
## 1299 21-Nov-14    314  294.25
## 1300 28-Nov-14    297  299.00
```

```
desc_stat(INJCJC[, -1], names(INJCJC)[-1],
          'Descriptive statistics of the INJCJC variables')
```

Table 3: Descriptive statistics of the INJCJC variables

	INJCJC	INJCJC4
Mean	371.14	371.24
St. Dev	67.38	66.30
1st Quartile	324.00	324.69
Median	353.50	352.12
3rd Quartile	406.00	405.75
Min	259.00	266.25
Max	665.00	659.25

The 1300 observations (of two variables, `INJCJC` and `INJCJC4`) correspond to $1,300/52 = 25$ periods of 52 weeks, i.e., almost 25 years from January 5, 1990, until November 28, 2014. All observations correspond to Fridays.

Since years are slightly longer (by 1 or 2 days) than 52 weeks, some years have 53 Fridays instead, and hence the last year in the sample (2014) is not complete (there were 1,304 Fridays in that 25-year period from 1990 to 2014).

```
x <- INJCJC %>%
  mutate(Date = as.Date(as.character(Date), '%d-%b-%y')) %>%
  mutate(Year = year(Date), Weekday = weekdays(Date)) %>%
  group_by(Year, Weekday) %>%
  summarise(obs = n(), start_date = min(Date), end_date = max(Date)) %>%
  print(n=Inf)
```

```
## Source: local data frame [25 x 5]
## Groups: Year [?]
##
##     Year Weekday   obs start_date   end_date
##    (dbl)   (chr) (int)     (date)     (date)
## 1   1990  Friday    52 1990-01-05 1990-12-28
## 2   1991  Friday    52 1991-01-04 1991-12-27
## 3   1992  Friday    52 1992-01-03 1992-12-25
## 4   1993  Friday    53 1993-01-01 1993-12-31
## 5   1994  Friday    52 1994-01-07 1994-12-30
## 6   1995  Friday    52 1995-01-06 1995-12-29
## 7   1996  Friday    52 1996-01-05 1996-12-27
## 8   1997  Friday    52 1997-01-03 1997-12-26
## 9   1998  Friday    52 1998-01-02 1998-12-25
## 10  1999  Friday    53 1999-01-01 1999-12-31
## 11  2000  Friday    52 2000-01-07 2000-12-29
## 12  2001  Friday    52 2001-01-05 2001-12-28
## 13  2002  Friday    52 2002-01-04 2002-12-27
## 14  2003  Friday    52 2003-01-03 2003-12-26
## 15  2004  Friday    53 2004-01-02 2004-12-31
## 16  2005  Friday    52 2005-01-07 2005-12-30
## 17  2006  Friday    52 2006-01-06 2006-12-29
## 18  2007  Friday    52 2007-01-05 2007-12-28
## 19  2008  Friday    52 2008-01-04 2008-12-26
## 20  2009  Friday    52 2009-01-02 2009-12-25
## 21  2010  Friday    53 2010-01-01 2010-12-31
## 22  2011  Friday    52 2011-01-07 2011-12-30
## 23  2012  Friday    52 2012-01-06 2012-12-28
## 24  2013  Friday    52 2013-01-04 2013-12-27
## 25  2014  Friday    48 2014-01-03 2014-11-28
```

```
kable(INJCJC %>%
  mutate(week_num = 1:obs,
         week = ifelse(week_num %% 52== 0, 52, week_num %% 52)) %>%
  filter(week %% 52 < 2))
```

Date	INJCJC	INJCJC4	week_num	week
5-Jan-90	355	362.25	1	1

Date	INJCJC	INJCJC4	week_num	week
28-Dec-90	454	456.00	52	52
4-Jan-91	415	447.50	53	1
27-Dec-91	441	456.75	104	52
3-Jan-92	432	446.00	105	1
25-Dec-92	313	339.00	156	52
1-Jan-93	341	336.75	157	1
24-Dec-93	290	323.00	208	52
31-Dec-93	341	324.00	209	1
23-Dec-94	314	324.25	260	52
30-Dec-94	319	323.00	261	1
22-Dec-95	374	366.50	312	52
29-Dec-95	359	363.00	313	1
20-Dec-96	350	347.25	364	52
27-Dec-96	357	353.50	365	1
19-Dec-97	310	317.00	416	52
26-Dec-97	303	313.25	417	1
18-Dec-98	297	309.50	468	52
25-Dec-98	336	316.00	469	1
17-Dec-99	287	283.50	520	52
24-Dec-99	268	278.50	521	1
15-Dec-00	354	342.25	572	52
22-Dec-00	364	344.25	573	1
14-Dec-01	389	434.50	624	52
21-Dec-01	416	415.75	625	1
13-Dec-02	429	405.25	676	52
20-Dec-02	394	406.25	677	1
12-Dec-03	363	360.25	728	52
19-Dec-03	354	360.25	729	1
10-Dec-04	316	326.75	780	52
17-Dec-04	322	329.00	781	1
9-Dec-05	327	320.75	832	52
16-Dec-05	312	317.75	833	1
8-Dec-06	311	328.25	884	52
15-Dec-06	318	326.25	885	1
7-Dec-07	332	340.00	936	52
14-Dec-07	350	344.50	937	1
5-Dec-08	570	541.75	988	52
12-Dec-08	566	549.25	989	1
4-Dec-09	497	490.25	1040	52
11-Dec-09	498	488.00	1041	1
3-Dec-10	431	427.50	1092	52
10-Dec-10	428	426.00	1093	1
2-Dec-11	390	390.25	1144	52
9-Dec-11	369	386.25	1145	1
30-Nov-12	379	406.25	1196	52
7-Dec-12	343	380.50	1197	1
29-Nov-13	317	328.75	1248	52
6-Dec-13	358	332.75	1249	1
28-Nov-14	297	299.00	1300	52

```
# Count weeks
sum(sapply(1990:2014, function(y)
  ifelse(((y %% 4 == 0) & (y %% 100 != 0)) | (y %% 400 == 0), 366, 365))) / 7
```

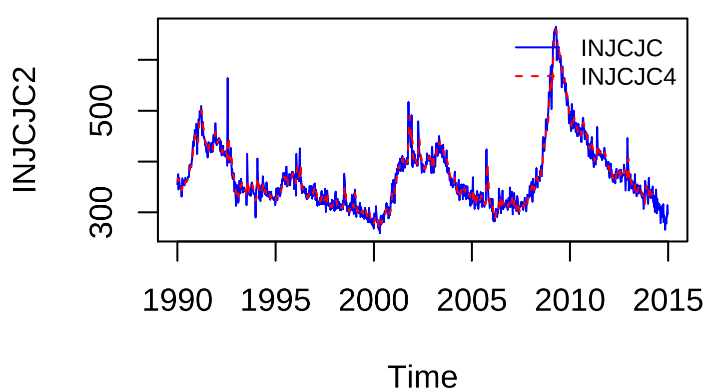
```
## [1] 1304.429
```

```
# Count Fridays in that period
ceiling(as.numeric(as.Date('2014-12-31') + 1 - 5 + 4) / 7) -
  ceiling(as.numeric(as.Date('1990-01-01') - 5 + 4) / 7)
```

```
## [1] 1304
```

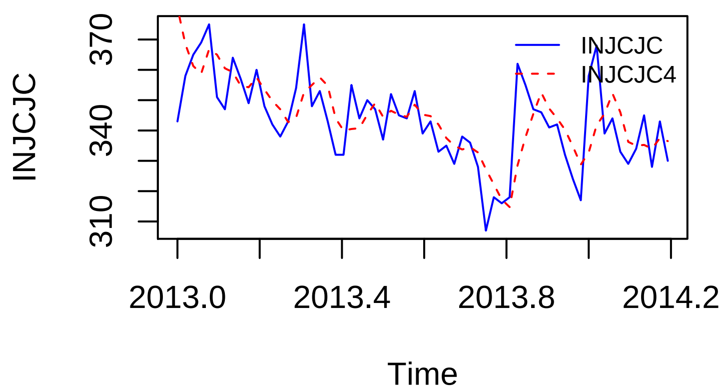
b. **Convert the variables `INJCJC` into a time series object `frequency=52, start=c(1990,1,1), end=c(2014,11,28)`. Examine the converted data series.**

```
# Convert the variables `INJCJC` into a time series object `frequency=52,
# start=c(1990,1,1), end=c(2014,11,28)`
# Examine the converted data series
INJCJC4 <- ts(INJCJC$INJCJC4, frequency = 52, start = c(1990, 1, 1),
              end = c(2014, 11, 28))
INJCJC2 <- INJCJC %>%
  mutate(Date = as.Date(as.character(Date), '%d-%b-%y'))
INJCJC2 <- ts(INJCJC2$INJCJC, frequency = 52, start = c(1990, 1, 1))
INJCJC <- ts(INJCJC$INJCJC, frequency = 52, start = c(1990, 1, 1),
             end = c(2014, 11, 28))
plot.ts(INJCJC2, col = 'blue')
lines(INJCJC4, col = 'red', lty = 2)
leg.txt <- c("INJCJC", "INJCJC4")
legend("topright", legend=leg.txt, lty=c(1,2), col=c("blue", "red"),
       bty = 'n', cex = .75)
```



```
# plot.ts(cbind(INJCJC, INJCJC4), main = 'Time', col = 'blue')
```

```
plot.ts(window(INJCJC, start = c(2013, 1)), col = 'blue',
        ylab = 'INJCJC')
lines(INJCJC4, col='red', lty = 2)
leg.txt <- c("INJCJC", "INJCJC4")
legend("topright", legend=leg.txt, lty=c(1,2), col=c("blue", "red"),
       bty = 'n', cex = .75)
```




```
time(INJCJC)
```

```
## Time Series:
## Start = c(1990, 1)
## End = c(2014, 11)
## Frequency = 52
##    [1] 1990.000 1990.019 1990.038 1990.058 1990.077 1990.096 1990.115
##    [8] 1990.135 1990.154 1990.173 1990.192 1990.212 1990.231 1990.250
##   [15] 1990.269 1990.288 1990.308 1990.327 1990.346 1990.365 1990.385
##   [22] 1990.404 1990.423 1990.442 1990.462 1990.481 1990.500 1990.519
##   [29] 1990.538 1990.558 1990.577 1990.596 1990.615 1990.635 1990.654
##   [36] 1990.673 1990.692 1990.712 1990.731 1990.750 1990.769 1990.788
##   [43] 1990.808 1990.827 1990.846 1990.865 1990.885 1990.904 1990.923
##   [50] 1990.942 1990.962 1990.981 1991.000 1991.019 1991.038 1991.058
##   [57] 1991.077 1991.096 1991.115 1991.135 1991.154 1991.173 1991.192
##   [64] 1991.212 1991.231 1991.250 1991.269 1991.288 1991.308 1991.327
##   [71] 1991.346 1991.365 1991.385 1991.404 1991.423 1991.442 1991.462
##   [78] 1991.481 1991.500 1991.519 1991.538 1991.558 1991.577 1991.596
##   [85] 1991.615 1991.635 1991.654 1991.673 1991.692 1991.712 1991.731
##   [92] 1991.750 1991.769 1991.788 1991.808 1991.827 1991.846 1991.865
##   [99] 1991.885 1991.904 1991.923 1991.942 1991.962 1991.981 1992.000
##  [106] 1992.019 1992.038 1992.058 1992.077 1992.096 1992.115 1992.135
##  [113] 1992.154 1992.173 1992.192 1992.212 1992.231 1992.250 1992.269
##  [120] 1992.288 1992.308 1992.327 1992.346 1992.365 1992.385 1992.404
```

```
## [127] 1992.423 1992.442 1992.462 1992.481 1992.500 1992.519 1992.538
## [134] 1992.558 1992.577 1992.596 1992.615 1992.635 1992.654 1992.673
## [141] 1992.692 1992.712 1992.731 1992.750 1992.769 1992.788 1992.808
## [148] 1992.827 1992.846 1992.865 1992.885 1992.904 1992.923 1992.942
## [155] 1992.962 1992.981 1993.000 1993.019 1993.038 1993.058 1993.077
## [162] 1993.096 1993.115 1993.135 1993.154 1993.173 1993.192 1993.212
## [169] 1993.231 1993.250 1993.269 1993.288 1993.308 1993.327 1993.346
## [176] 1993.365 1993.385 1993.404 1993.423 1993.442 1993.462 1993.481
## [183] 1993.500 1993.519 1993.538 1993.558 1993.577 1993.596 1993.615
## [190] 1993.635 1993.654 1993.673 1993.692 1993.712 1993.731 1993.750
## [197] 1993.769 1993.788 1993.808 1993.827 1993.846 1993.865 1993.885
## [204] 1993.904 1993.923 1993.942 1993.962 1993.981 1994.000 1994.019
## [211] 1994.038 1994.058 1994.077 1994.096 1994.115 1994.135 1994.154
## [218] 1994.173 1994.192 1994.212 1994.231 1994.250 1994.269 1994.288
## [225] 1994.308 1994.327 1994.346 1994.365 1994.385 1994.404 1994.423
## [232] 1994.442 1994.462 1994.481 1994.500 1994.519 1994.538 1994.558
## [239] 1994.577 1994.596 1994.615 1994.635 1994.654 1994.673 1994.692
## [246] 1994.712 1994.731 1994.750 1994.769 1994.788 1994.808 1994.827
## [253] 1994.846 1994.865 1994.885 1994.904 1994.923 1994.942 1994.962
## [260] 1994.981 1995.000 1995.019 1995.038 1995.058 1995.077 1995.096
## [267] 1995.115 1995.135 1995.154 1995.173 1995.192 1995.212 1995.231
## [274] 1995.250 1995.269 1995.288 1995.308 1995.327 1995.346 1995.365
## [281] 1995.385 1995.404 1995.423 1995.442 1995.462 1995.481 1995.500
## [288] 1995.519 1995.538 1995.558 1995.577 1995.596 1995.615 1995.635
## [295] 1995.654 1995.673 1995.692 1995.712 1995.731 1995.750 1995.769
## [302] 1995.788 1995.808 1995.827 1995.846 1995.865 1995.885 1995.904
## [309] 1995.923 1995.942 1995.962 1995.981 1996.000 1996.019 1996.038
## [316] 1996.058 1996.077 1996.096 1996.115 1996.135 1996.154 1996.173
## [323] 1996.192 1996.212 1996.231 1996.250 1996.269 1996.288 1996.308
## [330] 1996.327 1996.346 1996.365 1996.385 1996.404 1996.423 1996.442
## [337] 1996.462 1996.481 1996.500 1996.519 1996.538 1996.558 1996.577
## [344] 1996.596 1996.615 1996.635 1996.654 1996.673 1996.692 1996.712
## [351] 1996.731 1996.750 1996.769 1996.788 1996.808 1996.827 1996.846
## [358] 1996.865 1996.885 1996.904 1996.923 1996.942 1996.962 1996.981
## [365] 1997.000 1997.019 1997.038 1997.058 1997.077 1997.096 1997.115
## [372] 1997.135 1997.154 1997.173 1997.192 1997.212 1997.231 1997.250
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## [386] 1997.404 1997.423 1997.442 1997.462 1997.481 1997.500 1997.519
## [393] 1997.538 1997.558 1997.577 1997.596 1997.615 1997.635 1997.654
## [400] 1997.673 1997.692 1997.712 1997.731 1997.750 1997.769 1997.788
## [407] 1997.808 1997.827 1997.846 1997.865 1997.885 1997.904 1997.923
## [414] 1997.942 1997.962 1997.981 1998.000 1998.019 1998.038 1998.058
## [421] 1998.077 1998.096 1998.115 1998.135 1998.154 1998.173 1998.192
## [428] 1998.212 1998.231 1998.250 1998.269 1998.288 1998.308 1998.327
## [435] 1998.346 1998.365 1998.385 1998.404 1998.423 1998.442 1998.462
## [442] 1998.481 1998.500 1998.519 1998.538 1998.558 1998.577 1998.596
## [449] 1998.615 1998.635 1998.654 1998.673 1998.692 1998.712 1998.731
## [456] 1998.750 1998.769 1998.788 1998.808 1998.827 1998.846 1998.865
## [463] 1998.885 1998.904 1998.923 1998.942 1998.962 1998.981 1999.000
## [470] 1999.019 1999.038 1999.058 1999.077 1999.096 1999.115 1999.135
## [477] 1999.154 1999.173 1999.192 1999.212 1999.231 1999.250 1999.269
## [484] 1999.288 1999.308 1999.327 1999.346 1999.365 1999.385 1999.404
## [491] 1999.423 1999.442 1999.462 1999.481 1999.500 1999.519 1999.538
## [498] 1999.558 1999.577 1999.596 1999.615 1999.635 1999.654 1999.673
```

```
## [505] 1999.692 1999.712 1999.731 1999.750 1999.769 1999.788 1999.808
## [512] 1999.827 1999.846 1999.865 1999.885 1999.904 1999.923 1999.942
## [519] 1999.962 1999.981 2000.000 2000.019 2000.038 2000.058 2000.077
## [526] 2000.096 2000.115 2000.135 2000.154 2000.173 2000.192 2000.212
## [533] 2000.231 2000.250 2000.269 2000.288 2000.308 2000.327 2000.346
## [540] 2000.365 2000.385 2000.404 2000.423 2000.442 2000.462 2000.481
## [547] 2000.500 2000.519 2000.538 2000.558 2000.577 2000.596 2000.615
## [554] 2000.635 2000.654 2000.673 2000.692 2000.712 2000.731 2000.750
## [561] 2000.769 2000.788 2000.808 2000.827 2000.846 2000.865 2000.885
## [568] 2000.904 2000.923 2000.942 2000.962 2000.981 2001.000 2001.019
## [575] 2001.038 2001.058 2001.077 2001.096 2001.115 2001.135 2001.154
## [582] 2001.173 2001.192 2001.212 2001.231 2001.250 2001.269 2001.288
## [589] 2001.308 2001.327 2001.346 2001.365 2001.385 2001.404 2001.423
## [596] 2001.442 2001.462 2001.481 2001.500 2001.519 2001.538 2001.558
## [603] 2001.577 2001.596 2001.615 2001.635 2001.654 2001.673 2001.692
## [610] 2001.712 2001.731 2001.750 2001.769 2001.788 2001.808 2001.827
## [617] 2001.846 2001.865 2001.885 2001.904 2001.923 2001.942 2001.962
## [624] 2001.981 2002.000 2002.019 2002.038 2002.058 2002.077 2002.096
## [631] 2002.115 2002.135 2002.154 2002.173 2002.192 2002.212 2002.231
## [638] 2002.250 2002.269 2002.288 2002.308 2002.327 2002.346 2002.365
## [645] 2002.385 2002.404 2002.423 2002.442 2002.462 2002.481 2002.500
## [652] 2002.519 2002.538 2002.558 2002.577 2002.596 2002.615 2002.635
## [659] 2002.654 2002.673 2002.692 2002.712 2002.731 2002.750 2002.769
## [666] 2002.788 2002.808 2002.827 2002.846 2002.865 2002.885 2002.904
## [673] 2002.923 2002.942 2002.962 2002.981 2003.000 2003.019 2003.038
## [680] 2003.058 2003.077 2003.096 2003.115 2003.135 2003.154 2003.173
## [687] 2003.192 2003.212 2003.231 2003.250 2003.269 2003.288 2003.308
## [694] 2003.327 2003.346 2003.365 2003.385 2003.404 2003.423 2003.442
## [701] 2003.462 2003.481 2003.500 2003.519 2003.538 2003.558 2003.577
## [708] 2003.596 2003.615 2003.635 2003.654 2003.673 2003.692 2003.712
## [715] 2003.731 2003.750 2003.769 2003.788 2003.808 2003.827 2003.846
## [722] 2003.865 2003.885 2003.904 2003.923 2003.942 2003.962 2003.981
## [729] 2004.000 2004.019 2004.038 2004.058 2004.077 2004.096 2004.115
## [736] 2004.135 2004.154 2004.173 2004.192 2004.212 2004.231 2004.250
## [743] 2004.269 2004.288 2004.308 2004.327 2004.346 2004.365 2004.385
## [750] 2004.404 2004.423 2004.442 2004.462 2004.481 2004.500 2004.519
## [757] 2004.538 2004.558 2004.577 2004.596 2004.615 2004.635 2004.654
## [764] 2004.673 2004.692 2004.712 2004.731 2004.750 2004.769 2004.788
## [771] 2004.808 2004.827 2004.846 2004.865 2004.885 2004.904 2004.923
## [778] 2004.942 2004.962 2004.981 2005.000 2005.019 2005.038 2005.058
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## [1247] 2013.962 2013.981 2014.000 2014.019 2014.038 2014.058 2014.077
## [1254] 2014.096 2014.115 2014.135 2014.154 2014.173 2014.192
```

```
# r = 'blue') +
#   labs(y = 'Level', x = 'Observation',
#        title = 'Plot of a simulation of an\nAR(1) model with coef. 0.9')
```

c. **Define a variable using the command `INJCJC.time<-time(INJCJC)`.**

...

d. **Using the following command to examine the first 10 rows of the data. Change the parameter to examine different number of rows of data.**

```
head(cbind(INJCJC.time, INJCJC),10)
```

...

e.

1. **Plot the time series plot of `INJCJC`. Remember that the graph must be well labelled.**

...

2. **Plot the histogram of `INJCJC`. What is shown and not shown in a histogram? How do you decide the number of bins used?**

...

3. **Plot the autocorrelation graph of `INJCJC` series.**

...

4. **Plot the partial autocorrelation graph of `INJCJC` series.**

...

5. **Plot a 3x3 Scatterplot Matrix of correlation against lag values.**

...

f.

1. **Generate two symmetric Moving Average Smoothers. Choose the number of moving average terms such that one of the smoothers is very smoother and the other one can trace through the dynamics of the series. Plot the smoothers and the original series in one graph.**

...

2. **Generate two regression smoothers, one being a cubic trend regression and the other being a periodic regression. Plot the smoothers and the original series in one graph.**

...

3. **Generate kernel smoothers. Choose the smoothing parametrs such that one of the smoothers is very smoother and the other one can trace through the dynamics of the series. Plot the smoothers and the original series in one graph.**

...

4. **Generate two nearest neighborhood smoothers. Choose the smoothing parametrs such that one of the smoothers is very smoother and the other one can trace through the dynamics of the series. Plot the smoothers and the original series in one graph.**

...

5. **Generate two LOWESS smoothers. Choose the smoothing parametrs such that one of the smoothers is very smoother and the other one can trace through the dynamics of the series. Plot the smoothers and the original series in one graph.**

...

6. **Generate two spline smoothers. Choose the smoothing parametrs such that one of the smoothers is very smoother and the other one can trace through the dynamics of the series. Plot the smoothers and the original series in one graph.**

...