## 1. Moving Averaging a Time Series

A moving average is a commonly used technique for analyzing time series data. It helps smooth out short-term fluctuations and highlight underlying trends or patterns in the data. The concept of a moving average involves calculating the average of a subset of data points within a specified window and moving that window along the time series.

Here's a step-by-step process for calculating a simple moving average (SMA) for a time series:

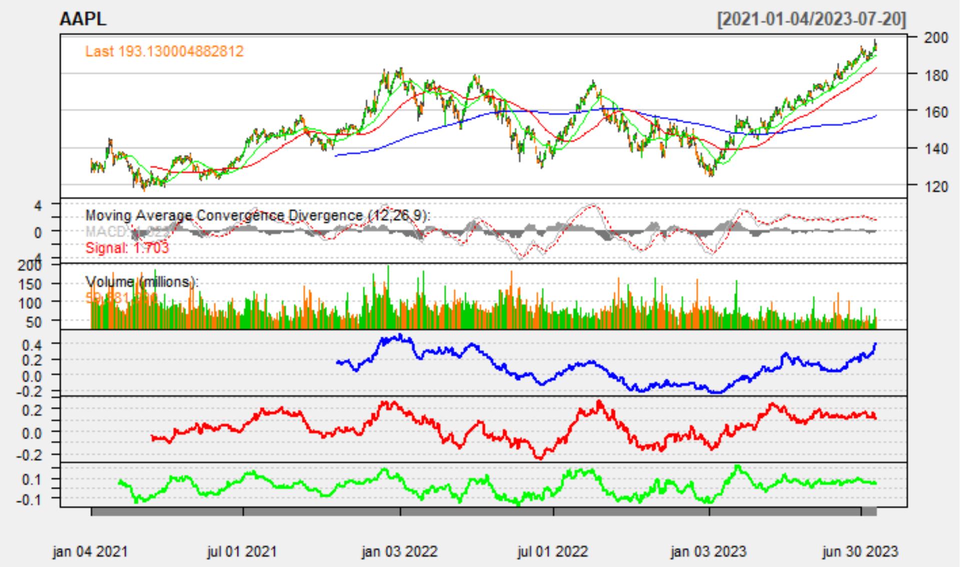
1. Define the window size: Decide on the number of data points you want to include in each calculation of the moving average. For example, if you choose a window size of 5, you will calculate the average of the current data point and the four preceding data points.
2. Start at the beginning: Begin with the first data point in your time series.
3. Calculate the average: Take the window size number of data points and calculate their average.
4. Move the window: Shift the window by one data point and repeat the calculation. Include the next data point in the average and exclude the earliest data point.
5. Continue moving the window: Repeat step 4 until you reach the end of the time series. Each time, calculate the average of the data points within the window.

The resulting sequence of moving averages forms a new time series that represents the smoothed version of the original data. The choice of window size will impact the level of smoothing: larger window sizes result in a smoother series, while smaller window sizes capture more short-term fluctuations.

Note that there are different variations of moving averages, such as weighted moving averages or exponential moving averages, which assign different weights to the data points within the window. These variations can provide different emphasis on recent data compared to older data points.

Moving averages can be calculated using various tools, such as spreadsheets (e.g., Excel), programming languages (e.g., Python, R), or specialized software for time series analysis. Many programming libraries and packages provide built-in functions for calculating moving averages, making the process relatively straightforward to implement.

## 2. Chart



## 3. Comments on Moving Averaging Stocks Using R

If you have never used ‘quantmod’ in your computer, it is necessary to install with command install.packages(“quantmod”); you have used it, just load with library(quantmod).

```
# load package quantmod
library(quantmod)
```

getSymbols() will read apple stocks (AAPL) from yahoo finance (src=’yahoo’). You can define the time period range using **from=** and **to=**

```
# AAPL (Apple Corporation)
getSymbols("AAPL",src='yahoo',from=as.Date('2021-01-01'))
```

type = chart type options: "auto", "candlesticks", "matchsticks", "bars", "line".
subset = define a time range subset
show.grid = show grid in the graph
TA = a vector of technical indicators and params, or character strings
TAsep= TA delimiter for TA strings
line.type = line type
bar.type = bar tyep
theme = chart background color
addSMA = add moving average of ‘n’ periods.
addROC = Add Rate Of Change indicator to chart.

```
chartSeries(AAPL, theme = 'white',
  type = c("auto", "matchsticks"), subset = '2021-01::',
  show.grid = TRUE, major.ticks='auto', minor.ticks=TRUE,
  multi.col = FALSE, TA=c(addMACD(),addVo(),addSMA(n=200,col = 'blue'),
  addSMA(n=50,col = 'red'),addSMA(n=22,col = 'green'),addROC(n=200,col = 'blue'),
  addROC(n=50,col = 'red'),addROC(n=22,col = 'green'))) # rate of change
```

**Copy and paste in the R programming panel**

```
library(quantmod)
# AAPL (Apple Corporation)
getSymbols("AAPL",src='yahoo',
           from=as.Date('2021-01-01'))
chartSeries(AAPL, theme = 'white',
  type = c("auto", "matchsticks"),
  subset = '2021-01::',
  show.grid = TRUE, major.ticks='auto',
  minor.ticks=TRUE,
  multi.col = FALSE, TA=c(addMACD(),addVo(),
                          addSMA(n=200,col = 'blue'),
  addSMA(n=50,col = 'red'),addSMA(n=22,col = 'green'),
  addROC(n=200,col = 'blue'),
  addROC(n=50,col = 'red'),addROC(n=22,col = 'green')))
```