HW 1

Homework 1 - instructions

For your first homework assignment, find a time series and plot it. Submit your plot to me. I will give you feedback *only if* your series contains anomalies that cannot be handled with the methods we have learned in class. You will analyze the series in your future homework assignments.

Please modify the notebook below:

- Replace the example series with your chosen series.
- Code and Markdown cells that need to be adjusted are in green.
- Save the notebook file as 'HW1_[your last name here].rmd' (e.g. HW1_sivec.rmd).
- Name the data file 'data_[your last name here].xls' (e.g. data_sivec.xls).

Submission:

- Submit both, the notebook and the data file (e.g. HW1_sivec.rmd & data_sivec.xls).

Submitt via email:vasja.sivec@uni.lu by 1.Oct.2023

Suggested sources:

https://statistiques.public.lu/en.html

```
Eurostat - Statistical office of the EU features numerous series on
economy, finance, population, industry, environment,...
```

https://ec.europa.eu/eurostat/web/main/data/database

```
ECB SDW - European Central Bank data data on interest rates, loans,
exchange rates, financial corporations,... for european countries
```

https://sdw.ecb.europa.eu/

```
World Bank - Global development data (rGDP, population, social
conditions,...) for almost all the countries in the world.
```

https://data.worldbank.org/

```
IMF - International Monetary Fund data features data on economic
and financial conditions for most countries of the world
```

https://www.imf.org/en/Data

```
FRED data Federal Reserve Bank of St. Louis - go-to source for any
data on socio-economic conditions in the US
```

https://fred.stlouisfed.org/

```
Penn world data University of Groningen development statistics
```

https://www.rug.nl/ggdc/productivity/pwt/?lang=en

Feel free to explore other sources! This could be the statistical office of your own country or a time series related to your hobby. It is advisable to select a series that features a sufficient number of observations, say at least 50.

HW1 - hand in part

Source and description

Full link or name of the provider: https://fred.stlouisfed.org/series/RGDPNALUA666NRUG

Series code: RGDPNALUA666NRUG

Date of access: Oct. 12, 2022

Description: Luxembourg gross domestic product at constant prices. Not seasonally adjusted.

Characteristics

Periodicity or frequency: Annual
Time span: 1950-2019
Number of observations: 70

Plot the series and corresponding correlation and autocorrelation functions. Please plot also the first differences of the series. Modify the code below so that it imports and plots your series.

```
# supress warnings
knitr::opts_chunk$set(warning = FALSE, message = FALSE)
# IMPORT DATA
# Load required packages
library(readxl)
```

```
## Warning: package 'readxl' was built under R version 4.2.3
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

```
library(forecast)
```

```
## Warning: package 'forecast' was built under R version 4.2.3
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
library(ggpubr)
```

```
## Warning: package 'ggpubr' was built under R version 4.2.3
```

```
##
## Attaching package: 'ggpubr'
```

```
## The following object is masked from 'package:forecast':
##
##     gghistogram
```

```
# Set working directory
setwd('C:\\Users\\xct385\\Desktop\\DS ws\\MADS_win23\\PART_1_intro_uni_ts\\Ex_models_R')

# Import data
df <- read_excel('rgdp_2021q4.xlsx')
y  <- ts(df[,"PIB_R_SA"],start=c(sub("*Q.","",df[1,"date"]),sub(".*Q","",df[1,"date"])),frequency=4)

# FIGURE 1 :  level of the series
plot_y  <- ggplot(data.frame(x = time(y), y = as.numeric(y)), aes(x = x, y = y)) +
  geom_line() +
```
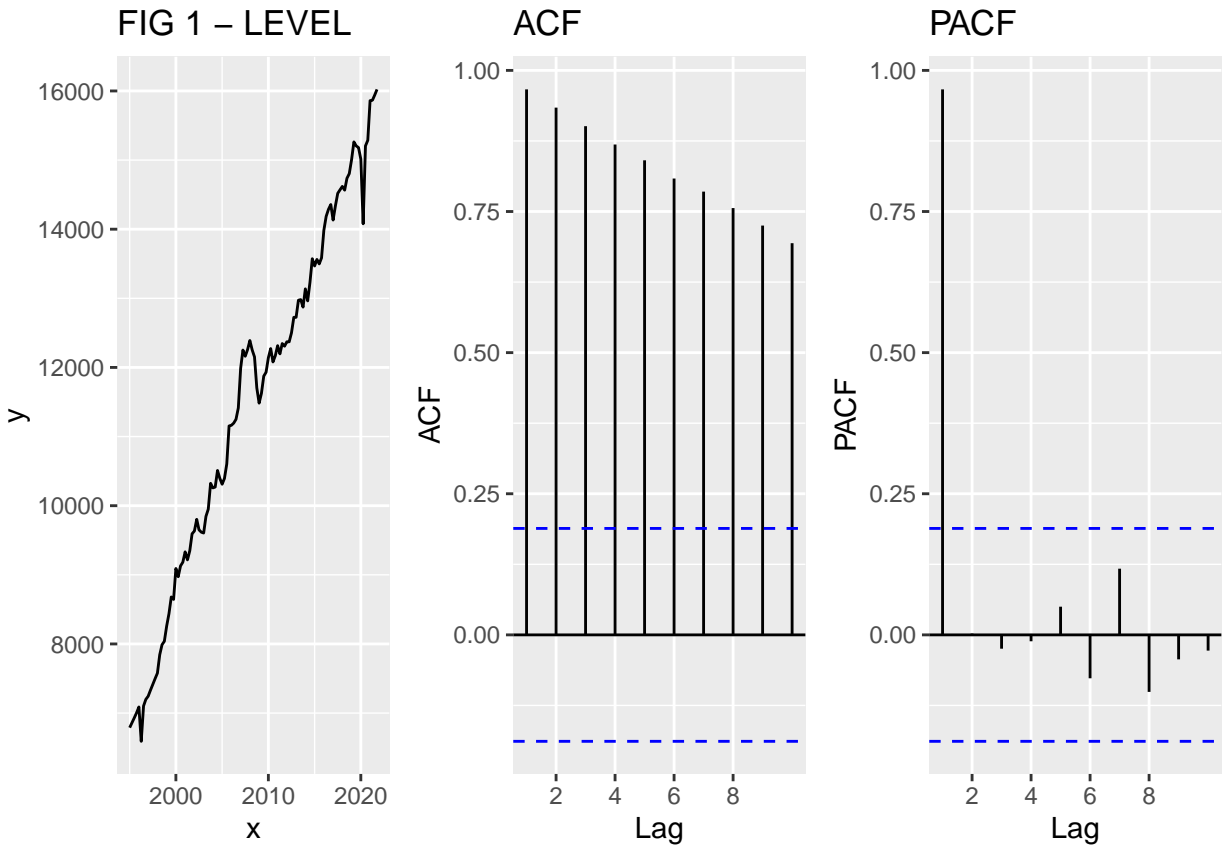
```
  labs(title = "FIG 1 - LEVEL")
plot_ac  <- ggAcf(y,lag.max = 10) + labs(title="ACF")
plot_pac <- ggPacf(y, lag.max = 10) + labs(title="PACF")
# Display plot
ggarrange(plot_y,plot_ac,plot_pac,ncol = 3)
```
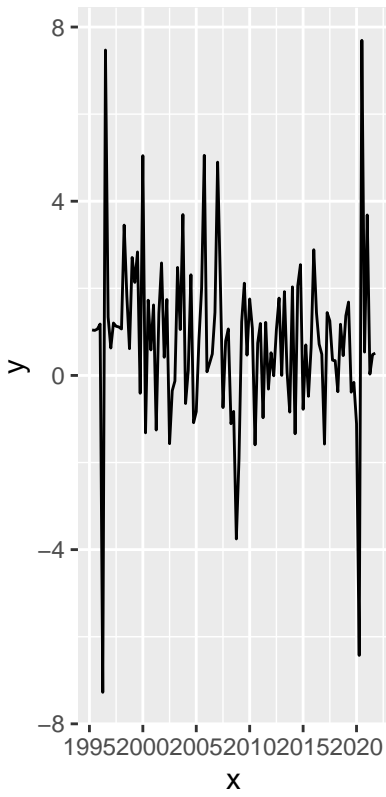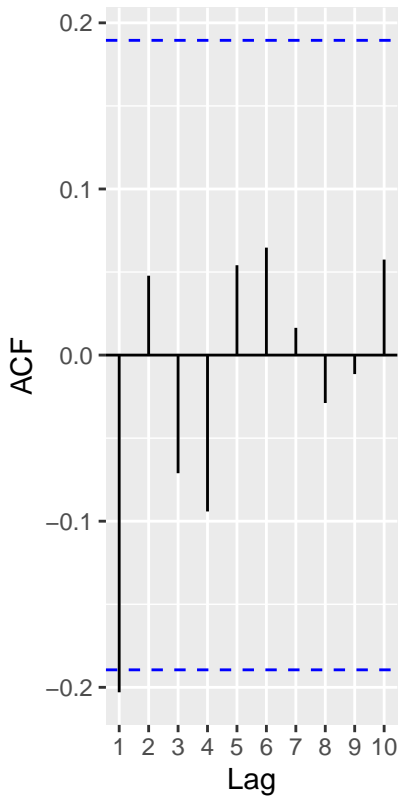


```
# FIGURE 2 :  1st diff of the series
y_gr <- c(100*diff(log(y)))
x    <- time(y)
plot_y  <- ggplot(data.frame(x = x[2:length(x)], y = y_gr), aes(x = x, y = y)) +
  geom_line() +
  labs(title = "FIG 2 - DIFF")
plot_ac  <- ggAcf(y_gr,lag.max = 10) + labs(title="ACF")
plot_pac <- ggPacf(y_gr, lag.max = 10) + labs(title="PACF")
# Display plot
ggarrange(plot_y,plot_ac,plot_pac,ncol = 3)
```